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(19) **United States**

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

(10) **Pub. No.: US 2014/0285380 A1**

(43) **Pub. Date: Sep. 25, 2014**

(54) **ANTENNA STRUCTURE AND THE  
MANUFACTURING METHOD THEREFOR**

**Publication Classification**

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

(51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
**H01P 11/00** (2006.01)

(72) Inventors: **Jian-Jhih Du**, Hsinchu (TW);  
**Chih-Yung Huang**, Hsinchu (TW);  
**Kuo-Chang Lo**, Hsinchu (TW)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/38** (2013.01); **H01P 11/001**  
(2013.01)  
USPC ..... **343/700 MS; 29/600**

(73) Assignee: **ARCADYAN TECHNOLOGY  
CORPORATION**, Hsinchu (TW)

(57) **ABSTRACT**

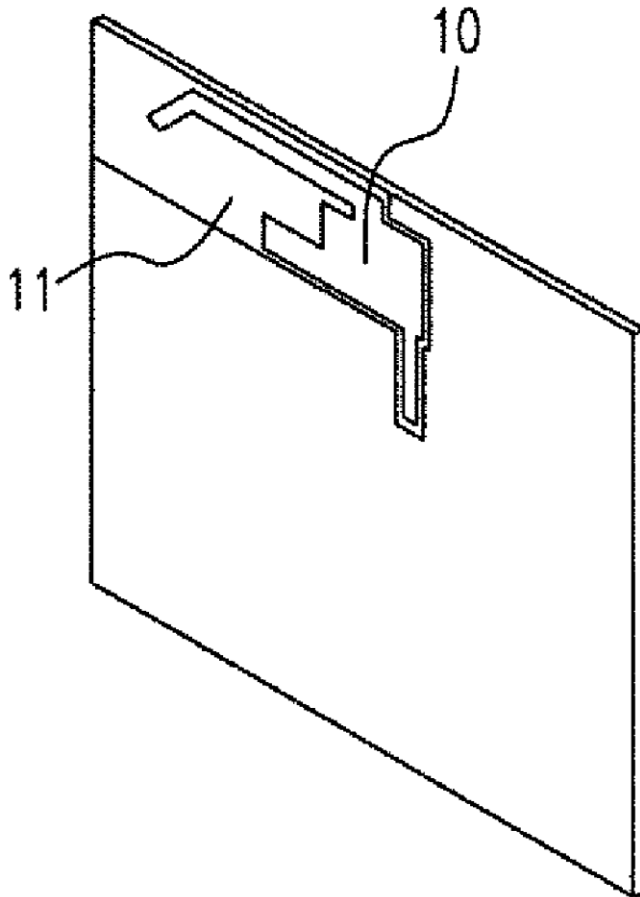
(21) Appl. No.: **13/950,727**

An antenna structure is provided. The antenna structure includes a radiating portion having an approximately quadrangular body, wherein the quadrangular body has a first side, a second side opposite to the first side, a third side, and a fourth side opposite to the third side; and a ground portion surrounding an entire length of the first side, an entire length of the fourth side, and at most a half of a length of the second side.

(22) Filed: **Jul. 25, 2013**

(30) **Foreign Application Priority Data**

Mar. 21, 2013 (TW) ..... 102110130





US 20140285381A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0285381 A1**  
(43) **Pub. Date: Sep. 25, 2014**

(54) **ANTENNA STRUCTURE**

**Publication Classification**

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

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

(72) Inventors: **YI-CHIEH LEE**, New Taipei (TW);  
**YEN-HUI LIN**, New Taipei (TW)

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

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

(57) **ABSTRACT**

An antenna structure includes a feed portion, a first radiating body, and a resonating section. The first radiating body includes first and second shared sections, and first, second, and third extending sections. The resonating section and the first shared section are connected to the feed portion and on receiving feed signals. The first radiating body achieves a first required frequency band. The first shared section and the resonating section together resonate at a second required frequency band. The first shared section and the second shared section together resonate at a third required frequency band.

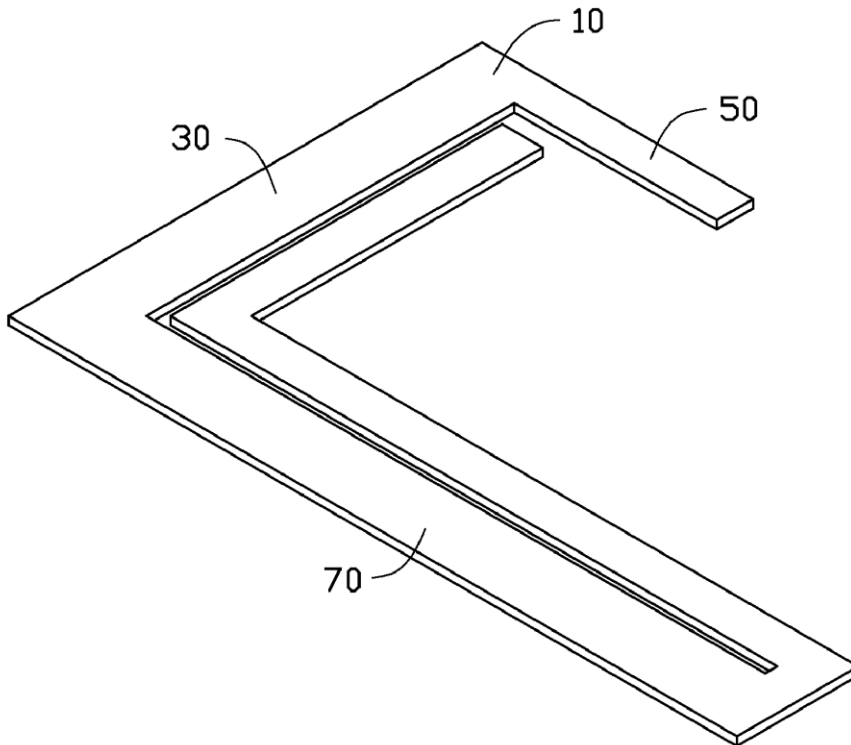
(21) Appl. No.: **14/014,610**

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

(30) **Foreign Application Priority Data**

Mar. 20, 2013 (TW) ..... 102109763

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US 20140285384A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0285384 A1**

(43) **Pub. Date: Sep. 25, 2014**

(54) **ANTENNA ASSEMBLY AND MOBILE  
TERMINAL USING SAME**

**Publication Classification**

(71) Applicants: **Ng Guan Hong**, Shenzhen (CN); **Tay  
Yew Siow**, Shenzhen (CN)

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

(72) Inventors: **Ng Guan Hong**, Shenzhen (CN); **Tay  
Yew Siow**, Shenzhen (CN)

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

(73) Assignee: **AAC TECHNOLOGIES PTE. LTD.**,  
Singapore city (SG)

(57) **ABSTRACT**

An embodiment of the present invention provides an antenna assembly and a mobile terminal. The antenna assembly includes an antenna body provided with a grounding plate and a feeding portion. The antenna body includes a radiating portion provided with an unclosed loop structure. The antenna assembly further has a metal frame. The metal frame is provided with a closed first loop portion surrounding an outer periphery of the radiating portion. An annular gap is formed between the first loop portion and the radiating portion. The antenna assembly of the present disclosure improves the product performance and makes the product appearance more aesthetic.

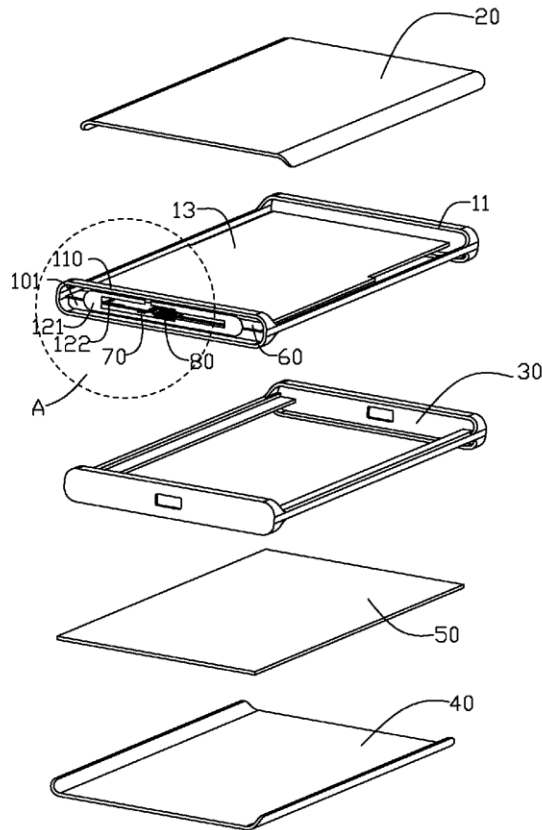
(21) Appl. No.: **14/217,634**

(22) Filed: **Mar. 18, 2014**

(30) **Foreign Application Priority Data**

Mar. 22, 2013 (CN) ..... 201310096530.6

100





US 20140285385A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0285385 A1**

(43) **Pub. Date: Sep. 25, 2014**

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

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

CPC ..... *H01Q 1/24* (2013.01)

USPC ..... **343/702**

(71) Applicant: **CASIO COMPUTER CO., LTD.**,  
Tokyo (JP)

(72) Inventors: **Yutaka AOKI**, Tokyo (JP); **Shigeru YAGI**, Tokyo (JP); **Kaoru YOSHIDA**, Tokyo (JP)

(57) **ABSTRACT**

(73) Assignee: **CASIO COMPUTER CO., LTD.**,  
Tokyo (JP)

An antenna device of the present invention includes an antenna element which transmits or receives an electromagnetic wave having a specific frequency by being supplied with electric power, a conductive element which is formed of a conductive material, arranged so as to be spaced apart from and face the antenna element, and serves as a parasitic element, and a housing having a sealed space therein. The antenna element is provided inside the housing, and the conductive element is provided on outer surface of the housing, or in inner part of the housing, or in a mount member by which the housing is worn on a human body, or in a holding member for holding the housing; the conductive element is electromagnetically coupled to the antenna element, resonates with the specific frequency; and transmits or receives the electromagnetic wave.

