



US 20140210673A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0210673 A1**

(43) **Pub. Date: Jul. 31, 2014**

(54) **DUAL-BAND ANTENNA OF WIRELESS COMMUNICATION APPARATUS**

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

CPC *H01Q 5/001* (2013.01)

USPC **343/700 MS**

(71) Applicant: **Realtek Semiconductor Corp.**, Hsinchu (TW)

(57)

ABSTRACT

(72) Inventors: **Sy-been WANG**, Zhubei City (TW);
Chih-pao LIN, Zhubei City (TW);
Ching-Wei LING, Zhubei City (TW)

A dual-band antenna of a wireless communication apparatus includes a first radiation part for receiving or transmitting signals at a first frequency band; a second radiation part for generating a coupling effect together with the first radiation part to receive or transmit signals at a second frequency band having a center frequency lower than a center frequency of the first frequency band, wherein the second radiation part comprises multiple radiation sections, and at least one of the multiple radiation sections is positioned on a first plane; a feeding element for coupling with a signal receiving terminal of the wireless communication apparatus; and a shorting element for coupling with a fixed-voltage region of the wireless communication apparatus. The first radiation part does not physically contact with the second radiation part, and at least a portion of the first radiation part is not positioned on the first plane.

(73) Assignee: **Realtek Semiconductor Corp.**, Hsinchu (TW)

(21) Appl. No.: **14/154,394**

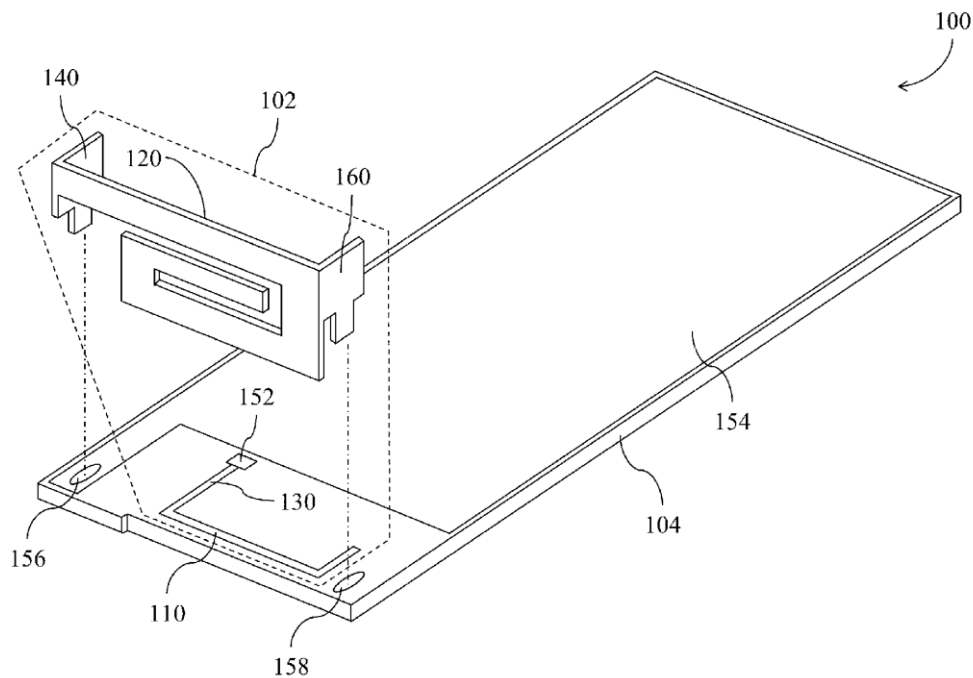
(22) Filed: **Jan. 14, 2014**

(30) **Foreign Application Priority Data**

Jan. 29, 2013 (TW) 102103371

Publication Classification

(51) **Int. Cl.**
H01Q 5/00 (2006.01)





US 20140210674A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0210674 A1**

(43) **Pub. Date: Jul. 31, 2014**

(54) **PLANAR INVERTED F ANTENNA**

(76) Inventors: **Yoshiyuki Yonei**, Chiba-shi (JP);
Masahiro Sobu, Chiba-shi (JP); **Akinori Matsui**, Fukaya-shi (JP); **Misao Haneishi**, Saitama-shi (JP)

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

CPC **H01Q 9/0407** (2013.01)

USPC **343/700 MS**

(57)

ABSTRACT

Provided is a planar inverted F antenna to which a feeding line can be readily connected. Two slits are provided up to locations where input impedance is $Z (=50\Omega)$, from the open end side of a main conductive plate that functions as an excitation conductive plate. Between these slits is used as a microstrip line (MSL) and the width (w) is determined such that the characteristic impedance for the transmission line is Z . A planar inverted F antenna having a U-shaped or L-shaped cross-section is formed by folding on both sides or on one side of the MSL, along the longitudinal direction of the MSL. In other words, a planar inverted F antenna is formed that has the excitation conductive plate and the MSL arranged separated by a prescribed distance, on the outside of a ground conductive plate bent into a U-shaped or L-shaped cross-section. The positional relationship between the connection position for the feeding pin and the radiation end can be changed, by folding the planar inverted F antenna along the longitudinal direction of the MSL.

(21) Appl. No.: **14/240,127**

(22) PCT Filed: **Aug. 10, 2012**

(86) PCT No.: **PCT/JP2012/070455**

§ 371 (c)(1),

(2), (4) Date: **Feb. 21, 2014**

(30) **Foreign Application Priority Data**

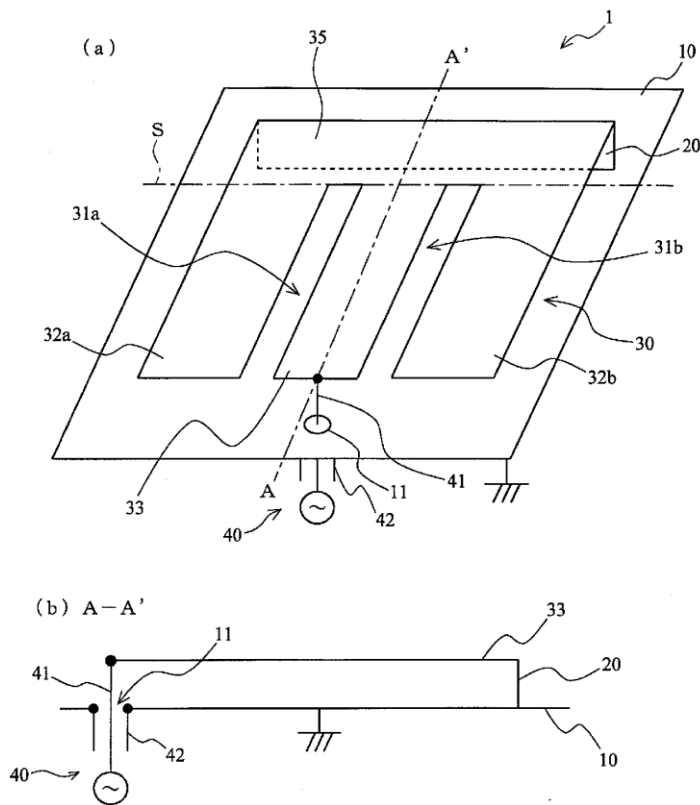
Aug. 26, 2011 (JP) 2011-185317

Publication Classification

(51) **Int. Cl.**

H01Q 9/04

(2006.01)





US 20140210675A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0210675 A1**

(43) **Pub. Date: Jul. 31, 2014**

(54) **ANTENNA DEVICE FOR PORTABLE TERMINAL**

Publication Classification

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

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

(72) Inventors: **Soon-Ho HWANG**, Seoul (KR);
Sung-Koo PARK, Suwon-si (KR);
Kyung-Jae LEE, Seoul (KR); **Joon-Ho BYUN**, Yongin-si (KR)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01)
USPC **343/702**

(57) **ABSTRACT**

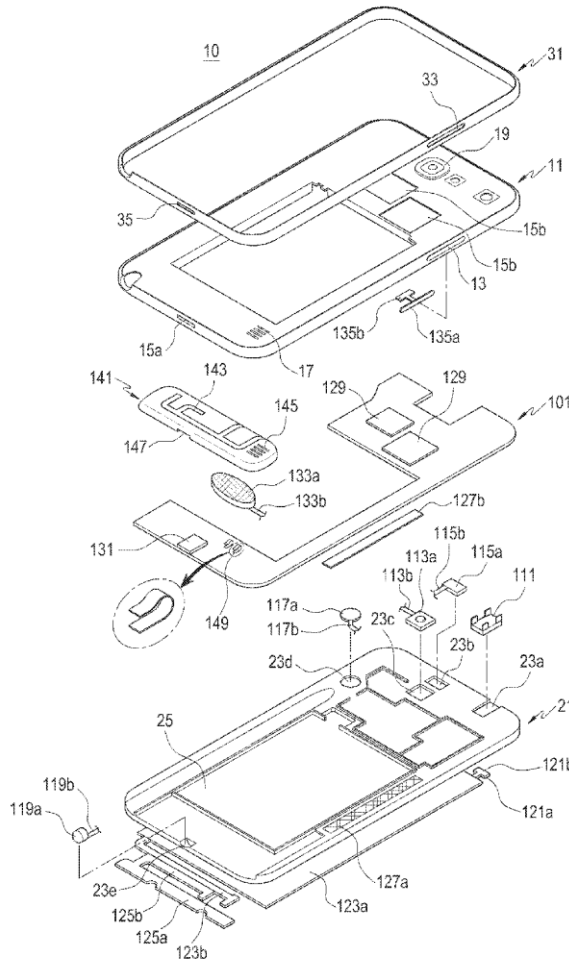
An antenna device of a portable terminal including conductive components is provided. The antenna device includes a first radiator connected to a power feeding unit of the portable terminal and a second radiator connected to each of the power feeding unit and a ground part of the portable terminal. At least one of the conductive components is connected to at least one the first radiator and the second radiator. The conductive components may be used as a radiator of the antenna device such that the antenna device may be easily installed within an inner space of a miniaturized and lightened portable terminal and the inner space of the portable terminal may be efficiently used.

(21) Appl. No.: **13/937,725**

(22) Filed: **Jul. 9, 2013**

(30) **Foreign Application Priority Data**

Jan. 30, 2013 (KR) 10-2013-0010477





US 20140210679A1

(19) **United States**

(12) **Patent Application Publication**
PARK

(10) **Pub. No.: US 2014/0210679 A1**

(43) **Pub. Date: Jul. 31, 2014**

(54) **ANTENNA APPARATUS AND FEEDING STRUCTURE THEREOF**

Publication Classification

(71) Applicant: **Bum Ki PARK**, Seoul (KR)

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

(72) Inventor: **Bum Ki PARK**, Seoul (KR)

(52) **U.S. Cl.**
CPC **H01Q 1/50** (2013.01)
USPC **343/745; 333/24 R**

(73) Assignee: **LG INNOTEK CO., LTD.**, Seoul (KR)

(57) **ABSTRACT**

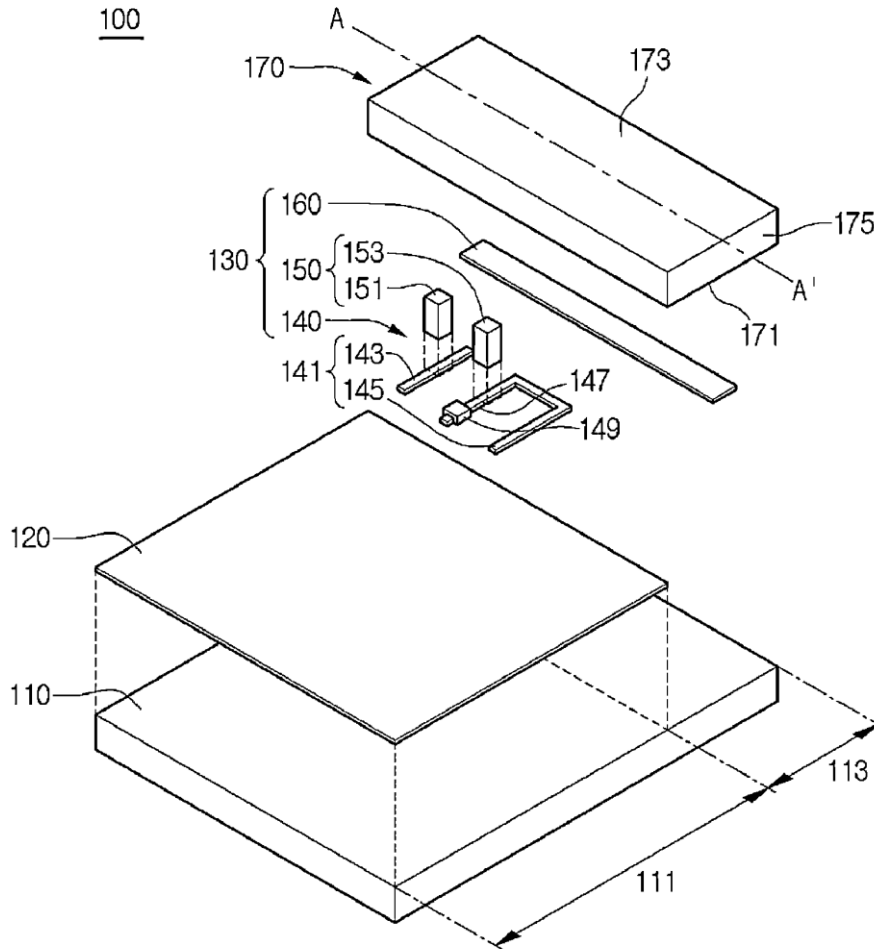
(21) Appl. No.: **14/165,258**

Disclosed are an antenna apparatus and a feeding structure thereof. An antenna apparatus includes: a radiator; a feeding structure including a feeding unit to provide a signal to the radiator, a ground unit to ground the radiator, and a resonance applying part between the feeding unit and the ground unit; and a contact part to connect the radiator with the feeding structure. The antenna apparatus may include the contact part to easily adjust at least one of the resonance bands and a space in the antenna apparatus can be efficiently used.