(21) Appl. No.: **14/222,504**

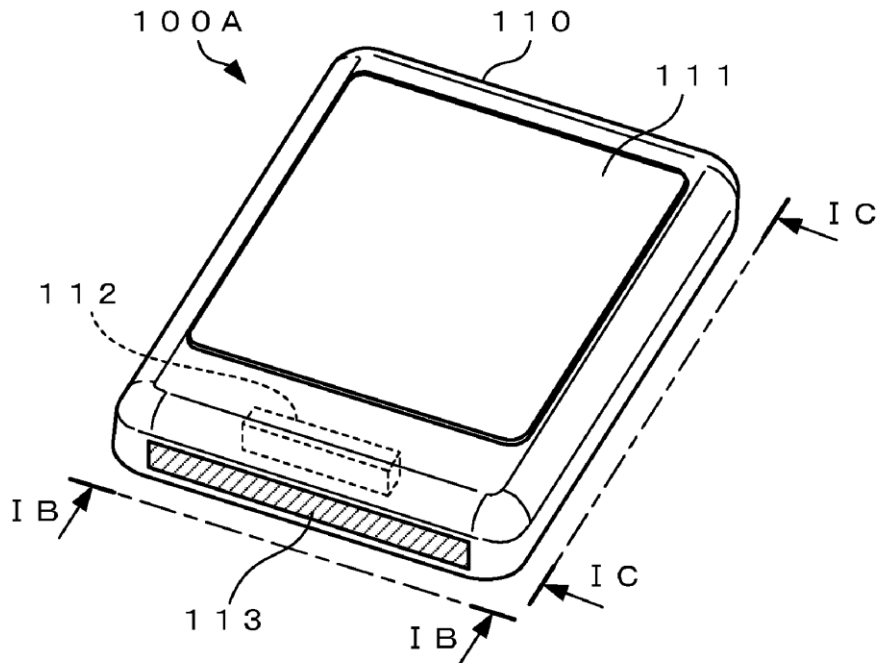
(22) Filed: **Mar. 21, 2014**

(30) **Foreign Application Priority Data**

Mar. 22, 2013 (JP) ..... 2013-059429

**Publication Classification**

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





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(19) **United States**

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

(10) **Pub. No.: US 2014/0285386 A1**

(43) **Pub. Date: Sep. 25, 2014**

(54) **STRUCTURES FOR FORMING CONDUCTIVE PATHS IN ANTENNAS AND OTHER ELECTRONIC DEVICE STRUCTURES**

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

(72) Inventors: **Nicholas G. L. Merz**, San Francisco, CA (US); **Daniel W. Jarvis**, Sunnyvale, CA (US); **Sawyer I. Cohen**, Sunnyvale, CA (US)

(21) Appl. No.: **14/300,704**

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

**Related U.S. Application Data**

(62) Division of application No. 13/024,300, filed on Feb. 9, 2011, now Pat. No. 8,780,581.

(60) Provisional application No. 61/431,520, filed on Jan. 11, 2011.

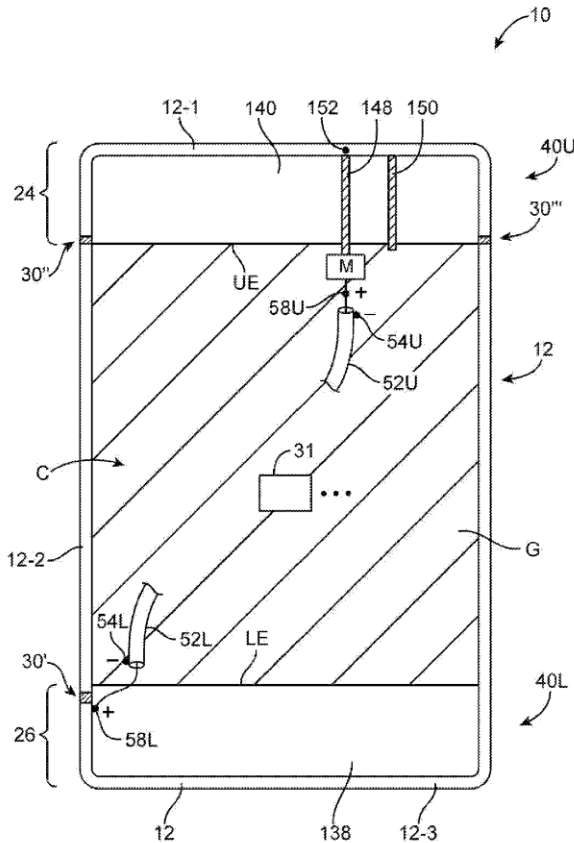
**Publication Classification**

(51) **Int. Cl.**  
*H01Q 1/50* (2006.01)  
*H01Q 1/48* (2006.01)

(52) **U.S. Cl.**  
CPC ... *H01Q 1/50* (2013.01); *H01Q 1/48* (2013.01)  
USPC ..... **343/702; 343/848**

(57) **ABSTRACT**

Electronic devices may be provided that contain conductive paths. A conductive path may be formed from an elongated metal member that extends across a dielectric gap in an antenna. The antenna may be formed from conductive structures that form an antenna ground and conductive structures that are part of a peripheral conductive housing member in the electronic device. The gap may separate the peripheral conductive housing member from the conductive structures. A conductive path may also be formed using one or more springs. A spring may be welded to a conductive member and may have prongs that press against an additional conductive member when the spring is compressed. The prongs may have narrowed tips, curved shapes, and burrs that help form a satisfactory electrical contact between the spring prongs and the additional conductive member.





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(19) **United States**

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

(10) **Pub. No.: US 2014/0285391 A1**

(43) **Pub. Date: Sep. 25, 2014**

(54) **LOW-BAND REFLECTOR FOR DUAL BAND DIRECTIONAL ANTENNA**

**Publication Classification**

(71) Applicant: **Ruckus Wireless, Inc.**, Sunnyvale, CA (US)

(51) **Int. Cl.**  
**H01Q 15/00** (2006.01)  
**H01Q 9/04** (2006.01)

(72) Inventors: **Bernard Baron**, Mountain View, CA (US); **Chia-Ching Lin**, San Jose, CA (US); **Victor Shtrom**, Los Altos, CA (US)

(52) **U.S. Cl.**  
CPC ..... **H01Q 15/0013** (2013.01); **H01Q 9/04** (2013.01)  
USPC ..... **343/837**

(73) Assignee: **Ruckus Wireless, Inc.**, Sunnyvale, CA (US)

(57) **ABSTRACT**

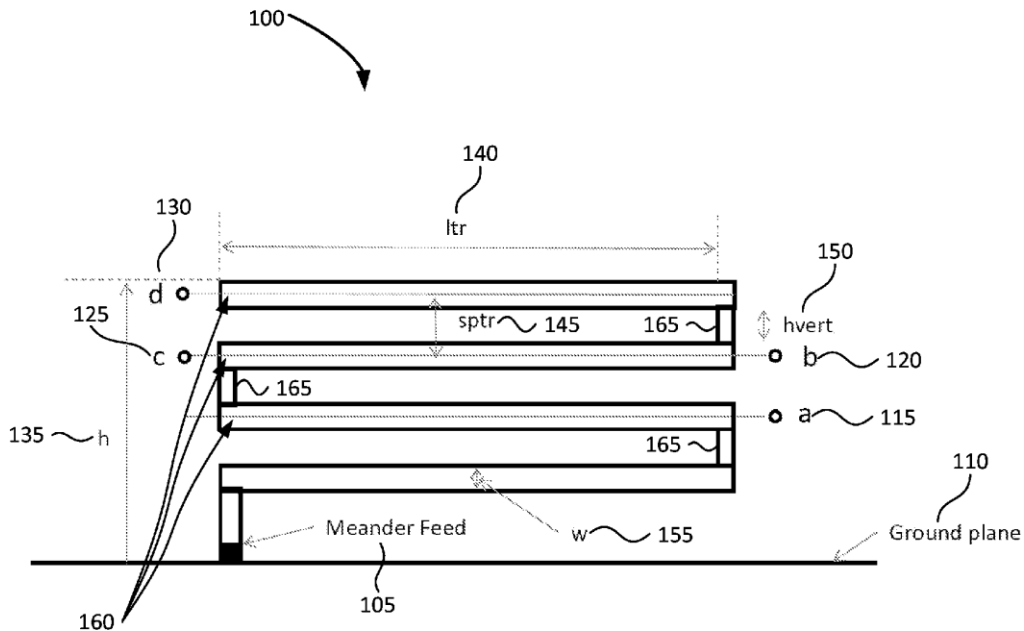
(21) Appl. No.: **14/217,392**

(22) Filed: **Mar. 17, 2014**

**Related U.S. Application Data**

(60) Provisional application No. 61/800,854, filed on Mar. 15, 2013.

A dual band directional antenna with low frequency band reflectors that form desired antenna patterns in a low frequency band while remaining transparent to a higher frequency band. As a result of such frequency transparency, pattern changes in the lower frequency bands do not affect patterns in the higher band frequencies.





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(19) **United States**

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

(10) **Pub. No.: US 2014/0285391 A1**

(43) **Pub. Date: Sep. 25, 2014**

(54) **LOW-BAND REFLECTOR FOR DUAL BAND DIRECTIONAL ANTENNA**

**Publication Classification**

(71) Applicant: **Ruckus Wireless, Inc.**, Sunnyvale, CA (US)

(51) **Int. Cl.**  
**H01Q 15/00** (2006.01)  
**H01Q 9/04** (2006.01)

(72) Inventors: **Bernard Baron**, Mountain View, CA (US); **Chia-Ching Lin**, San Jose, CA (US); **Victor Shtrom**, Los Altos, CA (US)

(52) **U.S. Cl.**  
CPC ..... **H01Q 15/0013** (2013.01); **H01Q 9/04** (2013.01)  
USPC ..... **343/837**

(73) Assignee: **Ruckus Wireless, Inc.**, Sunnyvale, CA (US)

(57) **ABSTRACT**

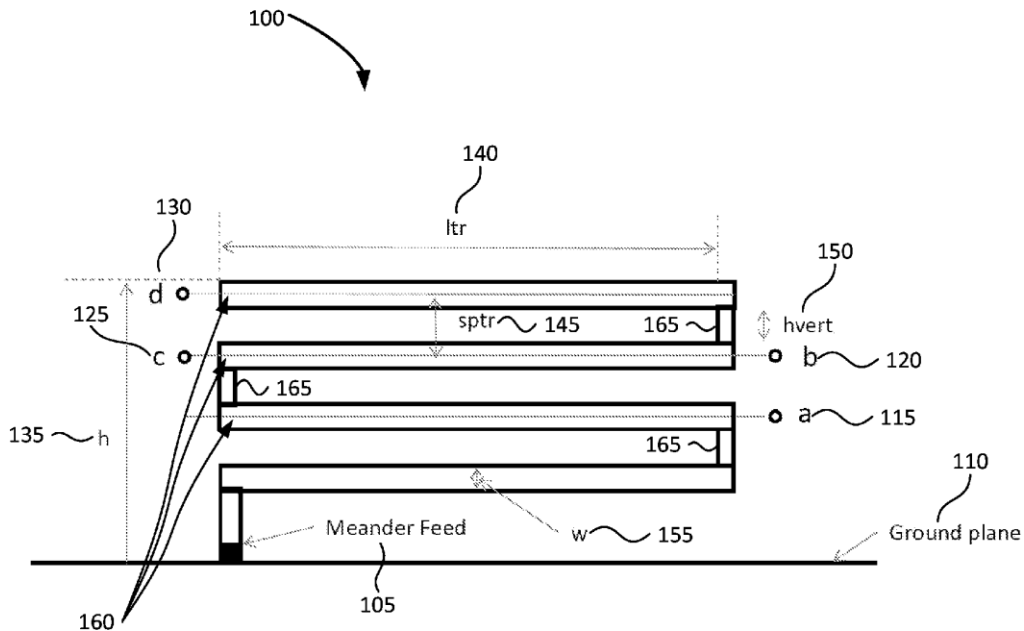
(21) Appl. No.: **14/217,392**

(22) Filed: **Mar. 17, 2014**

**Related U.S. Application Data**

(60) Provisional application No. 61/800,854, filed on Mar. 15, 2013.

A dual band directional antenna with low frequency band reflectors that form desired antenna patterns in a low frequency band while remaining transparent to a higher frequency band. As a result of such frequency transparency, pattern changes in the lower frequency bands do not affect patterns in the higher band frequencies.





US 20140292583A1

(19) **United States**

(12) **Patent Application Publication**  
**HSU**

(10) **Pub. No.: US 2014/0292583 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **ANTENNA STRUCTURE**

**Publication Classification**

(71) Applicant: **Chi Mei Communication Systems, Inc.**, New Taipei (TW)

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

(72) Inventor: **CHO-KANG HSU**, New Taipei (TW)

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

(21) Appl. No.: **13/930,284**

(57) **ABSTRACT**

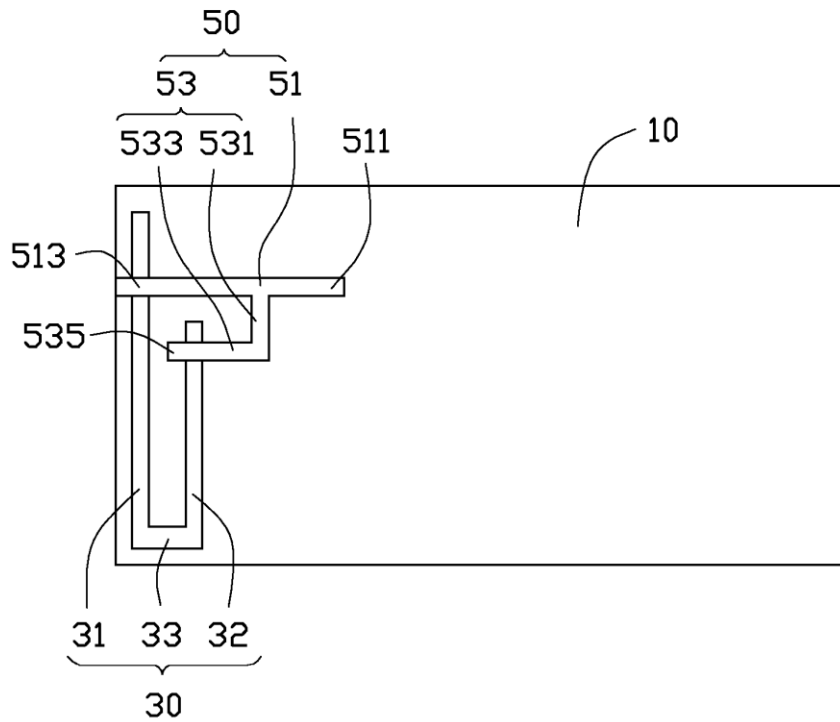
(22) Filed: **Jun. 28, 2013**

An antenna structure is configured to transmit and receive signal for a wireless communication device. The antenna structure includes a base board, a radiating unit, and a feed unit. The radiating unit and the feed unit are formed on the base board. The feed unit partially overlaps on the radiating unit to form a number of signal feed paths.

(30) **Foreign Application Priority Data**

Mar. 27, 2013 (TW) ..... 102110826

100







US 20140292584A1

(19) **United States**

(12) **Patent Application Publication**  
LIN

(10) **Pub. No.: US 2014/0292584 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **ANTENNA ASSEMBLY AND ELECTRONIC DEVICE USING THE ANTENNA ASSEMBLY**

**Publication Classification**

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

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

(72) Inventor: **YEN-HUI LIN**, New Taipei (TW)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/42** (2013.01)  
USPC ..... **343/700 MS**

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

(57) **ABSTRACT**

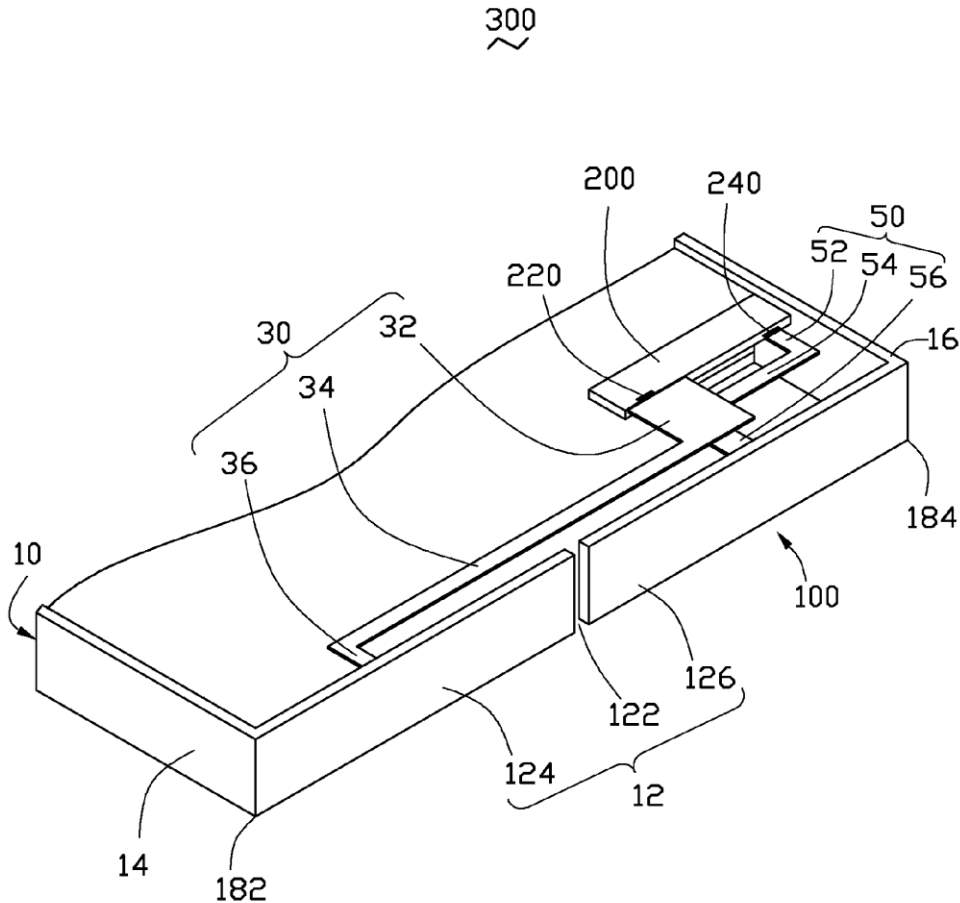
(21) Appl. No.: **14/023,692**

An antenna assembly includes a first antenna, a second antenna, and a metal member. The second antenna is separate and spaced from the first antenna. A gap is defined on the metal member to divide the metal member into a first frame assembly and a second frame assembly. The first antenna is connected to the first frame assembly, the second antenna is connected to the second frame assembly, and the first antenna is electronically coupled to the second antenna.

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

(30) **Foreign Application Priority Data**

Apr. 2, 2013 (TW) ..... 102111899





US 20140292585A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292585 A1**

(43) **Pub. Date: Oct. 2, 2014**

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

**Publication Classification**

(71) Applicant: **MURATA MANUFACTURING CO., LTD.**, Kyoto (JP)

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

(72) Inventors: **Kunihiro KOMAKI**, Kyoto (JP);  
**Chiharu MINAMI**, Kyoto (JP)

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

(73) Assignee: **MURATA MANUFACTURING CO., LTD.**, Kyoto (JP)

(57) **ABSTRACT**

(21) Appl. No.: **14/301,617**

An antenna includes a dielectric base and a radiation electrode formed in the surface of the dielectric base. The radiation electrode includes a side surface electrode formed in the side surface of the dielectric base and a top surface electrode formed in the top surface of the dielectric base. A first point and a second point in the middle of an electrical length leading from a power feeding end of the radiation electrode to an open end are adjacent to each other, and in this adjacent portion, capacitance is formed between the first point and the second point. In addition, a third point and a fourth point in the middle of an electrical length are adjacent to each other, and in this adjacent portion, capacitance is formed between the third point and the fourth point.

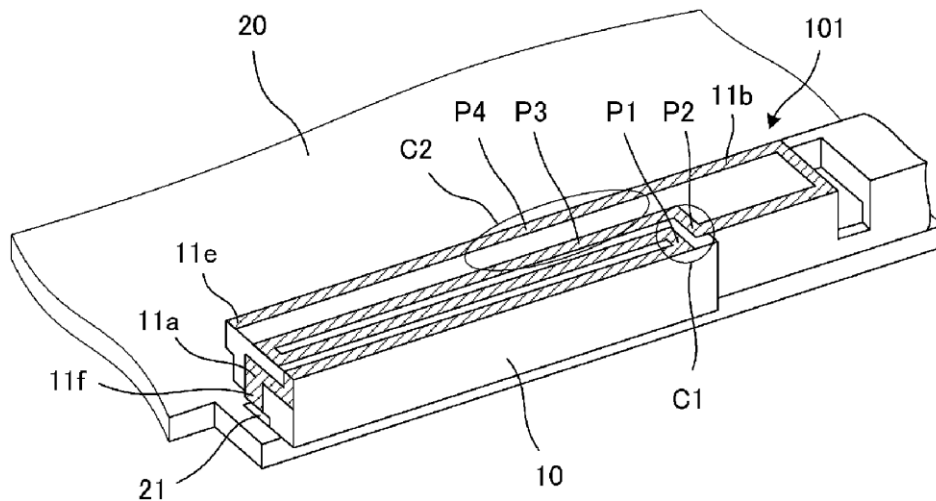
(22) Filed: **Jun. 11, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2013/065318, filed on Jun. 3, 2013.