(22) Filed: **Jan. 27, 2014**

(30) **Foreign Application Priority Data**

Jan. 25, 2013 (KR) 10-2013-0008749





US 20140210680A1

(19) **United States**

(12) **Patent Application Publication**
STOYTCHEV

(10) **Pub. No.: US 2014/0210680 A1**

(43) **Pub. Date: Jul. 31, 2014**

(54) **MULTIBAND HYBRID ANTENNA**

Publication Classification

(71) Applicant: **Galtronics Corporation Ltd.**, Tiberias (IL)

(51) **Int. Cl.**
H01Q 5/00 (2006.01)

(72) Inventor: **Marin STOYTCHEV**, Chandler, AZ (US)

(52) **U.S. Cl.**
CPC **H01Q 5/0024** (2013.01)
USPC **343/806**

(73) Assignee: **Galtronics Corporation Ltd.**, Tiberias (IL)

(57) **ABSTRACT**

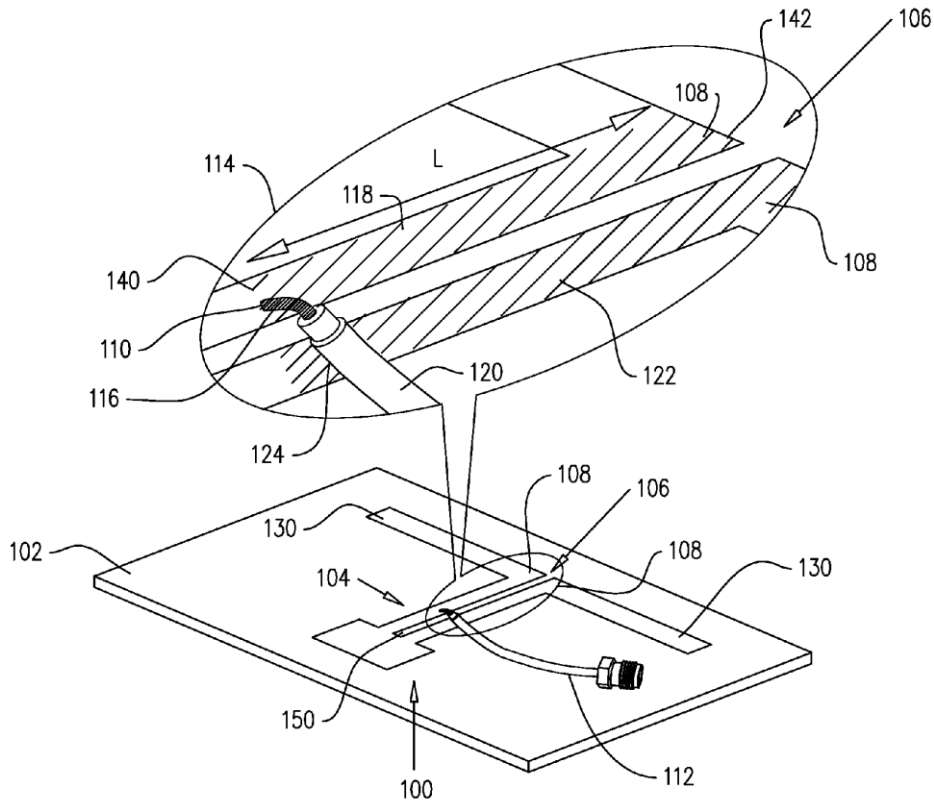
(21) Appl. No.: **14/168,249**

An antenna including a high band generating assembly having a first end and a second end, the high band generating assembly including a feed point and a bifurcated conductive element coupled to the feed point and having an angularly bent tip, the feed point defining the first end of the high band generating assembly, the angularly bent tip defining the second end of the high band generating assembly, at least one low band generating assembly, the at least one low band generating assembly including the high band generating assembly and at least one pair of dipole arms extending from the bifurcated conductive element, and a balun portion coupled to the feed point.

(22) Filed: **Jan. 30, 2014**

Related U.S. Application Data

(60) Provisional application No. 61/758,335, filed on Jan. 30, 2013.





US 20140210682A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0210682 A1**

(43) **Pub. Date: Jul. 31, 2014**

(54) **ANTENNA**

Publication Classification

(71) Applicant: **ASUSTeK COMPUTER INC.**, TAIPEI (TW)

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

(72) Inventors: **Yeh-Chun KAO**, TAIPEI (TW); **You-Fu CHENG**, TAIPEI (TW); **Yu-Chia CHANG**, TAIPEI (TW)

(52) **U.S. Cl.**
CPC **H01Q 7/00** (2013.01)
USPC **343/843; 343/866; 343/870**

(73) Assignee: **ASUSTeK COMPUTER INC.**, TAIPEI (TW)

(57) **ABSTRACT**

(21) Appl. No.: **14/138,119**

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

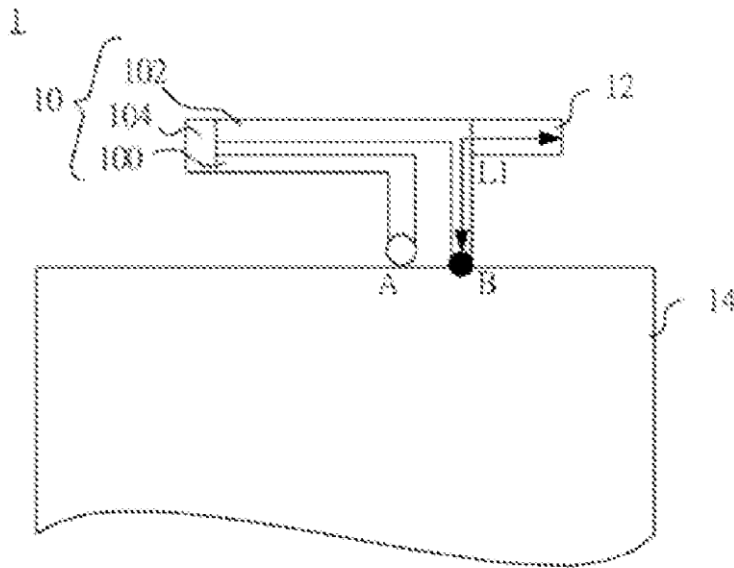
Related U.S. Application Data

(60) Provisional application No. 61/757,718, filed on Jan. 29, 2013.

(30) **Foreign Application Priority Data**

Sep. 3, 2013 (TW) 102131729

An antenna device is provided. The antenna includes a feeding end, a grounding end, a loop metal portion and a protruded metal portion. The grounding end is electrically connected to a ground plane. The loop metal portion extends from the feeding end to the grounding end to form a loop antenna structure. The protruded metal portion is electrically connected to the loop metal portion, wherein the distance between the protruded metal portion and the grounding end is shorter than the distance between the protruded metal portion and the feeding end.





US 20140210685A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0210685 A1**

(43) **Pub. Date: Jul. 31, 2014**

(54) **ELECTRONIC DEVICE AND ANTENNA CONTROL METHOD THEREOF**

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

CPC *H01Q 1/50* (2013.01); *H01Q 21/00* (2013.01); *H01Q 1/38* (2013.01); *H01Q 21/0087* (2013.01)
USPC **343/861**; 343/893; 343/700 MS; 29/601

(71) Applicant: **Acer Incorporated**, New Taipei City (TW)

(72) Inventors: **Chih-Hua Chang**, New Taipei City (TW); **Pei-Ji Ma**, New Taipei City (TW); **Kuo-Hua Tseng**, New Taipei City (TW); **Shao-Yu Huang**, New Taipei City (TW)

(57)

ABSTRACT

An electronic device including a first body and a second body is disclosed. The first body includes a first system circuit board, a first grounding element, and a primary antenna. The first grounding element is disposed on the first system circuit board. The primary antenna is disposed on the first system circuit board and electrically connected to the first grounding element. The primary antenna transmits/receives at least one radio frequency (RF) signal. The second body includes a second system circuit board and a clearance area. The clearance area is on the second system circuit board, and no circuit exists in the clearance area. When the first body and the second body are stacked by parallelizing the first system circuit board and the second system circuit board, the clearance area is corresponding to the primary antenna.

(21) Appl. No.: **13/913,522**

(22) Filed: **Jun. 10, 2013**

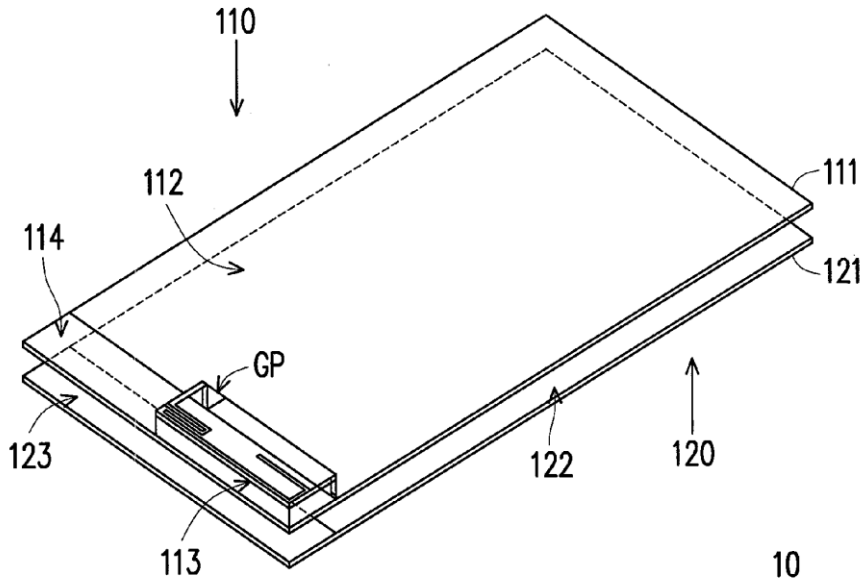
(30) **Foreign Application Priority Data**

Jan. 30, 2013 (TW) 102103552

Publication Classification

(51) **Int. Cl.**

H01Q 1/50 (2006.01)
H01Q 1/38 (2006.01)
H01Q 21/00 (2006.01)



10



US 20140217183A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0217183 A1**

(43) **Pub. Date: Aug. 7, 2014**

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

Publication Classification

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

(51) **Int. Cl.**
G06K 19/077 (2006.01)
H01Q 1/22 (2006.01)

(72) Inventors: **Kuniaki YOSUI**, Nagaokakyo-shi (JP);
Takahiro BABA, Nagaokakyo-shi (JP);
Yuki WAKABAYASHI,
Nagaokakyo-shi (JP); **Naoki GOUCHI**,
Nagaokakyo-shi (JP); **Nobuo**
IKEMOTO, Nagaokakyo-shi (JP)

(52) **U.S. Cl.**
CPC **G06K 19/07783** (2013.01); **H01Q 1/2225**
(2013.01)
USPC **235/492; 343/702**

(73) Assignee: **Murata Manufacturing Co., Ltd.**,
Nagaokakyo-shi (JP)

(57) **ABSTRACT**

(21) Appl. No.: **14/250,547**

An antenna device is configured as a jacket of a communication terminal, such as a mobile terminal, and a communication apparatus includes the antenna device attached to the communication terminal. The antenna device uses an HF-band high frequency signal as a carrier frequency, and is configured as a reader/writer antenna device for a near field communication system. The base body of the antenna device is a plate-shaped base member made of a resin. An antenna coil and a feeding coil are provided integrally with the plate-shaped base member. High-frequency signals are transmitted between the feeding coil and the antenna coil through magnetic coupling in a non-contact manner.

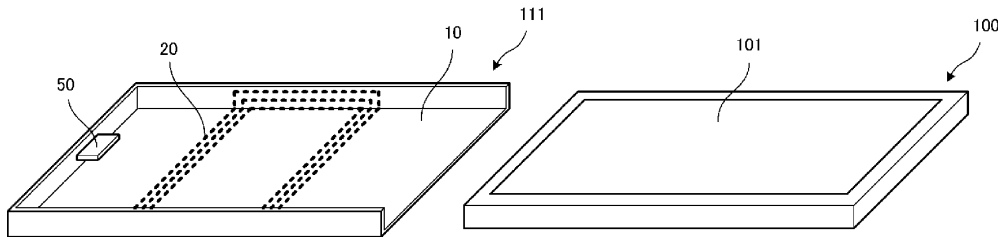
(22) Filed: **Apr. 11, 2014**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2012/077418,
filed on Oct. 24, 2012.

(30) **Foreign Application Priority Data**

Nov. 8, 2011 (JP) 2011-244251





US 20140218243A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0218243 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **COMMUNICATION DEVICE WITH TUNABLE GROUND PLANE ANTENNA ELEMENT**

Publication Classification

(71) Applicant: **ACER INCORPORATED**, New Taipei City (TW)

(51) **Int. Cl.**
H01Q 1/50 (2006.01)
H01Q 9/06 (2006.01)

(72) Inventors: **Kin-Lu Wong**, Kaohsiung City (TW);
Meng-Ting Chen, Kaohsiung City (TW)

(52) **U.S. Cl.**
CPC . *H01Q 1/50* (2013.01); *H01Q 9/065* (2013.01)
USPC **343/700 MS**

(73) Assignee: **ACER INCORPORATED**, New Taipei City (TW)

(57) **ABSTRACT**

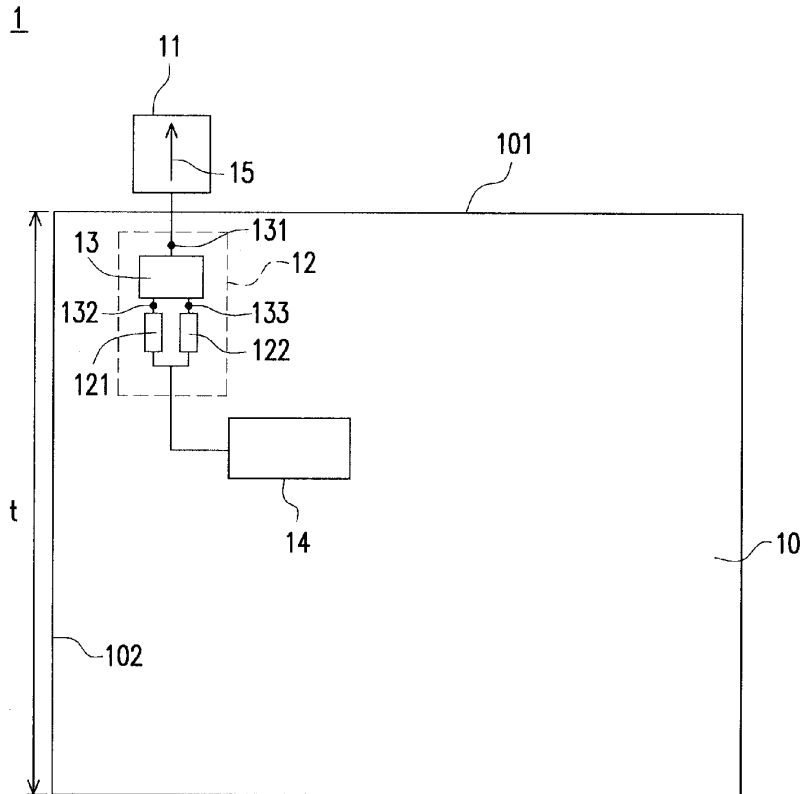
(21) Appl. No.: **13/802,772**

A communication device including a ground element and an antenna element is provided. The ground element has a first edge and a second edge, wherein the first edge is substantially perpendicular to the second edge. The antenna element is disposed adjacent to the first edge of the ground element. The ground element is coupled to a circuit module. The circuit module includes at least two reactive circuits, such that the antenna element is selectively operated in a first band or a second band. The antenna element and the ground element form an unsymmetrical dipole antenna structure. The longest current path length of the antenna element is less than 0.3 times the length of the second edge.

(22) Filed: **Mar. 14, 2013**

(30) **Foreign Application Priority Data**

Feb. 4, 2013 (TW) 102104260





US 20140218244A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0218244 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **ANTENNA ASSEMBLY AND WIRELESS COMMUNICATION DEVICE EMPLOYING SAME**

Publication Classification

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

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

(72) Inventors: **TZE-HSUAN CHANG**, New Taipei (TW); **CHO-KANG HSU**, New Taipei (TW)

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

(73) Assignee: **CHIUN MAI COMMUNICATION SYSTEMS, INC.**, New Taipei (TW)

(57) **ABSTRACT**

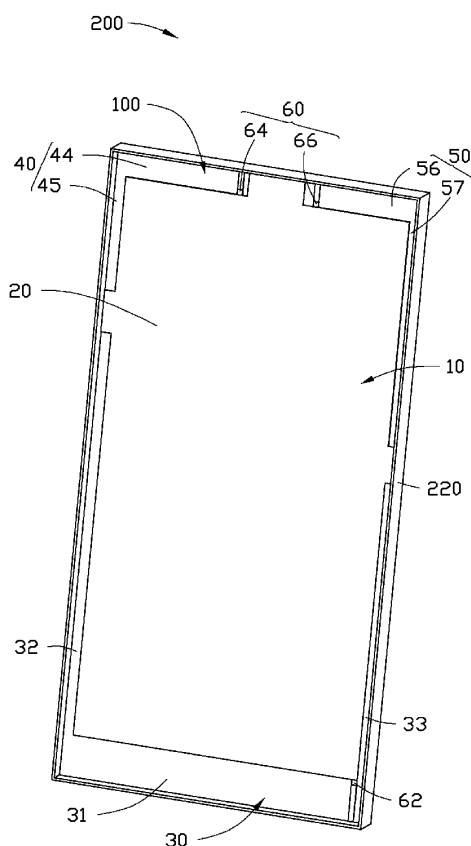
An antenna assembly includes a base, a ground surface, a first radiating portion, a second radiating portion, a third radiating portion, and a feed portion. The ground surface is arranged on a surface of the base. The feed portion includes a plurality of feed points mounted on the radiating portions. The first radiating portion and one feed point transmit and receive wireless signals at a first frequency band and a second frequency band; the second radiating portion and the third radiating portion couple with the feed points to transmit and receive wireless signals at a third frequency band and a fourth frequency. The first radiating portion, the second radiating portion, and the third radiating portion form several slot antennas. A wireless communication device employing the antenna assembly is also described.

(21) Appl. No.: **14/081,052**

(22) Filed: **Nov. 15, 2013**

(30) **Foreign Application Priority Data**

Feb. 1, 2013 (TW) 102104102





US 20140218245A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0218245 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **ANTENNA AND METHOD FOR STEERING
ANTENNA BEAM DIRECTION**

Feb. 17, 2011, now Pat. No. 8,362,962, which 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)

Publication Classification

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

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

(52) **U.S. Cl.**
CPC **H01Q 9/0442** (2013.01)
USPC **343/745**

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

(21) Appl. No.: **14/144,461**

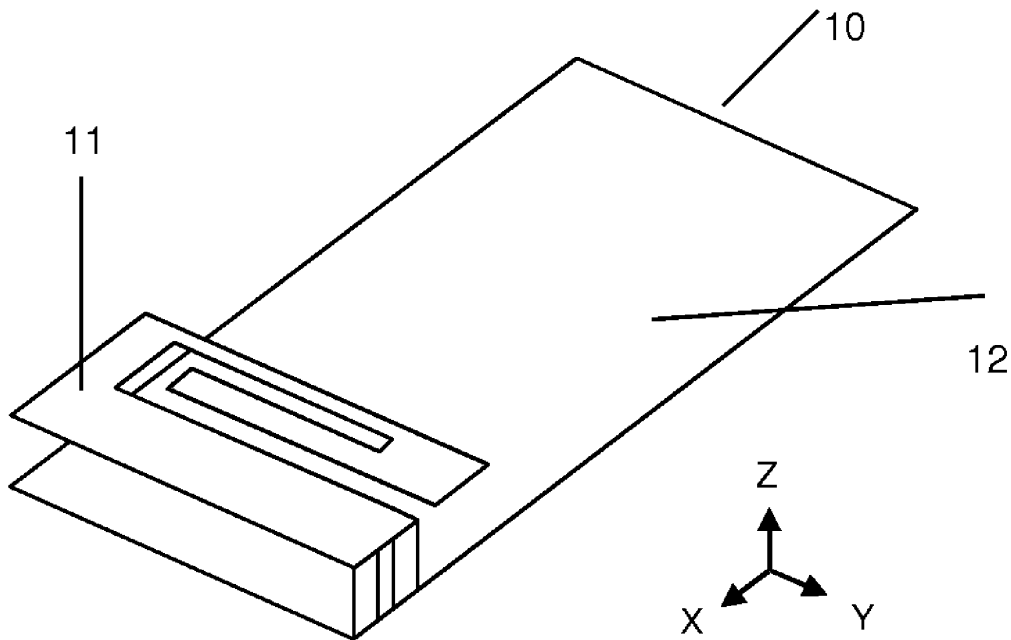
(57) **ABSTRACT**

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

An antenna comprising an IMD element and one or more parasitic and active tuning elements is disclosed. The IMD element, when used in combination with the active tuning and parasitic elements, allows antenna operation at multiple resonant frequencies. In addition, the direction of antenna radiation pattern may be arbitrarily rotated in accordance with the parasitic and active tuning elements.

Related U.S. Application Data

(63) Continuation of application No. 13/726,477, filed on Dec. 24, 2012, now Pat. No. 8,648,755, which is a continuation of application No. 13/029,564, filed on





US 20140218246A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0218246 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **ANTENNA DEVICE AND COMMUNICATION
TERMINAL APPARATUS**

Publication Classification

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

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

(72) Inventors: **Kenichi ISHIZUKA**, Nagaokakyo-shi
(JP); **Hiroshi NISHIDA**,
Nagaokakyo-shi (JP)

(52) **U.S. Cl.**
CPC **H01Q 1/50** (2013.01)
USPC **343/749**

(73) Assignee: **Murata Manufacturing Co., Ltd.**,
Nagaokakyo-shi (JP)

(57) **ABSTRACT**

(21) Appl. No.: **14/247,271**

A multiband-capable antenna device includes a loop-shaped radiation element including a power feed end and a ground end, and a matching circuit including a first inductance element loaded at the power feed end and a second inductance element loaded at the ground end and magnetic-field coupled to the first inductance element. The loop-shaped radiation element is configured to resonate in a plurality of resonance modes including an even mode and an odd mode. The first inductance element and the second inductance element are wound and connected such that magnetic fields are mutually strengthened for one of the even mode and the odd mode, and such that the magnetic fields are mutually weakened for the other of the even mode and the odd mode.

(22) Filed: **Apr. 8, 2014**

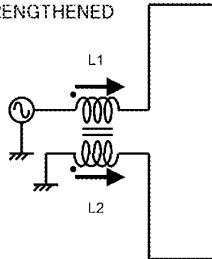
Related U.S. Application Data

(63) Continuation of application No. PCT/JP2013/072673,
filed on Aug. 26, 2013.

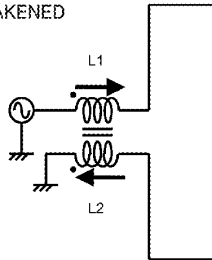
(30) **Foreign Application Priority Data**

Aug. 28, 2012 (JP) 2012-187238

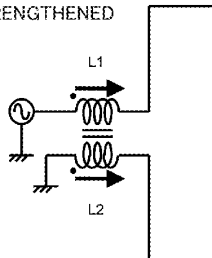
•RESONANCE1
MUTUALLY STRENGTHENED
IN L1 AND L2



•RESONANCE2
MUTUALLY WEAKENED
IN L1 AND L2



•RESONANCE3
MUTUALLY STRENGTHENED
IN L1 AND L2





US 20140218247A1

(19) **United States**

(12) **Patent Application Publication**
Tefiku

(10) **Pub. No.: US 2014/0218247 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **ANTENNA ARRANGEMENT**

(71) Applicant: **NOKIA CORPORATION**, Espoo (FI)

(72) Inventor: **Faton Tefiku**, San Diego, CA (US)

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

(21) Appl. No.: **13/758,474**

(22) Filed: **Feb. 4, 2013**

Publication Classification

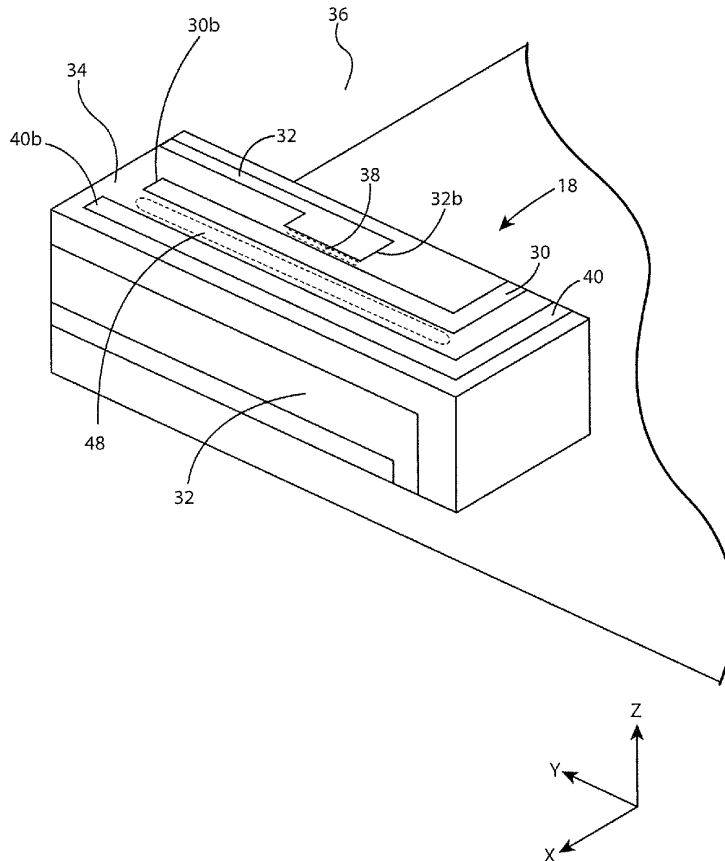
(51) **Int. Cl.**
H01Q 21/30 (2006.01)
H01P 11/00 (2006.01)
H01Q 1/50 (2006.01)

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

CPC **H01Q 21/30** (2013.01); **H01Q 1/50**
(2013.01); **H01P 11/00** (2013.01)
USPC **343/752**; 343/850; 29/600

(57) **ABSTRACT**

An antenna, a portable electronic device incorporating an antenna and a method of operation are provided. The antenna includes a first radiator extending from a first end configured to be coupled to radio frequency circuitry to a second end that is electrically open. The antenna also includes a second radiator extending from a first end that is configured to be grounded to a second end that is electrically open. The antenna is configured such that the second end of one of the first or second radiators is electrically coupled to the other of the first or second radiators at a coupling region between the first and second ends of the other of the first or second radiators. The second end of the second radiator may be electrically coupled to the first radiator at a location between the first and second ends of the first radiator.





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(19) **United States**

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

(10) **Pub. No.: US 2014/0218250 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **CASE AND ELECTRONIC APPARATUS**

(30) **Foreign Application Priority Data**

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

May 30, 2013 (KR) 10-2013-0062156

Publication Classification

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

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

(52) **U.S. Cl.**
CPC **H01Q 13/106** (2013.01)
USPC **343/767**

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

(57) **ABSTRACT**

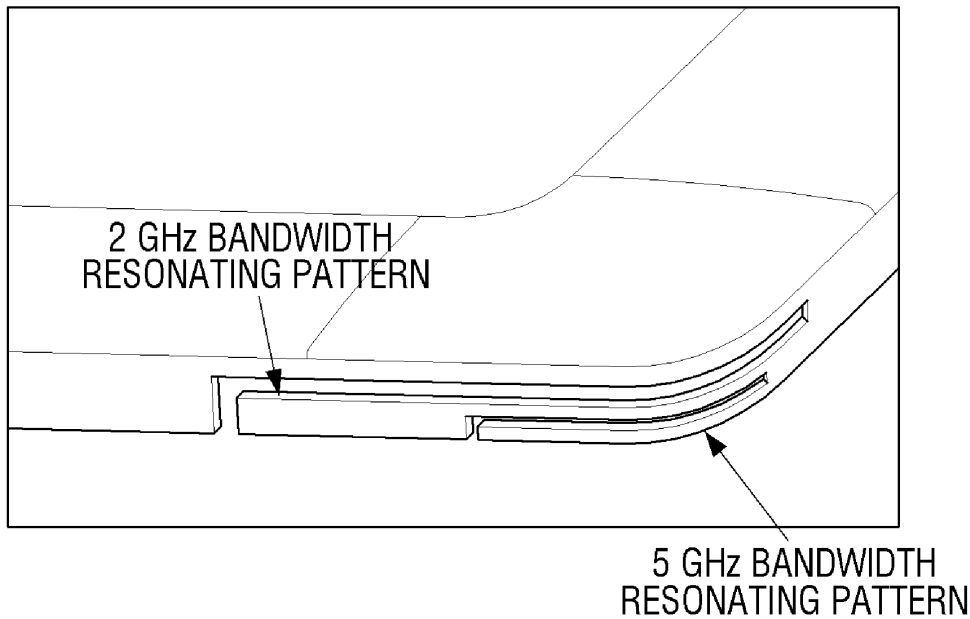
(21) Appl. No.: **14/083,920**

An electronic apparatus includes a metallic case including an antenna pattern formed on an area of the metallic case where two sides surfaces of the case meet, the antenna pattern forming a slit antenna including a slit connecting one side of the antenna pattern to an open area of the metallic case, and a circuit board configured to process signals received at the antenna pattern.

(22) Filed: **Nov. 19, 2013**

Related U.S. Application Data

(60) Provisional application No. 61/760,229, filed on Feb. 4, 2013.