(30) **Foreign Application Priority Data**

Jun. 8, 2012 (JP) ..... 2012-130975





US 20140292587A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292587 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **ELECTRONIC DEVICE WITH REDUCED  
EMITTED RADIATION DURING LOADED  
ANTENNA OPERATING CONDITIONS**

(52) **U.S. Cl.**  
CPC ..... *H01Q 1/24* (2013.01)  
USPC ..... **343/702**; 343/700 MS; 343/904

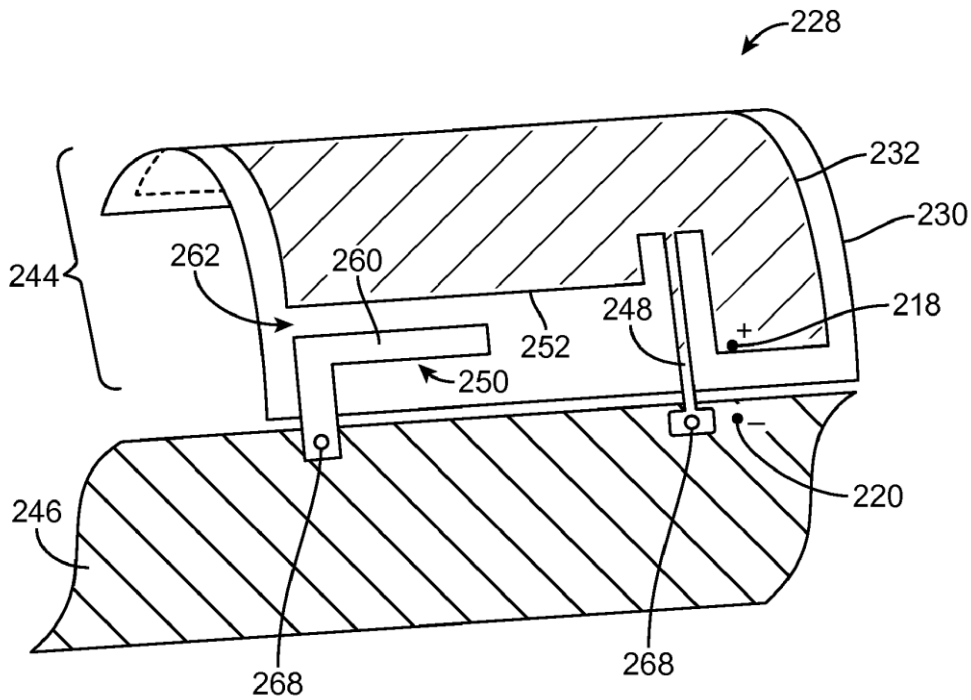
(71) Applicant: **APPLE INC.**, Cupertino, CA (US)  
(72) Inventors: **Salih Yarga**, Sunnyvale, CA (US);  
**Qingxiang Li**, Mountain View, CA (US);  
**Robert W. Schlub**, Cupertino, CA (US)

(57) **ABSTRACT**  
An electronic device may have an antenna for providing coverage in wireless communications bands of interest. The wireless communications bands may include a communications band at a first frequency. The antenna may have a parasitic antenna resonating element that supports a low efficiency resonance. In response to operation of the electronic device in free space, the low efficiency resonance will be located at a second frequency that is greater than the first frequency. In response to operation of the electronic device in proximity to a user's body or other external object, the antenna will be loaded and the low efficiency resonance associated with the parasitic antenna resonating element will shift to the communications band at the first frequency. The antenna may include a resonating element formed on a flexible printed circuit or a dielectric carrier such as a plastic support structure.

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)  
(21) Appl. No.: **13/855,568**  
(22) Filed: **Apr. 2, 2013**

**Publication Classification**

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





US 20140292588A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292588 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **DISPLAY DEVICE HAVING ANTENNA**

(30) **Foreign Application Priority Data**

(71) Applicant: **Samsung Display Co., Ltd.**, Yongin-city (KR)

Apr. 2, 2013 (KR) ..... 10-2013-0035912

**Publication Classification**

(72) Inventors: **Sangrock YOON**, Hwaseong-city (KR); **Sunghwan Kim**, Seoul-city (KR); **Onsik Choi**, Hwaseong-si (KR); **Ung Choi**, Asan-si (KR)

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

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/22** (2013.01)  
USPC ..... **343/702; 343/721**

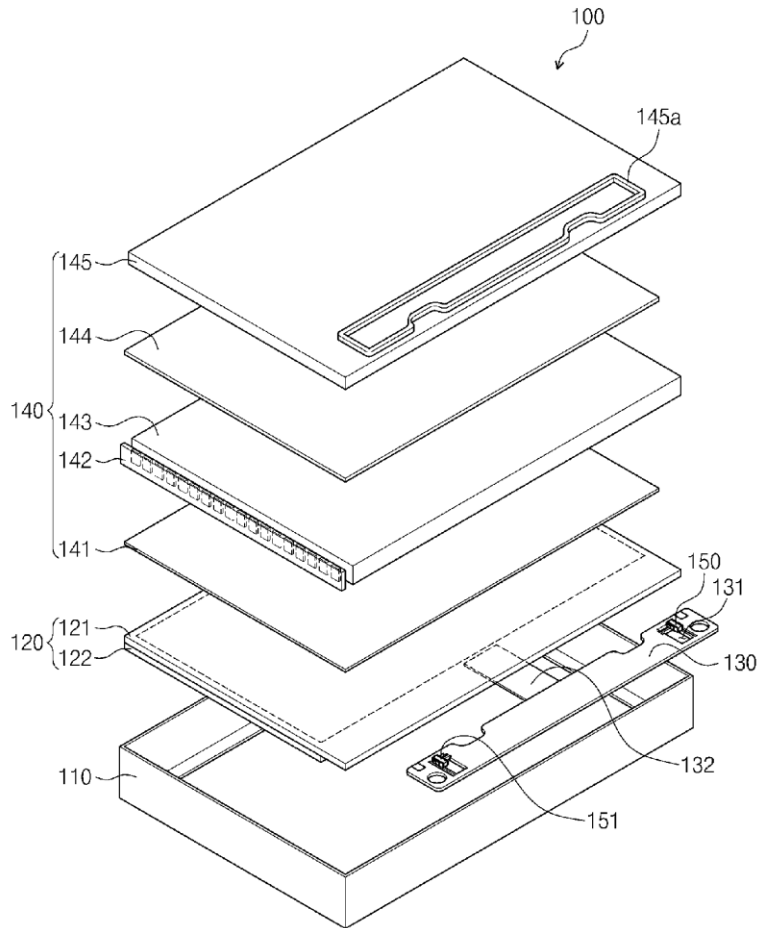
(73) Assignee: **Samsung Display Co., Ltd.**, Yongin-city (KR)

(57) **ABSTRACT**

A display device includes a display panel which displays an image, a driving circuit substrate disposed on a rear surface of the display panel and controlling the display panel to display the image, and a chip antenna connected to an end portion of the driving circuit substrate in a longitudinal direction of the driving circuit substrate.

(21) Appl. No.: **13/958,053**

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





US 20140292589A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292589 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **ANTENNA FOR PORTABLE DEVICE**

**Publication Classification**

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

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

(72) Inventors: **Hoon PARK**, Seoul (KR); **Ho-Saeng KIM**, Gyeonggi-do (KR); **Yeon-Woo KIM**, Seoul (KR); **Seong-Tae JEONG**, Gyeonggi-do (KR); **Sang-Min HAN**, Gyeonggi-do (KR)

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

(73) Assignee: **Samsung Electronics Co., Ltd.**,  
Gyeonggi-do (KR)

(57) **ABSTRACT**

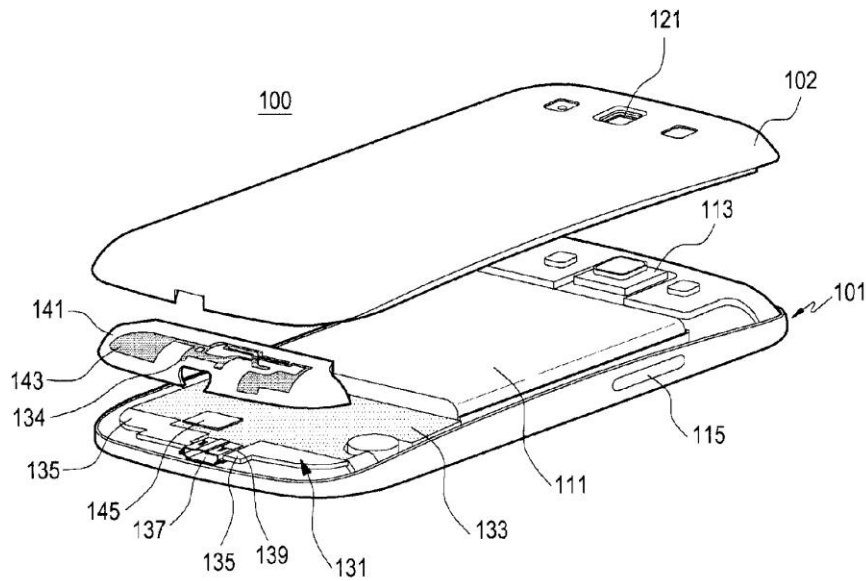
An antenna device of a portable device such as a smartphone includes a connecting member having a conductive case and mounted on a circuit board of the portable device in a manner such that the case is connected to a ground surface of the circuit board; a radiator spaced from the circuit board; and at least one connecting pin provided between the case and the radiator. The radiator is connected to the ground surface through the connecting pin and the case. The antenna device advantageously may be easily installed in the internal space of a miniaturized, lightened and/or slimmed portable device by practically using a conductive component, e.g., the case, of the connecting member.