US 20140218254A1

(19) **United States**

(12) **Patent Application Publication**
Kitchener

(10) **Pub. No.: US 2014/0218254 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **APERTURE COUPLED RADIATOR AND ANTENNA INCLUDING THE SAME**

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

CPC *H01Q 1/50* (2013.01)

USPC **343/834**

(75) Inventor: **Dean Kitchener**, Essex (GB)

(73) Assignee: **ACE TECHNOLOGIES CORPORATION**, Incheon (KR)

(57)

ABSTRACT

(21) Appl. No.: **14/117,357**

(22) PCT Filed: **May 18, 2011**

(86) PCT No.: **PCT/KR11/03667**

§ 371 (c)(1),

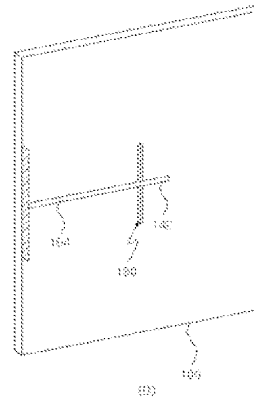
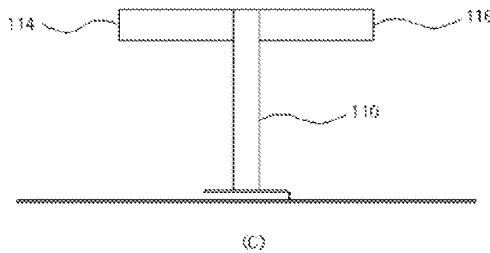
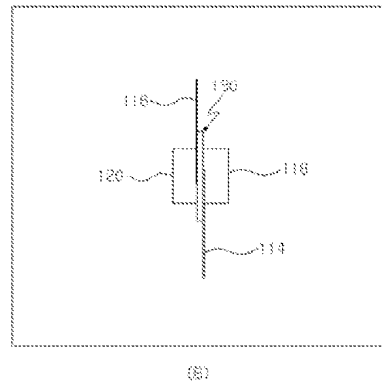
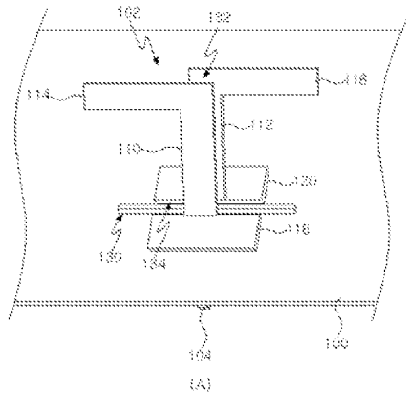
(2), (4) Date: **Nov. 12, 2013**

Publication Classification

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

(2006.01)

A radiator in which power is fed through a slot of a reflection plate and which can be manufactured in a simple manner and an antenna including the same are disclosed. The antenna includes a reflection plate and a radiator. The radiator includes feed sections disposed on a first surface of the reflection plate, first and second radiation elements extending perpendicular to the feed section or inclined towards the reflection plate, and first and second base plates configured to support the balanced parallel strip feed sections. Here, the first and second base plates are capacitively coupled to the reflection plate.





US 20140218260A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0218260 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **FLEXIBLE PIFA ANTENNA WITH TUNABLE COUPLING ELEMENT**

Publication Classification

(71) Applicants: **Chen Hung Huang**, Zhongli City (TW);
Ronan Quinlan, Wesford (IE)

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

(72) Inventors: **Chen Hung Huang**, Zhongli City (TW);
Ronan Quinlan, Wesford (IE)

(52) **U.S. Cl.**
CPC **H01Q 1/50** (2013.01)
USPC **343/861**

(21) Appl. No.: **14/091,182**

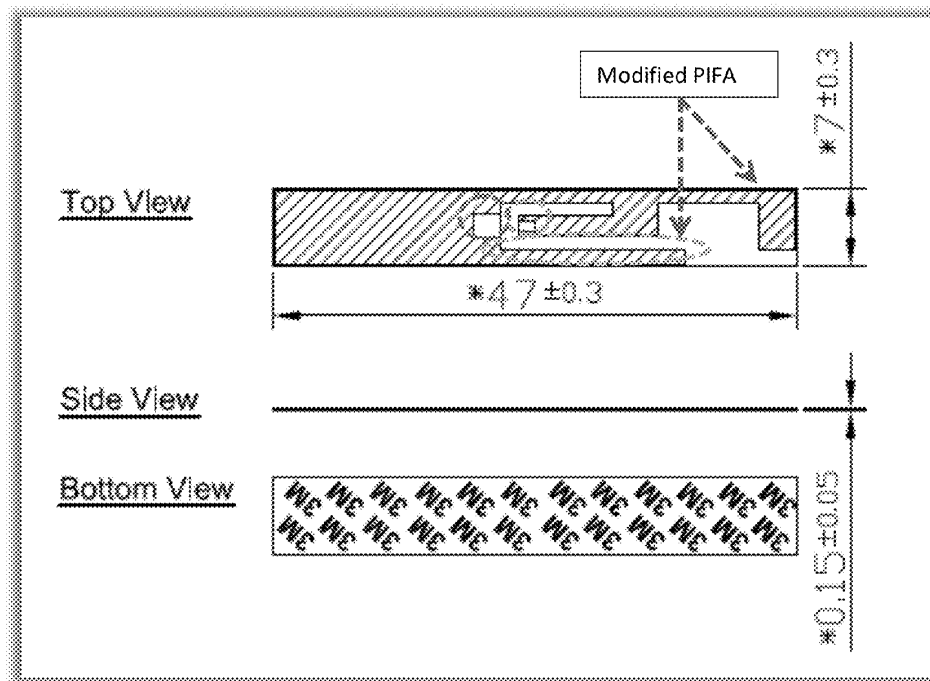
(57) **ABSTRACT**

(22) Filed: **Nov. 26, 2013**

A modified PIFA antenna is designed for wireless local area network (WLAN) applications. The modified PIFA antenna is configured to resist detuning effects caused by use of various cable lengths and is adapted for use in the 2.4 GHz operation band. A slot extends between the ground and feed portions of the antenna for slightly increasing frequency bandwidth of the antenna.

Related U.S. Application Data

(60) Provisional application No. 61/729,728, filed on Nov. 26, 2012.



Purple, Modified PIFA
 Orange, tunable coupling element
 Green, signal feed soldering pad
 Blue, cable soldering pad



US 20140218913A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0218913 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **LIGHTING DEVICE WITH INTEGRATED
SLOT ANTENNA**

Publication Classification

(71) Applicant: **GALTRONICS CORPORATION
LTD.**, Tiberias (IL)

(51) **Int. Cl.**
F21V 23/00 (2006.01)
F21V 7/00 (2006.01)

(72) Inventors: **Randell COZZOLINO**, Phoenix, AZ
(US); **Cliff CONNORS**, Tempe, AZ
(US); **Brian HAHN**, Gilbert, AZ (US)

(52) **U.S. Cl.**
CPC . *F21V 23/00* (2013.01); *F21V 7/00* (2013.01);
F21V 23/002 (2013.01)
USPC **362/235**; 362/249.01

(73) Assignee: **GALTRONICS CORPORATION
LTD.**, Tiberias (IL)

(57) **ABSTRACT**

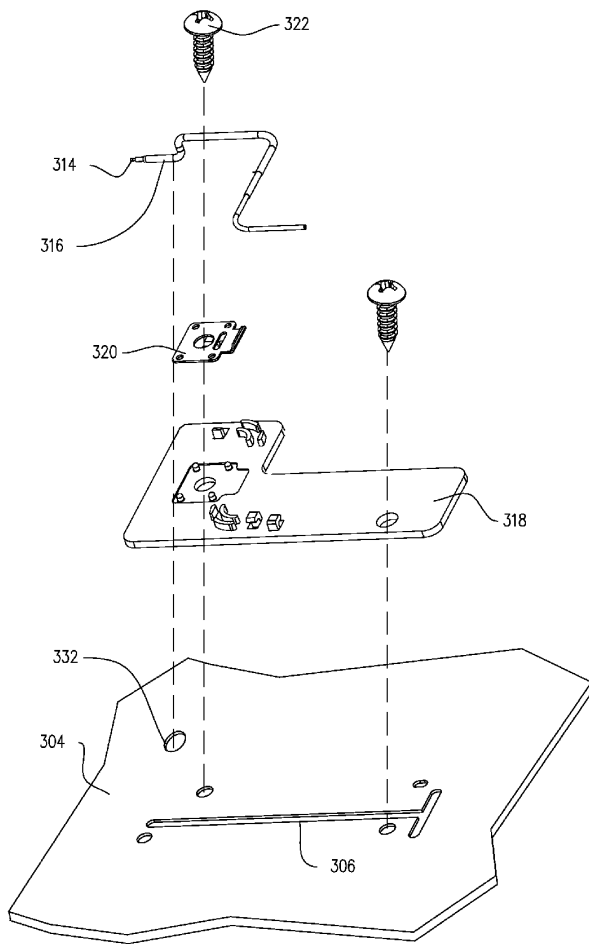
(21) Appl. No.: **14/172,520**

(22) Filed: **Feb. 4, 2014**

Related U.S. Application Data

(60) Provisional application No. 61/760,236, filed on Feb.
4, 2013.

A lighting device including a housing, at least one light source housed by the housing, a conductive element mounted to the housing and having portions that define a slot, the slot forming a slot antenna radiating element for wireless control of the at least one light source and a feedline for feeding the slot antenna radiating element.





US 20140220906A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0220906 A1**

(43) **Pub. Date: Aug. 7, 2014**

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

Publication Classification

(71) Applicant: **Kabushiki Kaisha Toshiba**, Tokyo (JP)

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H04B 1/40 (2006.01)

(72) Inventors: **Isao Ohba**, Hachioji-shi (JP); **Hiroyuki Hotta**, Hamura-shi (JP); **Koichi Sato**, Tachikawa-shi (JP); **Masao Teshima**, Kunitachi-shi (JP)

(52) **U.S. Cl.**
CPC *H01Q 9/0442* (2013.01); *H04B 1/40* (2013.01)
USPC **455/73; 343/750**

(73) Assignee: **KABUSHIKI KAISHA TOSHIBA**, Tokyo (JP)

(57) **ABSTRACT**

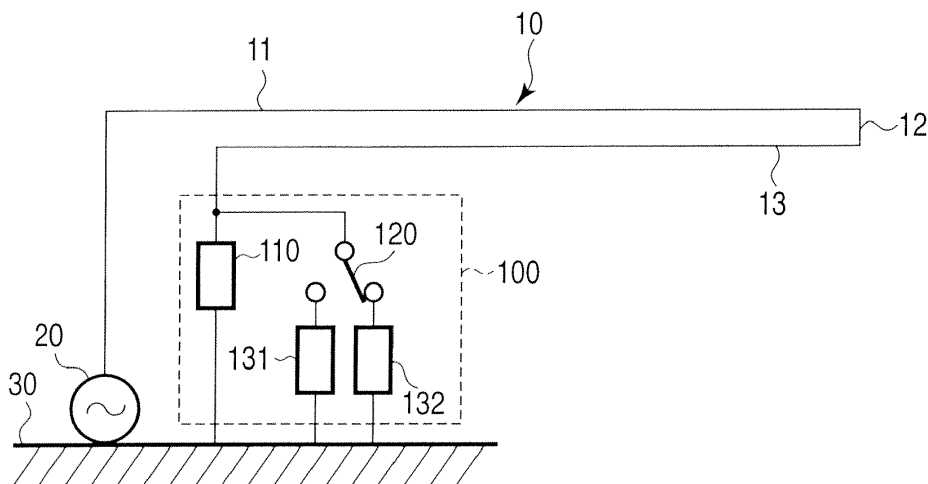
(21) Appl. No.: **14/171,254**

According to one embodiment, an antenna apparatus comprises an antenna element connected to a feeding point, a grounded first lumped constant element connected to the antenna element, and a grounded second and third lumped constant elements connected to the antenna element through a selector. The selector is configured to connect the grounded second lumped constant element to the antenna element in order to lower a resonant frequency of the antenna element, and to connect the grounded third lumped constant element to the antenna element in order to raise the resonant frequency of the antenna element.

(22) Filed: **Feb. 3, 2014**

Related U.S. Application Data

(63) Continuation of application No. 13/082,246, filed on Apr. 7, 2011, now Pat. No. 8,699,964, Continuation of application No. PCT/JP2009/064994, filed on Aug. 27, 2009.





US 20140220912A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0220912 A1**

(43) **Pub. Date: Aug. 7, 2014**

(54) **MOBILE COMMUNICATION DEVICE**

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

(71) Applicant: **Wistron Corporation**, New Taipei City (TW)

CPC **H04B 1/3827** (2013.01)

USPC **455/90.2**

(72) Inventors: **Shih-Ming Chuang**, New Taipei City (TW); **Wen-Yi Tsai**, New Taipei City (TW); **Pei-Cheng Hu**, New Taipei City (TW)

(57) **ABSTRACT**

(73) Assignee: **Wistron Corporation**, New Taipei City (TW)

A mobile communication device including a main board, a flexible printed circuit board (FPCB) and a transmission line. The main board includes a central process unit (CPU) disposed on the main board for outputting and receiving a control signal, and a wireless transmitter disposed on the main board and coupled to the CPU for modulating and demodulating a wireless signal. The FPCB is coupled to the CPU to operate as an antenna for transmitting the control signal and radiating and receiving the wireless signal. The FPCB includes a transmission unit coupled to the CPU for transmitting the control signal, a radiation unit for radiating and receiving the wireless signal, and a feed point formed on the radiation unit for feeding the wireless signal to the radiation unit. The transmission line is coupled between the feed point and the wireless transmitter for transmitting the wireless signal.

(21) Appl. No.: **14/055,896**

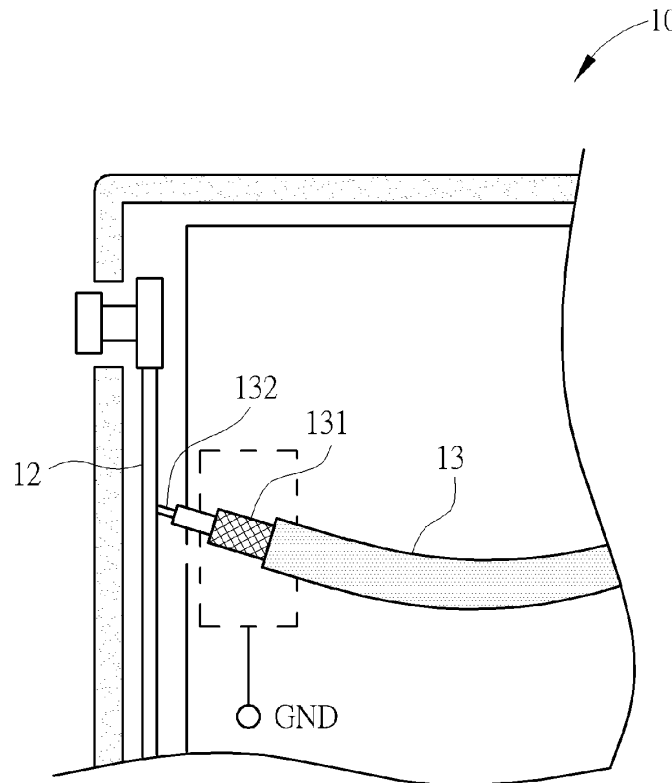
(22) Filed: **Oct. 17, 2013**

(30) **Foreign Application Priority Data**

Feb. 4, 2013 (TW) 102104236

Publication Classification

(51) **Int. Cl.**
H04B 1/38 (2006.01)





US 20140225781A1

(19) **United States**

(12) **Patent Application Publication**

Sato et al.