(21) Appl. No.: **14/101,550**

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

(30) **Foreign Application Priority Data**

Mar. 28, 2013 (KR) ..... 10-2013-0033475





US 20140292590A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292590 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **TERMINAL INCLUDING MULTIBAND ANTENNA AS CONDUCTIVE BORDER**

**Publication Classification**

(71) Applicant: **PANTECH CO., LTD.**, Seoul (KR)

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

(72) Inventors: **Kyoung Sang YOO**, Seoul (KR);  
**Myung Gu KANG**, Seoul (KR)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/243** (2013.01)  
USPC ..... **343/702; 29/600**

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

(57) **ABSTRACT**

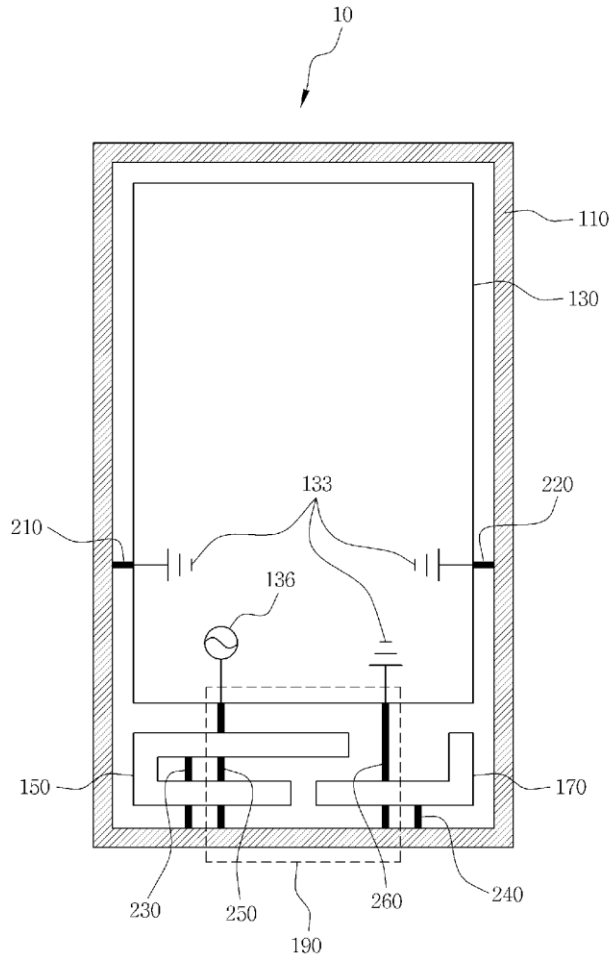
A conductive border surrounds a terminal along a direction. A mobile terminal includes a wireless transmission/reception circuit to output a signal for a wireless communication of the mobile terminal; a conductive border that forms side surfaces of the mobile terminal; a ground element electrically connected to the conductive border; a first antenna element electrically connected to the conductive border and the wireless transmission/reception circuit; and a second antenna element electrically connected to the conductive border and the ground element.

(21) Appl. No.: **14/222,090**

(22) Filed: **Mar. 21, 2014**

(30) **Foreign Application Priority Data**

Mar. 29, 2013 (KR) ..... 10-2013-0034406





US 20140292591A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292591 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **ANTENNAS MOUNTED UNDER DIELECTRIC PLATES**

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

CPC ..... *H01Q 1/243* (2013.01)

USPC ..... **343/702**

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

(72) Inventors: **Qingxiang Li**, Mountain View, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Fletcher R. Rothkopf**, Los Altos, CA (US); **Adam D. Mittleman**, San Francisco, CA (US); **Yi Jiang**, Sunnyvale, CA (US); **Emily McMillin**, Mountain View, CA (US); **Li-jun Zhang**, San Jose, CA (US)

(57)

**ABSTRACT**

Electronic devices are provided that contain wireless communications circuitry. The wireless communications circuitry may include radio-frequency transceiver circuitry and antenna structures. The antenna structures may include antennas such as inverted-F antennas that contain antenna resonating elements and antenna ground elements. Antenna resonating elements may be formed from patterned conductive traces on substrates such as flex circuit substrates. Antenna ground elements may be formed from conductive device structures such as metal housing walls. Support and biasing structures such as dielectric support members and layer of foam may be used to support and bias antenna resonating elements against planar device structures. The planar device structures against which the antenna resonating elements are biased may be planar dielectric members such as transparent layers of display cover glass or other planar structures. Adhesive may be interposed between the planar structures and the antenna resonating elements.

(21) Appl. No.: **14/306,121**

(22) Filed: **Jun. 16, 2014**

**Related U.S. Application Data**

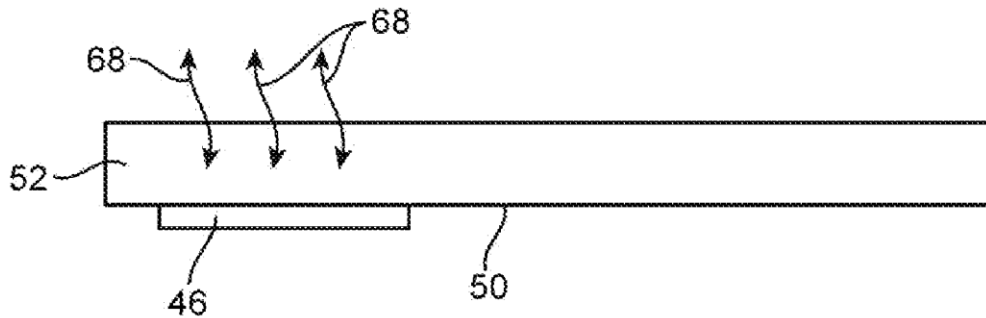
(63) Continuation of application No. 12/870,766, filed on Aug. 27, 2010, now Pat. No. 8,766,858.

**Publication Classification**

(51) **Int. Cl.**

*H01Q 1/24*

(2006.01)





US 20140292596A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292596 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **ANTENNA STRUCTURE**

**Publication Classification**

(71) Applicant: **CHIUN MAI COMMUNICATION SYSTEMS, INC., NEW TAIPEI (TW)**

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

(72) Inventors: **CHANG-HSIN OU, New Taipei (TW); HSI-CHIEH CHEN, New Taipei (TW); CHO-KANG HSU, New Taipei (TW)**

(52) **U.S. Cl.**  
CPC ..... **H01Q 5/0027** (2013.01)  
USPC ..... **343/722**

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

(57) **ABSTRACT**

An antenna structure includes a circuit board and an antenna formed on the circuit board. The antenna includes a ground portion and a feed portion extended from the ground portion and defining a cut with the ground portion, a connecting portion, a first resonance portion, and a second resonance portion. The first resonance portion defines a first gap with the connecting portion and the feed portion and obtains a first working frequency band by adjusting dimensions of the first resonance gap and the cut. The second resonance portion defines a second gap with the connecting portion and the ground portion, and obtains a second working frequency band by adjusting dimensions of the second resonance gap.

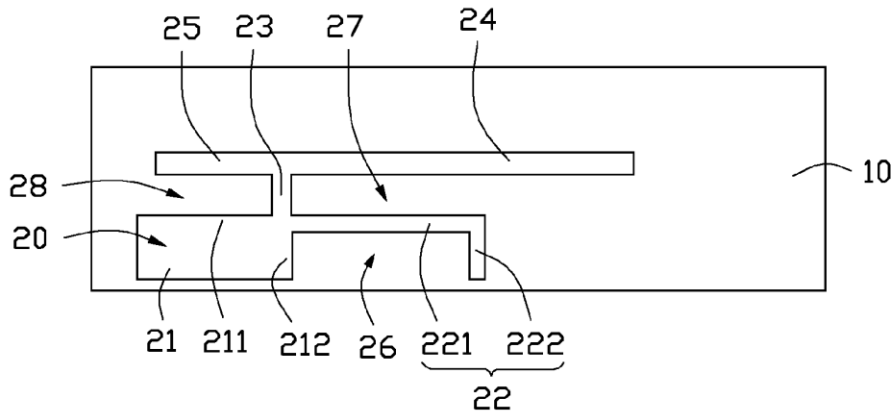
(21) Appl. No.: **14/019,761**

(22) Filed: **Sep. 6, 2013**

(30) **Foreign Application Priority Data**

Mar. 27, 2013 (TW) ..... 102110827

100







US 20140292598A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292598 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **ANTENNA SYSTEM WITH TUNING FROM COUPLED ANTENNA**

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

CPC ..... *H01Q 9/0442* (2013.01)

USPC ..... **343/745**

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

(57)

**ABSTRACT**

(72) Inventors: **Peter Bevelacqua**, San Jose, CA (US);  
**Hao Xu**, Cupertino, CA (US); **Jayesh Nath**, Milpitas, CA (US); **Jennifer M. Edwards**, San Francisco, CA (US);  
**Mattia Pascolini**, Campbell, CA (US)

Electronic devices may include radio-frequency transceiver circuitry and antenna structures. The antenna structures may form a dual arm inverted-F antenna and an additional antenna such as a monopole antenna sharing a common antenna ground. The antenna structures may have three ports. A first antenna port may be coupled to an inverted-F antenna resonating element at a first location and a second antenna port may be coupled to the inverted-F antenna resonating element at a second location. A third antenna port may be coupled to the additional antenna. An adjustable component may be coupled to the first antenna port to tune the inverted-F antenna. The inverted-F antenna may be near-field coupled to the additional antenna so that the inverted-F antenna may serve as a tunable parasitic antenna resonating element that tunes the additional antenna.