(10) **Pub. No.: US 2014/0225781 A1**

(43) **Pub. Date: Aug. 14, 2014**

(54) **MULTI-BAND ANTENNA AND TERMINAL DEVICE**

(71) Applicant: **SONY MOBILE COMMUNICATIONS AB**, Lund (SE)

(72) Inventors: **Takahiro Sato**, Tokyo (JP); **Tomihiko Omuro**, Tokyo (JP)

(73) Assignee: **SONY MOBILE COMMUNICATIONS AB**, Lund (SE)

(21) Appl. No.: **13/765,319**

(22) Filed: **Feb. 12, 2013**

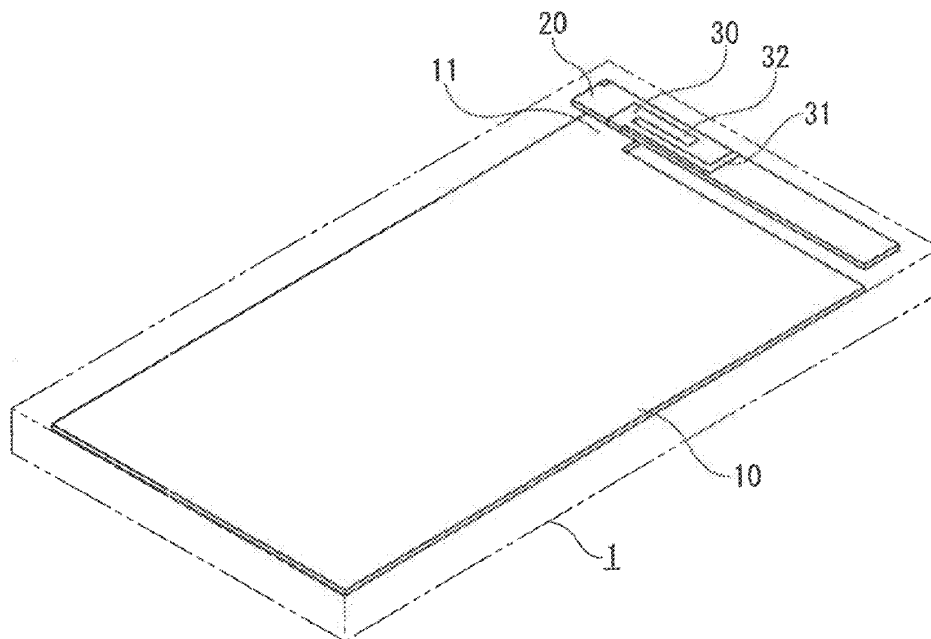
Publication Classification

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

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

(57) **ABSTRACT**

An antenna that includes a first element extending from a connection point, and has a curvature such that a first tip end of the first element extends in a direction toward the connection point. A second element is connected to the connection point, and has a second tip end that extends in a direction away from the connection point, the second tip end being disposed within an outer periphery of the first element. A distance between a portion of the first element that is parallel to the second element is greater than $\lambda_{gs}/100$, where λ_{gs} represents an effective wavelength of a first anti-resonance frequency.





US 20140225783A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0225783 A1**

(43) **Pub. Date: Aug. 14, 2014**

(54) **APPARATUS AND METHODS OF FORMING MOLDED PARTS**

Publication Classification

(75) Inventors: **Christian Saxe**, Copenhagen East (DK);
Dennis Sejersgaard-Jacobsen,
Bronshoj (DK)

(51) **Int. Cl.**
H01Q 1/36 (2006.01)
B29C 70/68 (2006.01)

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

(52) **U.S. Cl.**
CPC . *H01Q 1/36* (2013.01); *B29C 70/68* (2013.01)
USPC **343/700 MS**; 264/446; 264/255

(21) Appl. No.: **14/342,812**

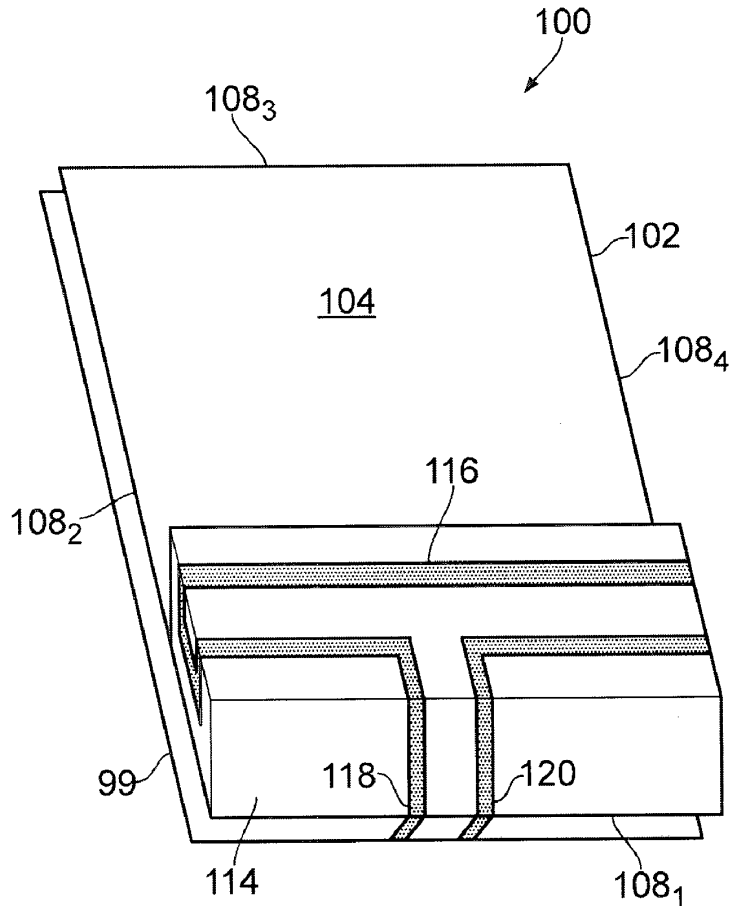
(57) **ABSTRACT**

(22) PCT Filed: **Sep. 9, 2011**

(86) PCT No.: **PCT/IB2011/053958**

§ 371 (c)(1),
(2), (4) Date: **Mar. 5, 2014**

An apparatus including a first molded part including a plurality of protrusions; and a second molded part, molded at least to the plurality of protrusions of the first molded part, the second molded part including an antenna configured to resonate at radio frequencies.





US 20140225784A1

(19) **United States**

(12) **Patent Application Publication**
Li

(10) **Pub. No.: US 2014/0225784 A1**

(43) **Pub. Date: Aug. 14, 2014**

(54) **PRINTED ANTENNA AND MOBILE COMMUNICATION EQUIPMENT**

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

CPC **H01Q 9/0407** (2013.01)

USPC **343/700 MS**

(75) Inventor: **Meng Li**, Shenzhen (CN)

(73) Assignee: **ZTE CORPORATION**, Shenzhen (CN)

(57)

ABSTRACT

(21) Appl. No.: **14/348,663**

(22) PCT Filed: **Dec. 31, 2011**

(86) PCT No.: **PCT/CN2011/085133**

§ 371 (c)(1),
(2), (4) Date: **Mar. 31, 2014**

Disclosed is a printed antenna which includes: a ground plane which is a layer of metal formed on the insulating layer; a feed unit which is multiple metallic lines formed on the insulating layer and includes a first end and a second end; a feed point which is set between the feed unit and the ground plane and is connected to the first end of the feed unit; a first radiation unit which is formed on the insulating layer, and configured to radiate or receive first frequency band signals; a second radiation unit which is formed on the insulating layer, connected to the second end of the feed unit, and configured to radiate or receive second frequency band signals; a third radiation unit, which is formed on the insulating layer, connected to the second end of the feed unit, and configured to radiate or receive third frequency band signals.

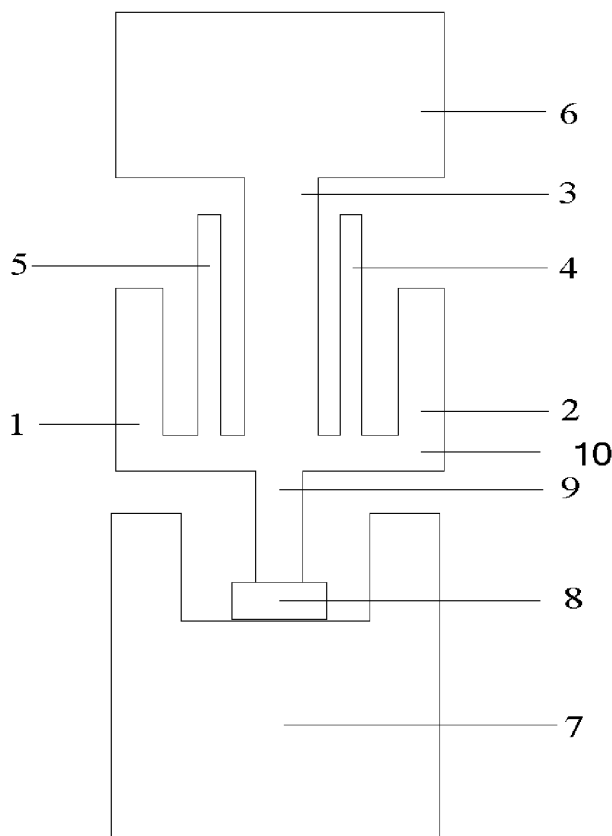
(30) **Foreign Application Priority Data**

Sep. 30, 2011 (CN) 201120372894.9

Publication Classification

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

(2006.01)





US 20140225785A1

(19) **United States**

(12) **Patent Application Publication**
YU

(10) **Pub. No.: US 2014/0225785 A1**

(43) **Pub. Date: Aug. 14, 2014**

(54) **ANTENNA REFLECTOR APPARATUS**

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

(71) Applicant: **SJ ANTENNA DESIGN**, Taipei City (TW)

CPC **H01Q 19/10** (2013.01)

USPC **343/702; 343/834**

(72) Inventor: **YA-CHUNG YU**, Taipei City (TW)

(57) **ABSTRACT**

(73) Assignee: **SJ ANTENNA DESIGN**, Taipei City (TW)

According to one aspect of the present invention, an antenna reflector apparatus provided comprises a shell body, a reflector indentation, and an antenna. The reflector indentation embedded in the shell body comprises a first indentation opening and a second indentation opening opposite to the first indentation opening. The first indentation opening is on the first surface of the shell body; the second indentation opening is on the second surface of the shell body. And the first indentation opening penetrates the shell body and connects to the second indentation opening. The antenna is located besides the second indentation opening of the reflector indentation. The area of the first indentation opening of the reflector indentation is larger than the area of the second indentation opening.

(21) Appl. No.: **14/164,098**

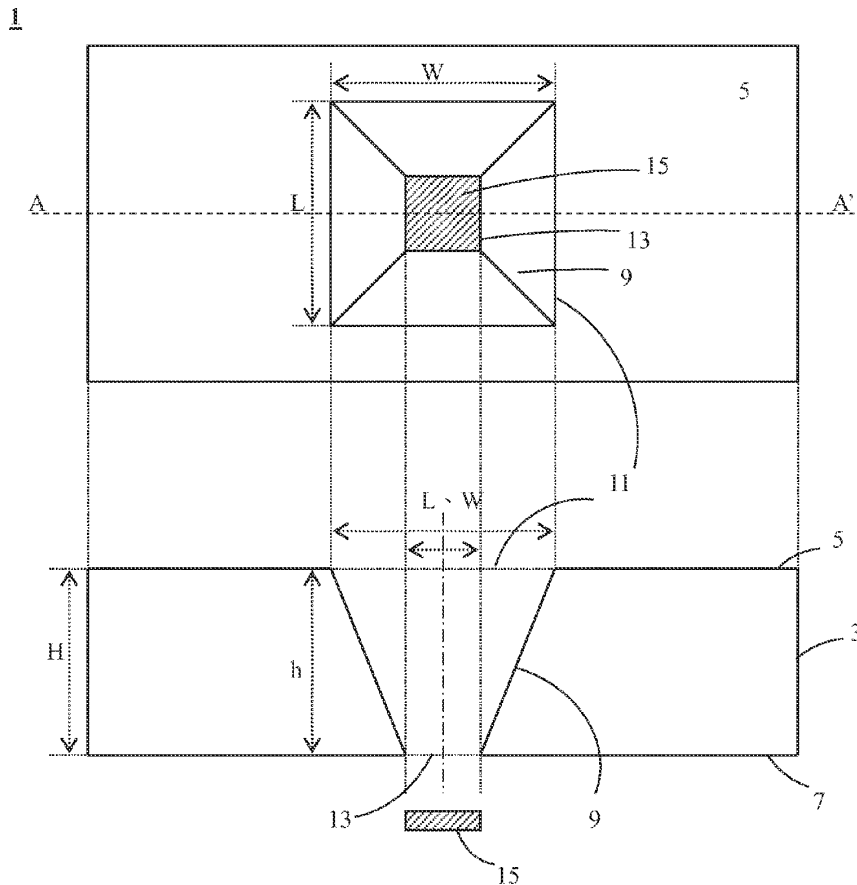
(22) Filed: **Jan. 24, 2014**

(30) **Foreign Application Priority Data**

Feb. 8, 2013 (TW) 102105468

Publication Classification

(51) **Int. Cl.**
H01Q 19/10 (2006.01)





US 20140225787A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0225787 A1**

(43) **Pub. Date: Aug. 14, 2014**

(54) **CHASSIS-EXCITED ANTENNA APPARATUS AND METHODS**

(71) Applicant: **Pulse Finland OY, Kempele (FI)**

(72) Inventors: **Prasadh Ramachandran, Kempele (FI);
Petteri Annamaa, Oulunsalo (FI)**

(21) Appl. No.: **14/177,093**

(22) Filed: **Feb. 10, 2014**

Related U.S. Application Data

(63) Continuation of application No. 13/026,078, filed on Feb. 11, 2011, now Pat. No. 8,648,752.