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

(21) Appl. No.: **13/851,471**

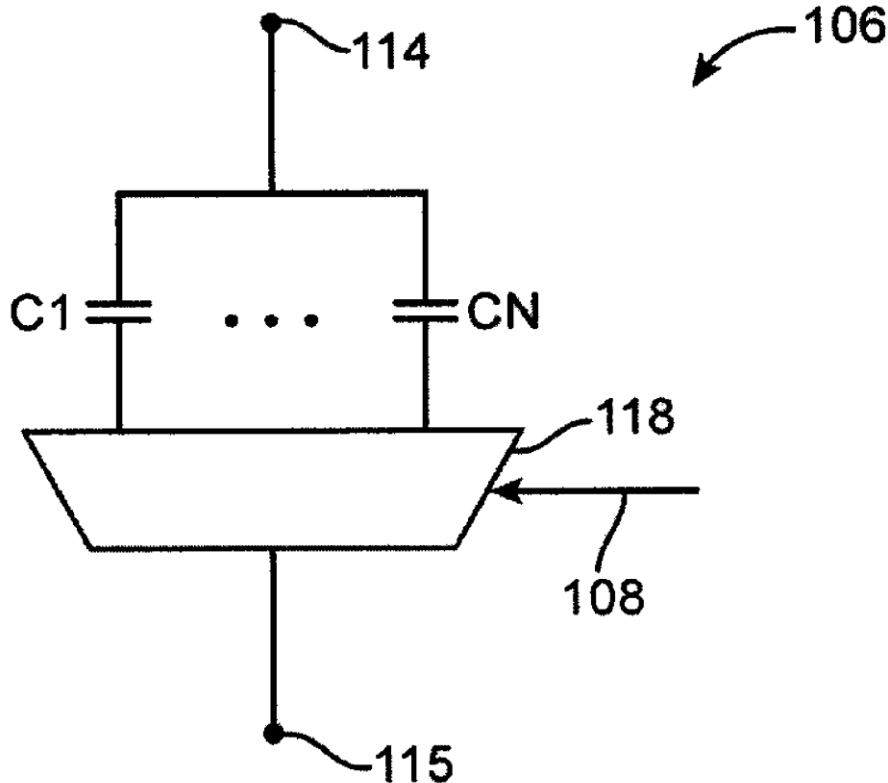
(22) Filed: **Mar. 27, 2013**

**Publication Classification**

(51) **Int. Cl.**

*H01Q 9/04*

(2006.01)





US 20140292602A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292602 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **MULTIBAND ANTENNA AND MOBILE TERMINAL**

**Publication Classification**

(75) Inventors: **Masaki Suzuki**, Kakegawa-shi (JP);  
**Shinichiro Kitano**, Kawasaki-shi (JP)

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

(73) Assignees: **NEC CASIO MOBILE COMMUNICATIONS, LTD.**,  
Kawasaki-shi, Kanagawa (JP); **NEC Access Technica, LTD.**, Kakegawa-shi,  
Shizuoka (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 9/04** (2013.01)  
USPC ..... **343/749**

(57) **ABSTRACT**

(21) Appl. No.: **14/359,852**

The antenna has a configuration in which three inductors, i.e., first to third inductors **5** to **7** having values of inductances **L1** to **L3**, respectively, are arranged in an inverted F-shaped antenna formed of miniaturized four antenna elements, i.e., first to fourth antenna elements **1** to **4** with an element length shorter than that of each wavelength of desired resonance frequencies are grounded at a GND ground point **11**. A power feeding unit **10** feeds electric power to the inverted F-shaped antenna through a matching circuit **9**, thereby enabling a plurality of antenna operations of a two-resonance loop antenna that resonates at two resonance frequencies on a high-frequency side, an inverted F-shaped antenna that resonates at two resonance frequencies on a low-frequency side, and an inverted L-shaped antenna.

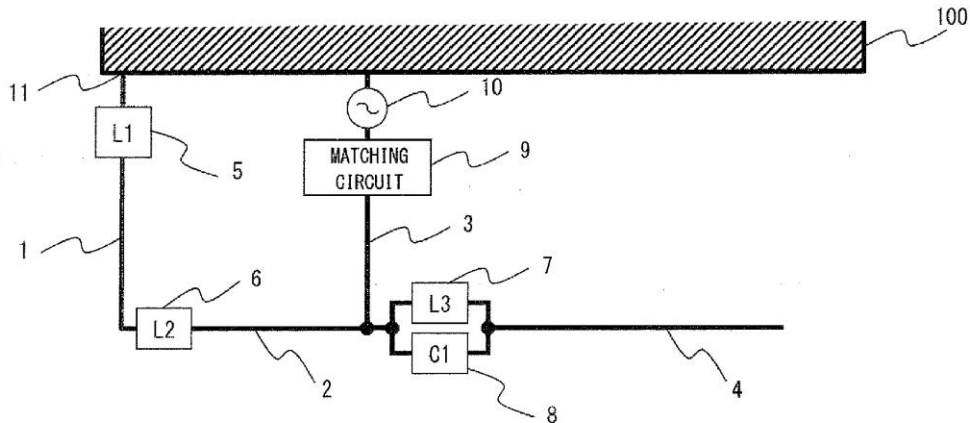
(22) PCT Filed: **Sep. 10, 2012**

(86) PCT No.: **PCT/JP2012/005726**

§ 371 (c)(1),  
(2), (4) Date: **May 21, 2014**

(30) **Foreign Application Priority Data**

Nov. 22, 2011 (JP) ..... 2011-254754





US 20140292607A1

(19) **United States**

(12) **Patent Application Publication**  
**CHANG**

(10) **Pub. No.: US 2014/0292607 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **BROADBAND ANTENNA DEVICE**

**Publication Classification**

(71) Applicant: **Arcadyan Technology Corporation,**  
Hsinchu (TW)

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

(72) Inventor: **Jin Su CHANG,** Hsinchu (TW)

(52) **U.S. Cl.**  
CPC ..... **H01Q 5/0093** (2013.01)  
USPC ..... **343/843; 343/700 MS; 343/860; 343/852**

(73) Assignee: **Arcadyan Technology Corporation,**  
Hsinchu (TW)

(57) **ABSTRACT**

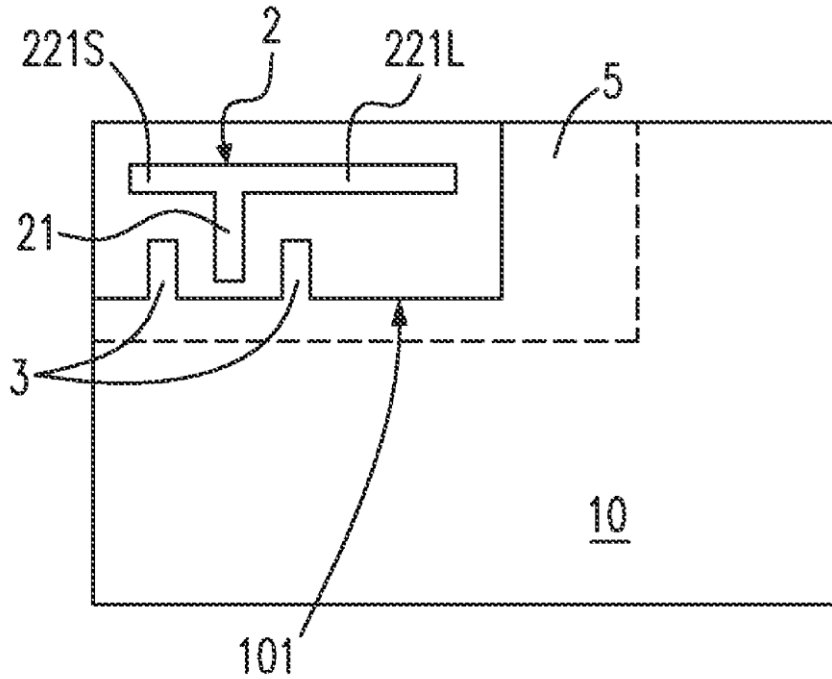
(21) Appl. No.: **13/948,623**

An antenna device is provided. The antenna device comprises a first radiation portion and a second radiation portion. The first radiation portion includes a first end and a second end. The second radiation portion is connected to the first end at a connecting part and includes a first arm and a second arm. The first arm and the second arm have different lengths and extend from the connecting part.

(22) Filed: **Jul. 23, 2013**

(30) **Foreign Application Priority Data**

Mar. 28, 2013 (TW) ..... 102111267





US 20140292608A1

(19) **United States**

(12) **Patent Application Publication**  
**HAMABE**

(10) **Pub. No.: US 2014/0292608 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **ANTENNA APPARATUS CAPABLE OF  
REDUCING DECREASE IN GAIN DUE TO  
ADJACENT METAL COMPONENTS**

**Publication Classification**

(71) Applicant: **PANASONIC CORPORATION**, Osaka  
(JP)

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

(72) Inventor: **Taichi HAMABE**, Osaka (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/48** (2013.01)  
USPC ..... **343/848**

(21) Appl. No.: **14/305,319**

(22) Filed: **Jun. 16, 2014**

(57) **ABSTRACT**

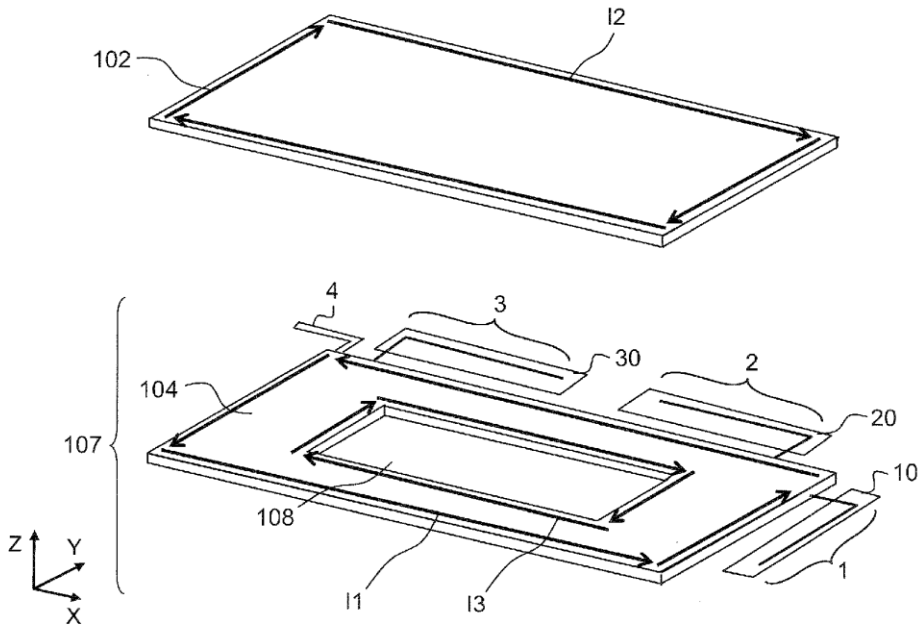
**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2013/007488,  
filed on Dec. 19, 2013.

An antenna apparatus is provided close to an external metal component. The antenna apparatus is provided with an antenna and a ground conductor plate. The ground conductor plate is provided on as to be close to the metal component to be electromagnetically coupled to the metal component, and so as to oppose the metal component. The ground conductor plate has at least one opening.

(30) **Foreign Application Priority Data**

Jan. 28, 2013 (JP) ..... 2013-012836





US 20140292613A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0292613 A1**

(43) **Pub. Date: Oct. 2, 2014**

(54) **HINGE ANTENNA AND FOLDABLE ELECTRONIC DEVICE USING THE SAME**

(52) **U.S. Cl.**  
CPC ..... *H01Q 1/2266* (2013.01)  
USPC ..... **343/905**

(71) Applicant: **Advanced-Connetek Inc.**, New Taipei City (TW)

(57) **ABSTRACT**

(72) Inventors: **Fu-Ren HSHAO**, New Taipei City (TW);  
**Chih-Fan CHEN**, New Taipei City (TW)

A hinge antenna comprises a metal hinge, a first metal connecting plate and a second metal connecting plate. The hinge antenna further comprises a microwave substrate, a signal feeding line, and a conductor, wherein the conductor is electrically connected to the microwave substrate and extended from the microwave substrate. Furthermore, the feed line of the signal feeding line is electrically connected to the microwave substrate and the ground line of the signal feeding line is electrically connected to the metal hinge, the first metal connecting plate, the second metal connecting plate, and an outside metal shield so that the metal hinge, the first metal connecting plate, the second metal connecting plate, and the outside metal shield can serve as a ground. The aforementioned configuration is utilized to form an antenna loop. In addition, the configuration of this antenna can be built in the interior space of the foldable electronic device.

(73) Assignee: **Advanced-Connetek Inc.**, New Taipei City (TW)

(21) Appl. No.: **14/224,840**

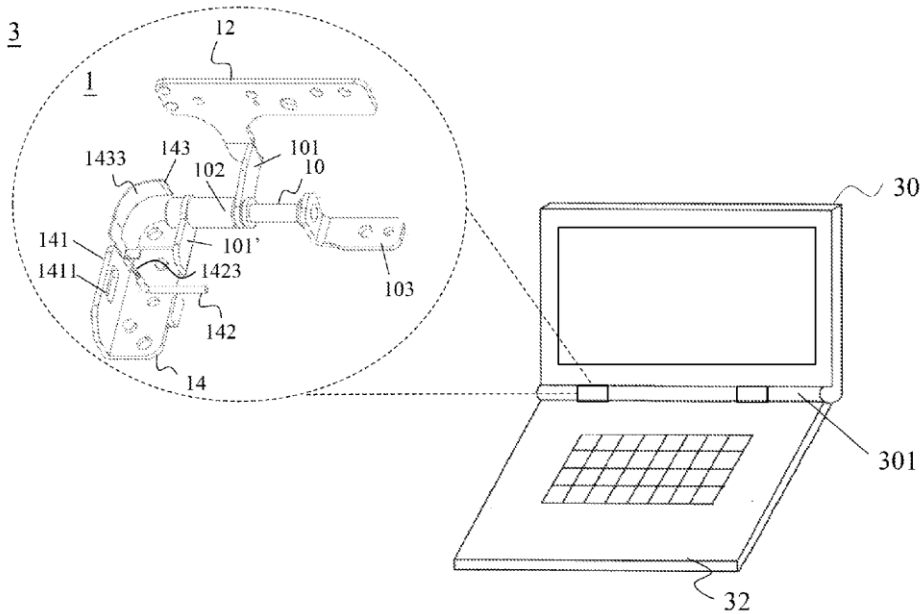
(22) Filed: **Mar. 25, 2014**

(30) **Foreign Application Priority Data**

Mar. 28, 2013 (TW) ..... 102111230

**Publication Classification**

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





US 20140295917A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0295917 A1**

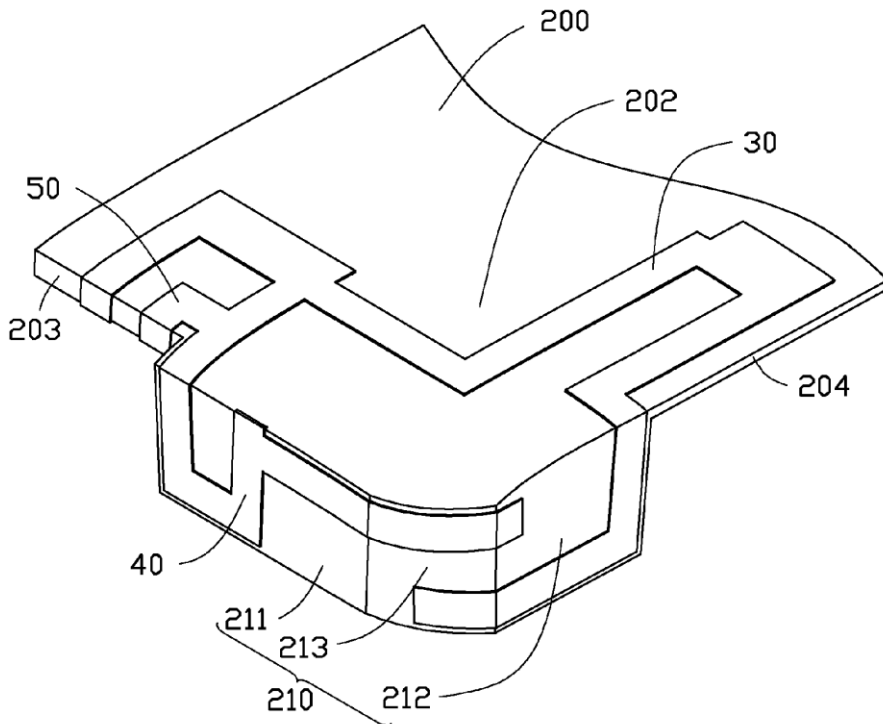
(43) **Pub. Date: Oct. 2, 2014**

- (54) **ANTENNA STRUCTURE AND WIRELESS COMMUNICATION DEVICE USING THE SAME**
- (71) Applicant: **Chiun Mai Communication Systems, Inc.**, New Taipei (TW)
- (72) Inventors: **CHO-KANG HSU**, New Taipei (TW); **JIN-BO CHEN**, New Taipei (TW)
- (73) Assignee: **Chiun Mai Communication Systems, Inc.**, New Taipei (TW)
- (21) Appl. No.: **14/014,616**
- (22) Filed: **Aug. 30, 2013**
- (30) **Foreign Application Priority Data**  
Apr. 2, 2013 (TW) ..... 102111898

**Publication Classification**

- (51) **Int. Cl.**  
*H01Q 9/04* (2006.01)  
*H04M 1/02* (2006.01)
- (52) **U.S. Cl.**  
CPC ..... *H01Q 9/04* (2013.01); *H04M 1/026* (2013.01)  
USPC ..... **455/562.1**; 343/700 MS

(57) **ABSTRACT**  
An antenna structure includes a feed portion, a ground portion, a first radiating body, a second radiating body, and a third radiating body. The feed portion is connected to a first shared portion of the first radiating body. The second radiating body further includes a second shared portion connected to the first shared portion. The first and second shared portions are included in a third radiating body together with a combining portion between the second shared portion and the ground portion. The first radiating body receives and sends wireless signals of a first frequency band, the second radiating body uses a second frequency band, and the third radiating body uses a third frequency band.





US 20140300453A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0300453 A1**

(43) **Pub. Date: Oct. 9, 2014**

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

**Publication Classification**

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

(51) **Int. Cl.**  
**G06K 7/00** (2006.01)

(72) Inventors: **Makoto TAKEOKA**, Nagaokakyo-shi  
(JP); **Noboru KATO**, Nagaokakyo-shi  
(JP); **Makoto YASUTAKE**,  
Nagaokakyo-shi (JP)

(52) **U.S. Cl.**  
CPC ..... **G06K 7/0008** (2013.01)  
USPC ..... **340/10.1**

(21) Appl. No.: **14/308,896**

(57) **ABSTRACT**

(22) Filed: **Jun. 19, 2014**

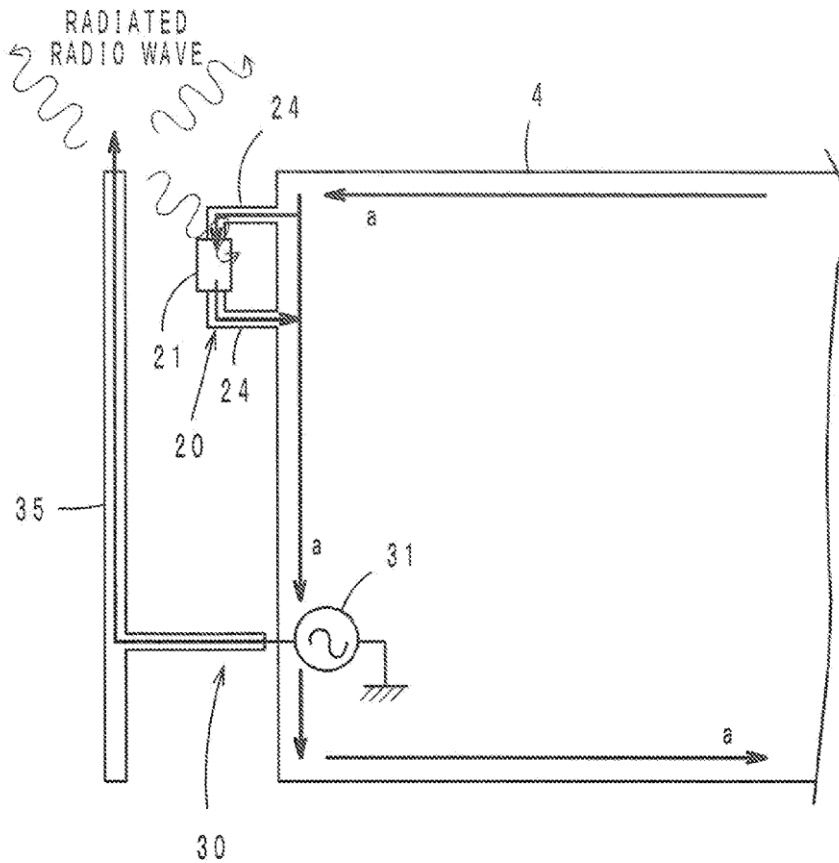
A wireless communication apparatus includes a first communication system, and a second communication system configured to transmit a transmission signal in a communication frequency band which is the same or substantially the same as that of the first communication system and at an electric power which is stronger than that of a reception signal of the first communication system. The first communication system includes a feeder circuit having a resonant frequency, the resonant frequency being within the communication frequency band if a reception signal of the first communication system is input, and the resonant frequency being out of the communication frequency band if a transmission signal of the second communication system is input.