Publication Classification

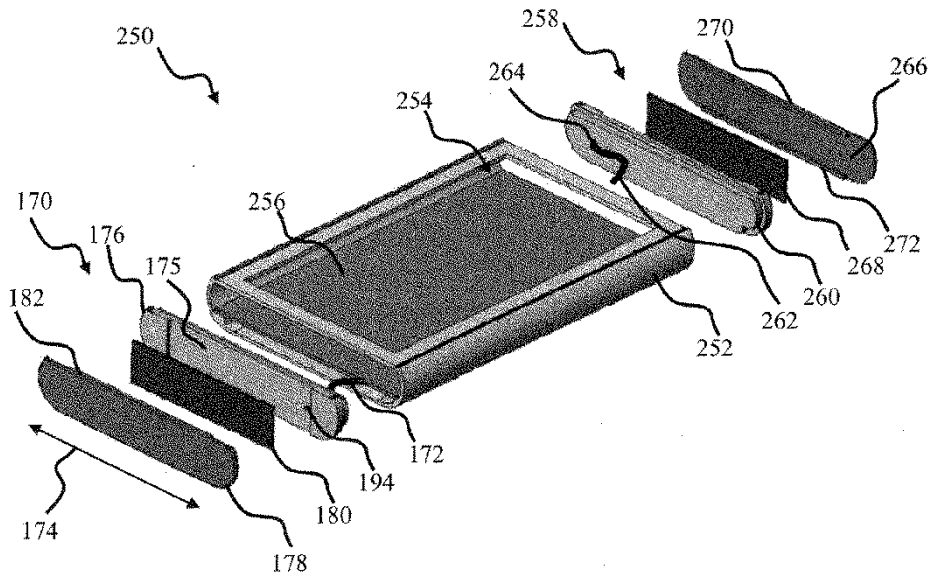
(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/50 (2006.01)
H01Q 7/00 (2006.01)

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

CPC . **H01Q 1/22** (2013.01); **H01Q 7/00** (2013.01);
H01Q 1/50 (2013.01)
USPC **343/702**; 343/867; 343/700 MS; 343/749

(57) **ABSTRACT**

A chassis-excited antenna apparatus, and methods of tuning and utilizing the same. In one embodiment, a distributed loop antenna configuration is used within a handheld mobile device (e.g., cellular telephone). The antenna comprises two radiating elements: one configured to operate in a high-frequency band, and the other in a low-frequency band. The two antenna elements are disposed on different side surfaces of the metal chassis of the portable device; e.g., on the opposing sides of the device enclosure. Each antenna component comprises a radiator and an insulating cover. The radiator is coupled to a device feed via a feed conductor and a ground point. A portion of the feed conductor is disposed with the radiator to facilitate forming of the coupled loop resonator structure.





US 20140225800A1

(19) **United States**

(12) **Patent Application Publication**
Jenwatanavet

(10) **Pub. No.: US 2014/0225800 A1**

(43) **Pub. Date: Aug. 14, 2014**

(54) **APPARATUS AND METHODS TO IMPROVE ANTENNA ISOLATION**

Publication Classification

(71) Applicant: **QUALCOMM INCORPORATED**, San Diego, CA (US)

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

(72) Inventor: **Jatupum Jenwatanavet**, San Diego, CA (US)

(52) **U.S. Cl.**
CPC **H01Q 1/521** (2013.01)
USPC **343/841**

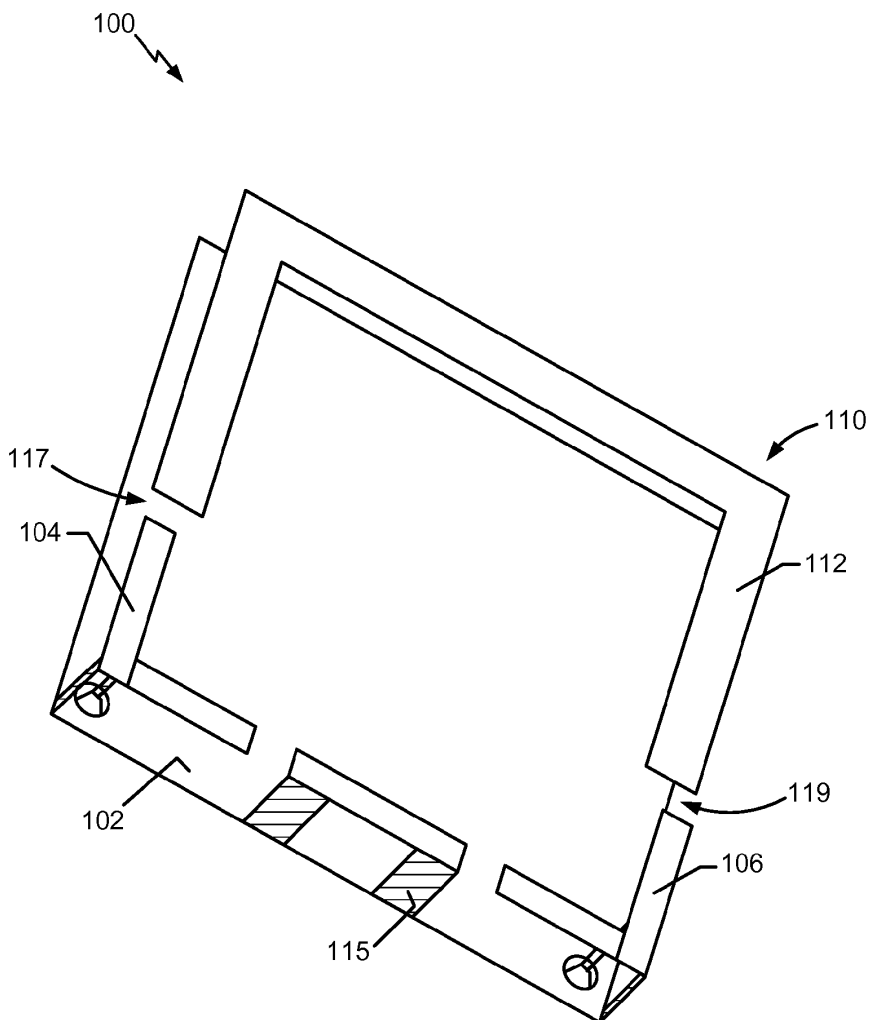
(73) Assignee: **QUALCOMM INCORPORATED**, San Diego, CA (US)

(57) **ABSTRACT**

(21) Appl. No.: **13/765,566**

An antenna apparatus includes a circuit card assembly, a first antenna and a second antenna fabricated on the circuit card assembly, the first antenna and the second antenna configured to operate at substantially the same frequency. A feature located proximate to the first antenna and the second antenna reduces electromagnetic coupling between the first antenna and the second antenna.

(22) Filed: **Feb. 12, 2013**





US 20140225801A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0225801 A1**

(43) **Pub. Date: Aug. 14, 2014**

(54) **ANTENNA APPARATUS AND METHODS**

Publication Classification

(75) Inventors: **Alexandre Pinto**, Copenhagen (DK);
Cviko Mirsad, Malmo (SE)

(51) **Int. Cl.**
H01Q 1/48 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/48** (2013.01)
USPC **343/848; 29/601**

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

(57) **ABSTRACT**

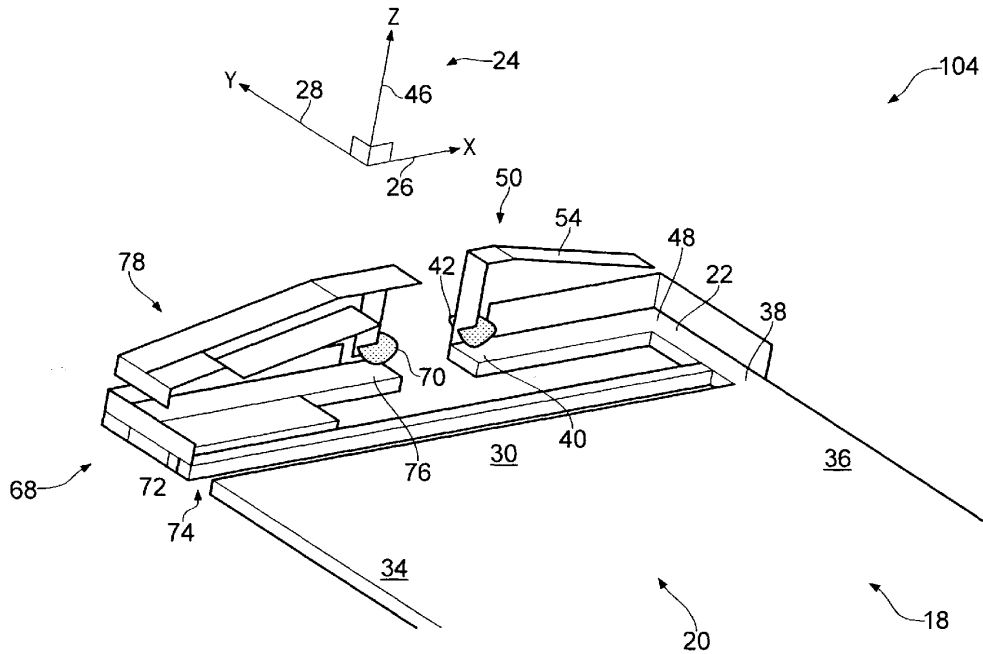
(21) Appl. No.: **13/876,231**

An apparatus including: a first ground member; a second ground member extending from the first ground member and including a feed point, the feed point being configured to receive a signal in a first frequency band and to receive an antenna configured to operate in the first frequency band, the first ground member and the second ground member having an electrical length configured to provide a resonant mode in the first ground member and the second ground member in the first frequency band.

(22) PCT Filed: **Oct. 6, 2010**

(86) PCT No.: **PCT/IB10/54524**

§ 371 (c)(1),
(2), (4) Date: **Jun. 24, 2013**





US 20140230237A1

(19) **United States**

(12) **Patent Application Publication**
MA

(10) **Pub. No.: US 2014/0230237 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **INSERT TYPE ANTENNA MODULE FOR PORTABLE TERMINAL AND METHOD FOR MANUFACTURING THE SAME**

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01)
USPC **29/600**

(71) Applicant: **Sang-Yong MA**, Ansan-si (KR)

(72) Inventor: **Sang-Yong MA**, Ansan-si (KR)

(21) Appl. No.: **14/247,337**

(22) Filed: **Apr. 8, 2014**

(57) **ABSTRACT**

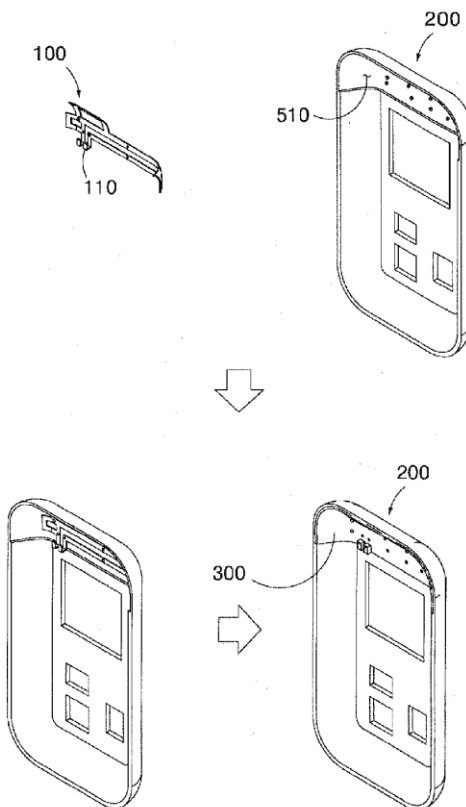
The present invention relates to an antenna module for an insert type antenna module for a portable terminal and a method for manufacturing the same. More specifically, the method for manufacturing an insert type antenna module for a portable terminal comprises an antenna radiation part manufacture step wherein an antenna core is manufactured, the antenna core being engaged by an insert so that an antenna radiation part configured in a predetermined shape selected between a plane shape and a curved shape with at least one axis by cutting and bending a conductive metal sheet is exposed toward an outer surface of one side, wherein in the antenna radiation part manufacture step, in the core forming mold is disposed an antenna support protrusion maintaining a gap for the sake of a thickness development of the antenna core.

Related U.S. Application Data

(63) Continuation of application No. 13/139,031, filed on Jun. 10, 2011, now Pat. No. 8,760,351, filed as application No. PCT/KR2009/007454 on Dec. 11, 2009.

Foreign Application Priority Data

(30) Dec. 11, 2008 (KR) 10-2008-0125877
Mar. 31, 2009 (KR) 10-2009-0027587
Jul. 13, 2009 (KR) 10-2009-0063476
Sep. 2, 2009 (KR) 10-2009-0082243





US 20140232484A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0232484 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **PHASE SHIFT CIRCUIT AND ANTENNA DEVICE**

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

CPC *H01P 1/184* (2013.01)

USPC **333/161**

(71) Applicant: **HITACHI METALS, LTD.**, Tokyo (JP)

(72) Inventors: **Kazuhiro SAKASAI**, Hitachi (JP);
Tomoyuki OGAWA, Hitachi (JP)

(57) **ABSTRACT**

(73) Assignee: **HITACHI METALS, LTD.**, Tokyo (JP)

(21) Appl. No.: **14/081,268**

(22) Filed: **Nov. 15, 2013**

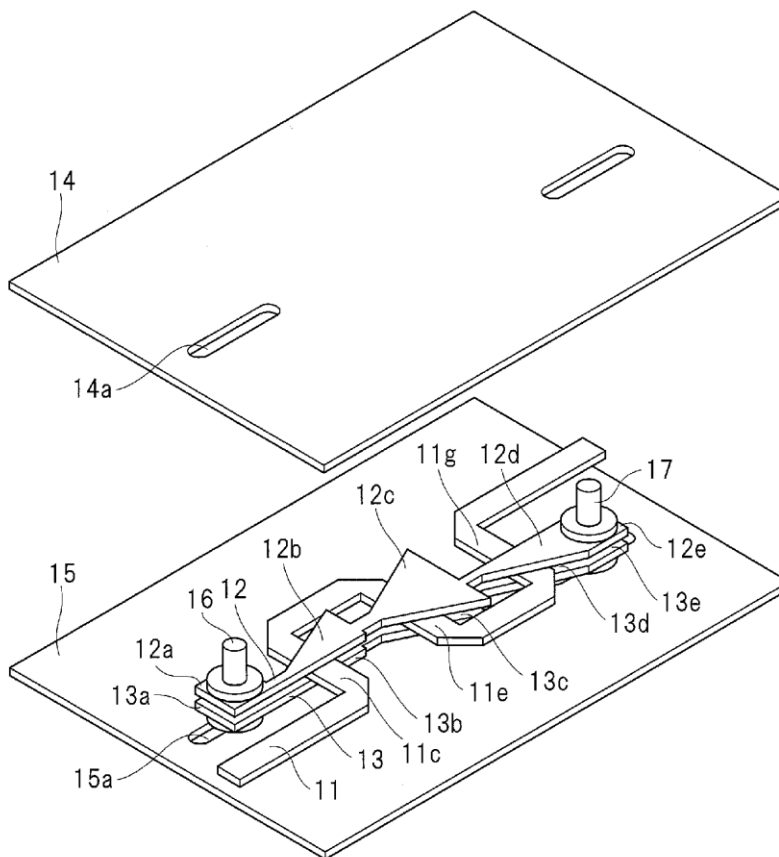
Techniques capable of reducing the width-direction size of a phase shift circuit as much as possible are provided. A phase shift circuit has a signal line, a first dielectric plate, and a second dielectric plate. The signal line has first to third intersecting parts extending in a direction intersecting with a longitudinal direction of the phase shift circuit. On the other hand, the first dielectric plate and the second dielectric plate have first to third overlapping parts overlapping the intersecting parts of the signal line. When the first dielectric plate and the second dielectric plate are moved in the longitudinal direction of the phase shift circuit, the overlapped areas between the intersecting parts of the signal line and the overlapping parts of the first dielectric plate and the second dielectric plate are changed.

(30) **Foreign Application Priority Data**

Feb. 15, 2013 (JP) 2013-28406

Publication Classification

(51) **Int. Cl.**
H01P 1/18 (2006.01)





US 20140232602A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0232602 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **ANTENNA MODULE**

Publication Classification

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

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

(72) Inventors: **HSI-Chieh CHEN**, New Taipei (TW);
Cho-Kang HSU, New Taipei (TW);
Chang-Ching HUANG, New Taipei (TW)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01)
USPC **343/702**

(73) Assignee: **Chiun Mai Communication Systems, Inc.**, New Taipei (TW)

(57) **ABSTRACT**

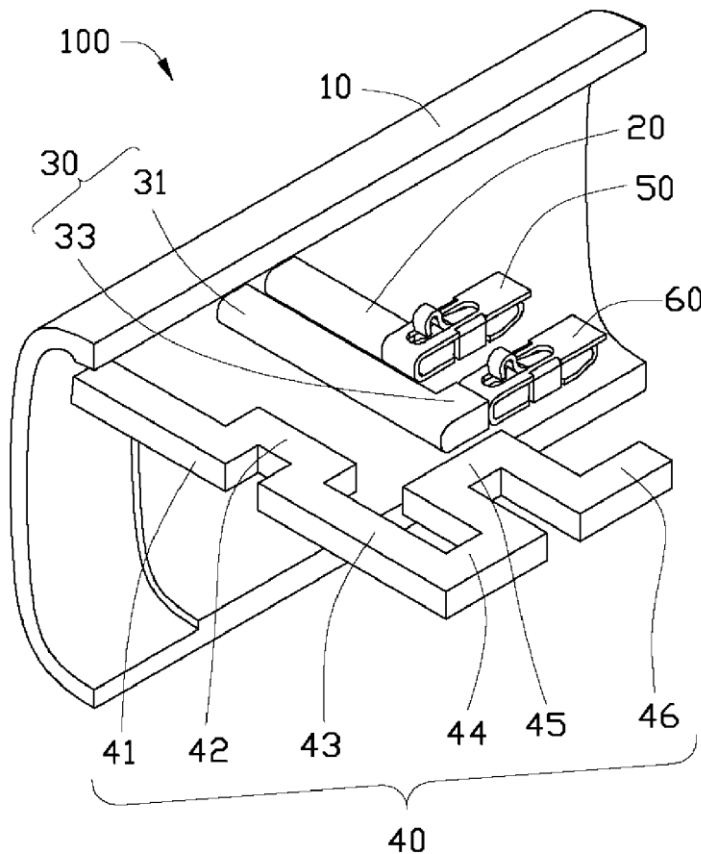
An exemplary antenna module includes a metal unit, a ground unit, a feed unit, and a resonating unit. The metal unit is a metal housing or a metal sidewall of a wireless communication device. One end of the ground unit is connected to the metal unit and another end of the ground unit is grounded. One end of the feed unit is connected to the metal unit and another end of the feed unit is connected to a feed point of the wireless communication device. The resonating unit and the metal unit cooperatively generate a resonating, thereby receiving/sending wireless signals in corresponding frequency bands.

(21) Appl. No.: **14/014,593**

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

(30) **Foreign Application Priority Data**

Feb. 20, 2013 (TW) 102105807





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(19) **United States**

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

(10) **Pub. No.: US 2014/0232604 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **MOBILE WIRELESS COMMUNICATIONS
DEVICE WITH ELECTRICALLY
CONDUCTIVE CONTINUOUS RING AND
RELATED METHODS**

continuation-in-part of application No. 13/005,311,
filed on Jan. 12, 2011, now Pat. No. 8,615,279.

(60) Provisional application No. 61/367,113, filed on Jul.
23, 2010.

(71) Applicant: **BLACKBERRY LIMITED**, Waterloo
(CA)

Publication Classification

(72) Inventors: **JOSHUA KWAN HO WONG**,
WATERLOO (CA); **JOHN ALFRED
WHITMORE**, HEIDELBERG (CA);
ADRIAN MATTHEW COOKE,
KITCHENER (CA); **STEVEN
EUGENE DOWNS**, IRVING, TX (US);
**JARI KRISTIAN VAN
WONTERGHEM**, TAMPERE (FI)

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

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01)
USPC **343/702**; 29/601

(73) Assignee: **BLACKBERRY LIMITED**, Waterloo
(CA)

(57) **ABSTRACT**

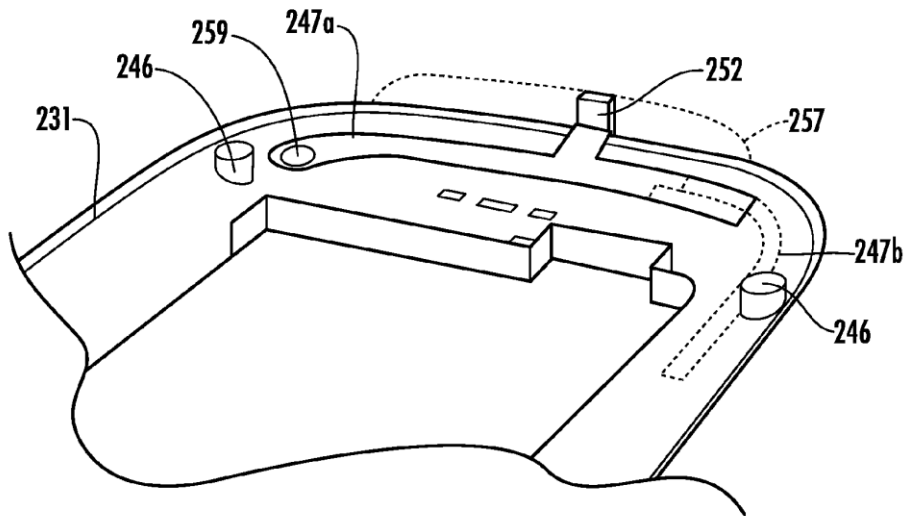
A mobile wireless communications device may include a portable housing that may include an electrically conductive continuous ring defining a perimeter of the portable housing. The electrically conductive continuous ring may be configured to function as an antenna. The mobile wireless communications device may further include a printed circuit board (PCB) carried by the portable housing and may include an electrically conductive layer defining a ground plane. The mobile wireless communications device may further include wireless transceiver circuitry carried by the PCB and coupled to the antenna. The mobile wireless communications device may also include an electrically conductive shorting member coupled between the electrically conductive continuous ring and the ground plane.

(21) Appl. No.: **14/260,363**

(22) Filed: **Apr. 24, 2014**

Related U.S. Application Data

(63) Continuation of application No. 13/099,025, filed on
May 2, 2011, now Pat. No. 8,774,880, which is a





US 20140232607A1

(19) **United States**

(12) **Patent Application Publication**

LEE et al.

(10) **Pub. No.: US 2014/0232607 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **MOBILE TERMINAL**

(71) Applicants: **Hyukjae LEE**, Seoul (KR); **Byunghwa Lee**, Seoul (KR)

(72) Inventors: **Hyukjae LEE**, Seoul (KR); **Byunghwa Lee**, Seoul (KR)

(21) Appl. No.: **14/140,771**

(22) Filed: **Dec. 26, 2013**

(30) **Foreign Application Priority Data**

Feb. 19, 2013 (KR) 10-2013-0017725

Publication Classification

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

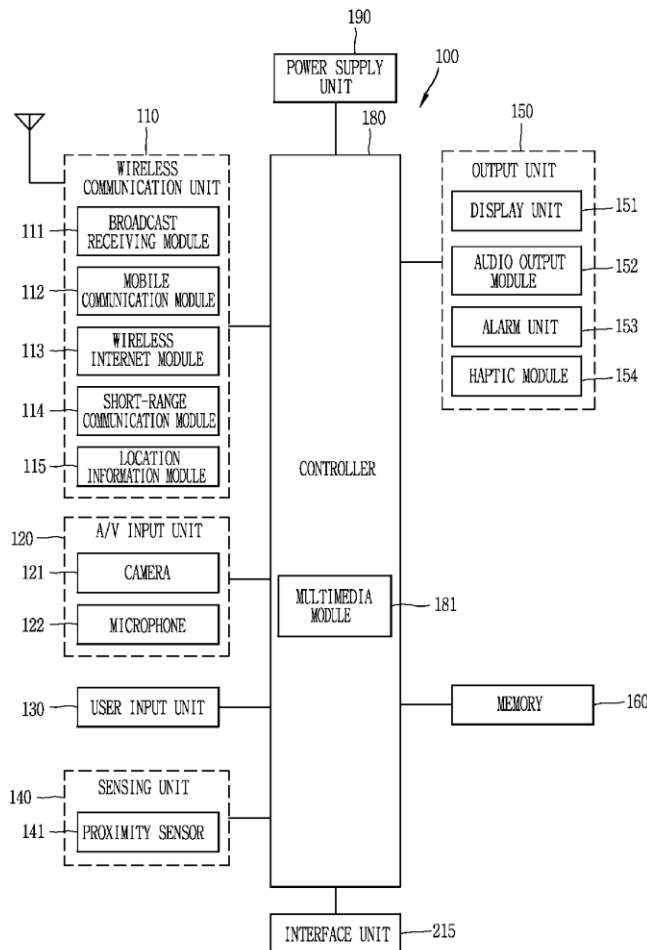
(52) **U.S. Cl.**

CPC **H01Q 1/526** (2013.01)

USPC **343/841**

(57) **ABSTRACT**

A mobile terminal includes: a terminal body having a battery and an antenna module; a printed circuit board having one or more processors disposed between the battery and the antenna module, and mounted to the terminal body; a partition wall formed at the terminal body such that a region for mounting the antenna module is partitioned from a region for mounting the printed circuit board; and a shielding member coupled to the partition wall, such that electromagnetic interference of an antenna device due to an operation of the processor is prevented.





US 20140232609A1

(19) **United States**

(12) **Patent Application Publication**
Lee

(10) **Pub. No.: US 2014/0232609 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **WINDOW ASSEMBLY FOR DISPLAY DEVICE WITH ANTENNA AND METHOD OF MANUFACTURING THE SAME**

(52) **U.S. Cl.**
CPC . **H01Q 1/42** (2013.01); **H01P 11/00** (2013.01)
USPC **343/873**; 29/600

(71) Applicant: **SAMSUNG DISPLAY CO., LTD.**,
Yongin-City (KR)

(57) **ABSTRACT**

(72) Inventor: **Hyun Jae Lee**, Seoul (KR)

(73) Assignee: **SAMSUNG DISPLAY CO., LTD.**,
Yongin-City (KR)

(21) Appl. No.: **13/958,504**

(22) Filed: **Aug. 2, 2013**

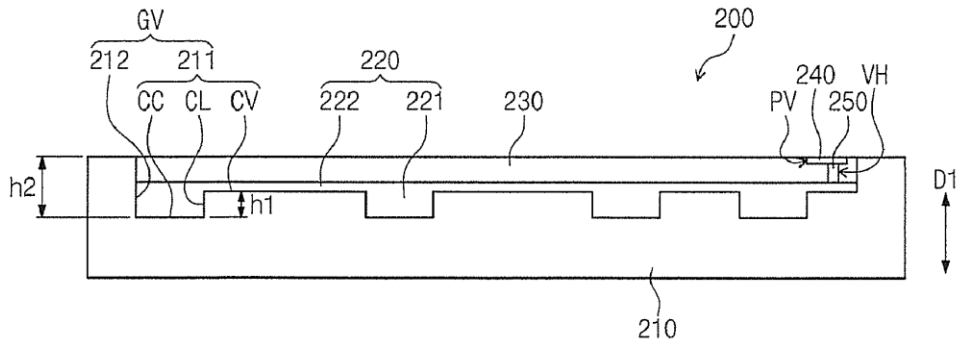
(30) **Foreign Application Priority Data**

Feb. 19, 2013 (KR) 10-2013-0017642

Publication Classification

(51) **Int. Cl.**
H01Q 1/42 (2006.01)
H01P 11/00 (2006.01)

A window assembly for a display device with an antenna includes a cover window, an antenna pattern, an insulating layer, and an antenna pad. The cover window includes a receiving recess having a bottom surface with a concavo-convex shape. The antenna pattern is accommodated in the receiving recess to cover the bottom surface and the antenna pattern has a lower surface with a concavo-convex shape corresponding to the concavo-convex shape of the bottom surface. The insulating layer is accommodated in the receiving recess to cover the antenna pattern. The antenna pad is disposed on the insulating layer and electrically coupled to the antenna pattern. Thus, a volume of the antenna pattern is increased, and a radiation capability of the antenna may be improved.





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(19) **United States**

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

(10) **Pub. No.: US 2014/0232610 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **ANTENNA DEVICE**

Publication Classification

(75) Inventors: **Yoko Shigemoto**, Chiba (JP); **Eiji Hirose**, Chiba (JP); **Tomoya Ishida**, Chiba (JP)

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

(73) Assignee: **Mitsubishi Steel MFG. Co., Ltd.**, Tokyo (JP)

(52) **U.S. Cl.**
CPC **H01Q 1/40** (2013.01)
USPC **343/873**

(21) Appl. No.: **13/982,345**

(57) **ABSTRACT**

(22) PCT Filed: **Jan. 19, 2012**

(86) PCT No.: **PCT/JP2012/051078**

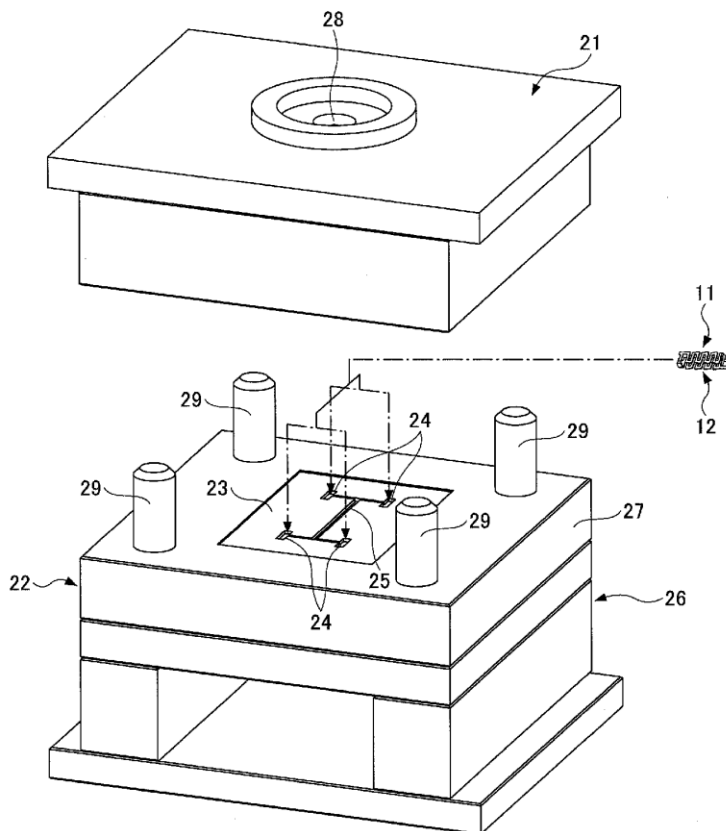
§ 371 (c)(1),
(2), (4) Date: **Aug. 29, 2013**

(30) **Foreign Application Priority Data**

Feb. 2, 2011 (JP) 2011-021059

An antenna device includes a first antenna element made of a conductive metallic plate and formed in a shape of a meander; a second antenna element made of another conductive metallic plate and formed in another shape of a meander; and a sealing material which is made of a high-dielectric material and is configured to seal the first and second antenna elements by the sealing material, wherein the first antenna element is arranged in parallel with the second antenna element, and wherein the first and second antenna elements are embedded inside the sealing material by insert molding.

20





US 20140232612A1

(19) **United States**

(12) **Patent Application Publication**
JENWATANAVET

(10) **Pub. No.: US 2014/0232612 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **MULTIPLE ANTENNA SYSTEM**

(71) Applicant: **QUALCOMM INCORPORATED**, San Diego, CA (US)

(72) Inventor: **Jatupum JENWATANAVET**, San Diego, CA (US)

(73) Assignee: **QUALCOMM INCORPORATED**, San Diego, CA (US)

(21) Appl. No.: **13/773,626**

(22) Filed: **Feb. 21, 2013**

Publication Classification

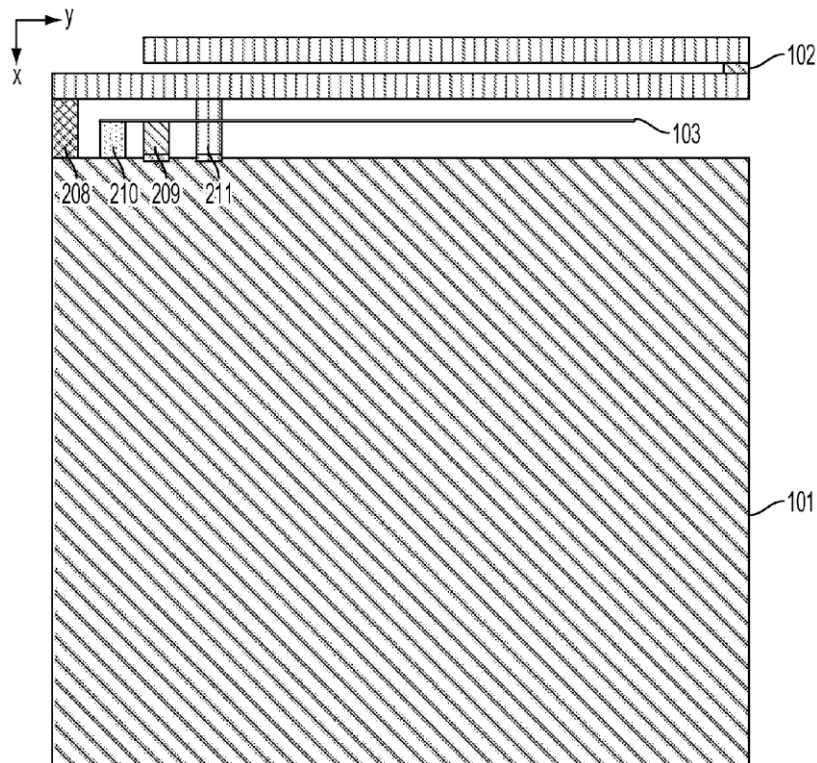
(51) **Int. Cl.**
H01Q 1/52 (2006.01)

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

CPC **H01Q 1/525** (2013.01)
USPC **343/893**

(57) **ABSTRACT**

A multiple antenna module suitable for use in small sized mobile computing devices includes at least a first antenna extending beyond a lateral edge of and coplanar with a printed circuit board assembly and connected to the printed circuit board assembly via a first antenna ground contact and a first antenna feed contact. The multiple antenna module also includes a second antenna located proximate to the first antenna and configured in a plane perpendicular to the plane continuing the first antenna and the printed circuit board. The second antenna is connected to the printed circuit board assembly via a second antenna ground contact and a second antenna feed contact in which the second antenna ground contact and second antenna feed contact are connect to the printed circuit between the first antenna ground contact and the first antenna feed contact.





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(19) **United States**

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

(10) **Pub. No.: US 2014/0233168 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **HANDHELD ELECTRONIC DEVICE WITH CABLE GROUNDING**

(22) Filed: **Apr. 30, 2014**

Related U.S. Application Data

(71) Applicant: , Cupertino, CA (US)

(63) Continuation of application No. 14/158,403, filed on Jan. 17, 2014, which is a continuation of application No. 13/021,689, filed on Feb. 4, 2011, now Pat. No. 8,681,056, which is a continuation of application No. 11/821,329, filed on Jun. 21, 2007, now Pat. No. 7,889,139.

(72) Inventors: **Phillip Michael Hobson**, Menlo Park, CA (US); **Erik L. Wang**, Redwood City, CA (US); **Kenneth A. Jenks**, Capitola, CA (US); **Robert J. Hill**, Salinas, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Richard H. Dinh**, San Jose, CA (US); **Tang Yew Tan**, Palo Alto, CA (US); **Adam D. Mittleman**, San Francisco, CA (US); **Bartley K. Andre**, Palo Alto, CA (US); **Daniel J. Coster**, San Francisco, CA (US); **Daniele De Iulius**, San Francisco, CA (US); **Richard P. Howarth**, San Francisco, CA (US); **Jonathan P. Iwe**, San Francisco, CA (US); **Steven P. Jobs**, Palo Alto, CA (US); **Duncan Robert Kerr**, San Francisco, CA (US); **Shin Nishibori**, Kailua, HI (US); **Matthew Dean Rohrbach**, San Francisco, CA (US); **Douglas B. Satzger**, San Francisco, CA (US); **Calvin Q. Seid**, Palo Alto, CA (US); **Christopher J. Stringer**, Woodside, CA (US); **Eugene Antony Whang**, San Francisco, CA (US); **Rico Zorkendorfer**, San Francisco, CA (US)

Publication Classification

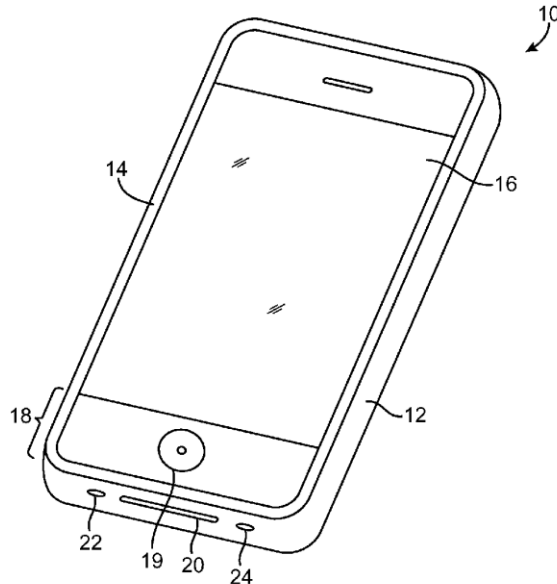
(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H04M 1/0266** (2013.01)
USPC **361/679.3; 343/702**

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(57) **ABSTRACT**

A handheld electronic device may be provided that contains a conductive housing and other conductive elements. The conductive elements may form an antenna ground plane. One or more antennas for the handheld electronic device may be formed from the ground plane and one or more associated antenna resonating elements. Transceiver circuitry may be connected to the resonating elements by transmission lines such as coaxial cables. Ferrules may be crimped to the coaxial cables. A bracket with extending members may be crimped over the ferrules to ground the coaxial cables to the housing and other conductive elements in the ground plane. The ground plane may contain an antenna slot. A dock connector and flex circuit may overlap the slot in a way that does not affect the resonant frequency of the slot. Electrical components may be isolated from the antenna using isolation elements such as inductors and resistors.

(21) Appl. No.: **14/266,532**





US 20140233169A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0233169 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **HANDBELED ELECTRONIC DEVICE WITH CABLE GROUNDING**

(22) Filed: **Apr. 30, 2014**

Related U.S. Application Data

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

(63) Continuation of application No. 14/158,403, filed on Jan. 17, 2014, which is a continuation of application No. 13/021,689, filed on Feb. 4, 2011, now Pat. No. 8,681,056, which is a continuation of application No. 11/821,329, filed on Jun. 21, 2007, now Pat. No. 7,889,139.

(72) Inventors: **Phillip Michael Hobson**, Menlo Park, CA (US); **Erik L. Wang**, Redwood City, CA (US); **Kenneth A. Jenks**, Capitola, CA (US); **Robert J. Hill**, Salinas, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Richard H. Dinh**, San Jose, CA (US); **Tang Yew Tan**, Palo Alto, CA (US); **Adam D. Mittleman**, San Francisco, CA (US); **Bartley K. Andre**, Palo Alto, CA (US); **Daniel J. Coster**, San Francisco, CA (US); **Daniele De Iuliis**, San Francisco, CA (US); **Richard P. Howarth**, San Francisco, CA (US); **Jonathan P. Ive**, San Francisco, CA (US); **Steven P. Jobs**, Palo Alto, CA (US); **Duncan Robert Kerr**, San Francisco, CA (US); **Shin Nishibori**, Kailua, HI (US); **Matthew Dean Rohrbach**, San Francisco, CA (US); **Douglas B. Satzger**, San Francisco, CA (US); **Calvin Q. Seid**, Palo Alto, CA (US); **Christopher J. Stringer**, Woodside, CA (US); **Eugene Antony Whang**, San Francisco, CA (US); **Rico Zorkendorfer**, San Francisco, CA (US)

Publication Classification

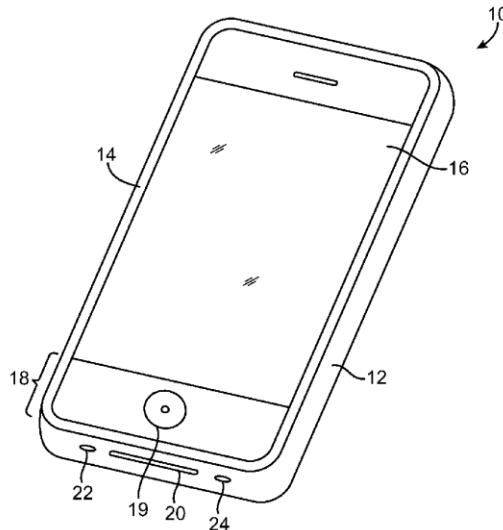
(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H04M 1/0266** (2013.01)
USPC **361/679.3**; 343/702

(57) **ABSTRACT**

A handheld electronic device may be provided that contains a conductive housing and other conductive elements. The conductive elements may form an antenna ground plane. One or more antennas for the handheld electronic device may be formed from the ground plane and one or more associated antenna resonating elements. Transceiver circuitry may be connected to the resonating elements by transmission lines such as coaxial cables. Ferrules may be crimped to the coaxial cables. A bracket with extending members may be crimped over the ferrules to ground the coaxial cables to the housing and other conductive elements in the ground plane. The ground plane may contain an antenna slot. A dock connector and flex circuit may overlap the slot in a way that does not affect the resonant frequency of the slot. Electrical components may be isolated from the antenna using isolation elements such as inductors and resistors.

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **14/266,561**





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(19) **United States**

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

(10) **Pub. No.: US 2014/0233170 A1**

(43) **Pub. Date: Aug. 21, 2014**

(54) **HANDHELD ELECTRONIC DEVICE WITH CABLE GROUNDING**

(22) Filed: **Apr. 30, 2014**

Related U.S. Application Data

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

(63) Continuation of application No. 14/158,403, filed on Jan. 17, 2014, which is a continuation of application No. 13/021,689, filed on Feb. 4, 2011, now Pat. No. 8,681,056, which is a continuation of application No. 11/821,329, filed on Jun. 21, 2007, now Pat. No. 7,889,139.

(72) Inventors: **Phillip Michael Hobson**, Menlo Park, CA (US); **Erik L. Wang**, Redwood City, CA (US); **Kenneth A. Jenks**, Capitola, CA (US); **Robert J. Hill**, Salinas, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Richard H. Dinh**, San Jose, CA (US); **Tang Yew Tan**, Palo Alto, CA (US); **Adam D. Mittleman**, San Francisco, CA (US); **Bartley K. Andre**, Palo Alto, CA (US); **Daniel J. Coster**, San Francisco, CA (US); **Daniele De Iuliis**, San Francisco, CA (US); **Richard P. Howarth**, San Francisco, CA (US); **Jonathan P. Ive**, San Francisco, CA (US); **Steven P. Jobs**, Palo Alto, CA (US); **Duncan Robert Kerr**, San Francisco, CA (US); **Shin Nishibori**, Kailua, HI (US); **Matthew Dean Rohrbach**, San Francisco, CA (US); **Douglas B. Satzger**, San Francisco, CA (US); **Calvin Q. Seid**, Palo Alto, CA (US); **Christopher J. Stringer**, Woodside, CA (US); **Eugene Antony Whang**, San Francisco, CA (US); **Rico Zorkendorfer**, San Francisco, CA (US)

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H04M 1/0266** (2013.01)
USPC **361/679.3**; 343/702

(57) **ABSTRACT**

A handheld electronic device may be provided that contains a conductive housing and other conductive elements. The conductive elements may form an antenna ground plane. One or more antennas for the handheld electronic device may be formed from the ground plane and one or more associated antenna resonating elements. Transceiver circuitry may be connected to the resonating elements by transmission lines such as coaxial cables. Ferrules may be crimped to the coaxial cables. A bracket with extending members may be crimped over the ferrules to ground the coaxial cables to the housing and other conductive elements in the ground plane. The ground plane may contain an antenna slot. A dock connector and flex circuit may overlap the slot in a way that does not affect the resonant frequency of the slot. Electrical components may be isolated from the antenna using isolation elements such as inductors and resistors.

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **14/266,570**