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2013/080453,  
filed on Nov. 11, 2013.

**Foreign Application Priority Data**

(30) Nov. 16, 2012 (JP) ..... 2012-252570





US 20140300517A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0300517 A1**

(43) **Pub. Date: Oct. 9, 2014**

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

**Publication Classification**

(71) Applicant: **MURATA MANUFACTURING CO., LTD.**, Kyoto (JP)

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

(72) Inventors: **Kengo ONAKA**, Kyoto (JP); **Hiroya TANAKA**, Kyoto (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 5/0027** (2013.01)  
USPC ..... **343/700 MS**

(73) Assignee: **MURATA MANUFACTURING CO., LTD.**, Kyoto (JP)

(57) **ABSTRACT**

(21) Appl. No.: **14/286,176**

A first radiation electrode is formed on a bottom surface of a no-ground conductor formation area of a board, and second radiation electrodes are formed on a top surface of the no-ground conductor formation area. A longitudinal electrode of the first radiation electrode is electrically continuous with a ground conductor. A first end portion and a second end portion of a transverse electrode of the first radiation electrode extend toward the ground conductor. The transverse electrode of the first radiation electrode operates as a radiation element for radiating a signal at a first frequency. The second radiation electrodes each operate as a radiation element for radiating a signal at a second frequency, and also as a capacitive feed electrode for the first radiation electrode. This enables to strengthen directivity toward an antenna portion side (forward direction) of the board, and further enables multiband use.

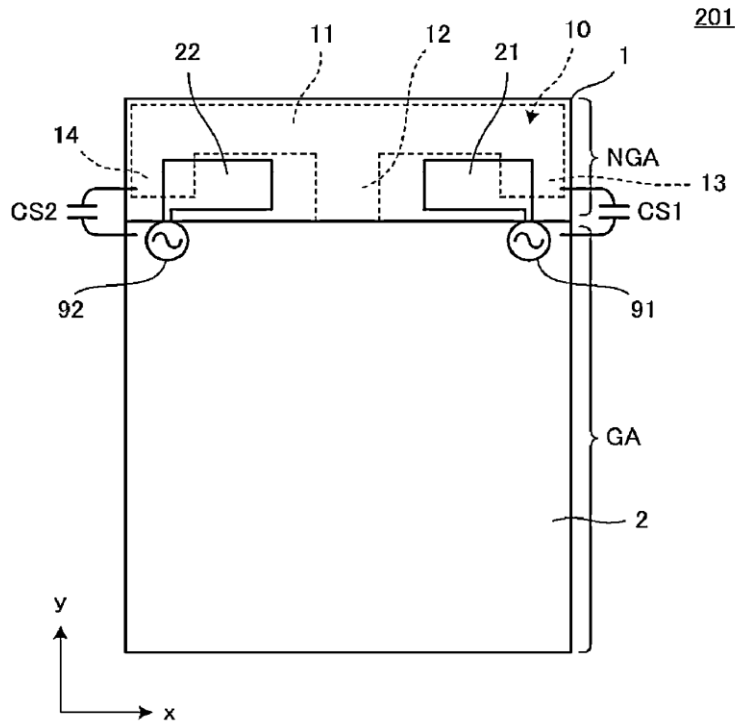
(22) Filed: **May 23, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2012/080007, filed on Nov. 20, 2012.

(30) **Foreign Application Priority Data**

Nov. 25, 2011 (JP) ..... 2011-257023







US 20140300523A1

(19) **United States**

(12) **Patent Application Publication**  
**Hogg**

(10) **Pub. No.: US 2014/0300523 A1**

(43) **Pub. Date: Oct. 9, 2014**

(54) **ANTENNA MOUNTING SYSTEM FOR METALLIC STRUCTURES**

**Publication Classification**

(71) Applicant: **ESSEX ELECTRONICS, INC.**,  
Carpinteria, CA (US)

(51) **Int. Cl.**  
*H01Q 1/42* (2006.01)  
*H01Q 1/52* (2006.01)

(72) Inventor: **Robert D. Hogg**, Santa Barbara, CA  
(US)

(52) **U.S. Cl.**  
CPC . *H01Q 1/42* (2013.01); *H01Q 1/526* (2013.01)  
USPC ..... **343/789**

(73) Assignee: **ESSEX ELECTRONICS, INC.**,  
Carpinteria, CA (US)

(21) Appl. No.: **14/248,707**

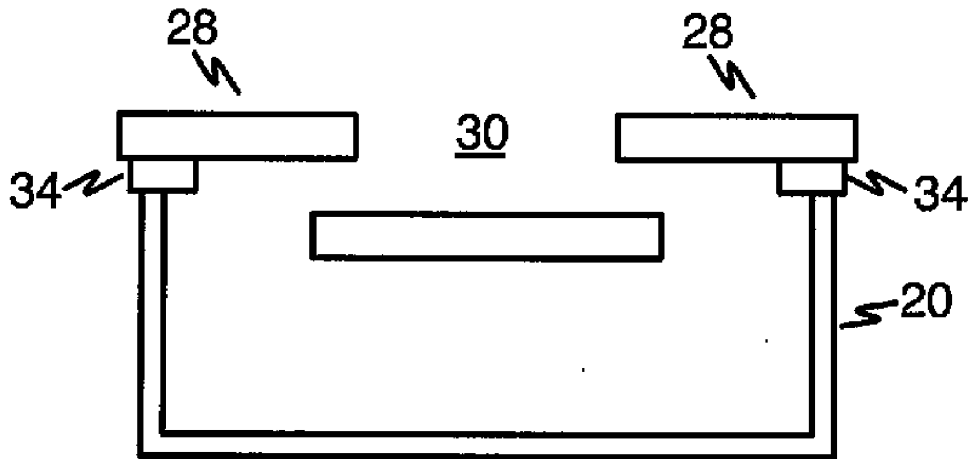
(57) **ABSTRACT**

(22) Filed: **Apr. 9, 2014**

**Related U.S. Application Data**

(60) Provisional application No. 61/810,231, filed on Apr. 9, 2013.

An antenna mounting system includes a metal plate having a void formed therein and one or more continuous slots extending from the void to an edge of the metal plate. An antenna is mounted inside the void.





US 20140300524A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0300524 A1**

(43) **Pub. Date: Oct. 9, 2014**

(54) **ANTENNA ASSEMBLY**

**Publication Classification**

(71) Applicant: **CHIUN MAI COMMUNICATION SYSTEMS, INC.**, New Taipei (TW)

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

(72) Inventors: **GENG-HONG LIOU**, New Taipei (TW); **YEN-HUI LIN**, New Taipei (TW)

(52) **U.S. Cl.**  
CPC ..... **H01Q 5/02** (2013.01)  
USPC ..... **343/810**

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

(57) **ABSTRACT**

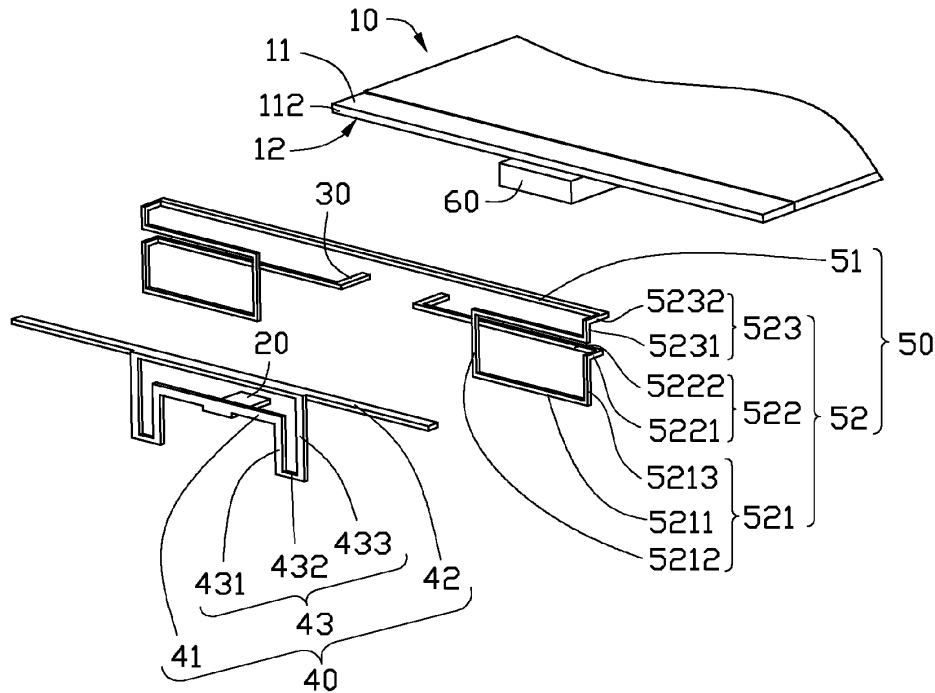
(21) Appl. No.: **14/038,977**

An antenna assembly includes a feed end, a pair of ground ends, a first antenna, and a second antenna connected to the ground ends. The first antenna is connected to the feed end. The first antenna activates a high frequency band resonance mode. The second antenna is connected to the ground ends, and coupled with the first antenna to activate a low frequency band resonance mode. The feed end and the pair of ground ends are parallel to each other. The feed end and the pair of ground ends are coplanar to form a coplanar-waveguide feed structure.

(22) Filed: **Sep. 27, 2013**

(30) **Foreign Application Priority Data**

Apr. 9, 2013 (TW) ..... 10211525





US 20140300527A1

(19) **United States**

(12) **Patent Application Publication**

**Lo et al.**

(10) **Pub. No.: US 2014/0300527 A1**

(43) **Pub. Date: Oct. 9, 2014**

(54) **ANTENNA FOR WIRELESS COMMUNICATION DEVICE**

**Publication Classification**

(71) Applicant: **RALINK TECHNOLOGY CORP.**,  
Hsinchu County (TW)

(51) **Int. Cl.**  
**H01Q 1/12** (2006.01)

(72) Inventors: **Shao-Chin Lo**, Miaoli County (TW);  
**Cheng-Hao Kuo**, Hualien County (TW)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/1207** (2013.01)  
USPC ..... **343/882; 343/878**

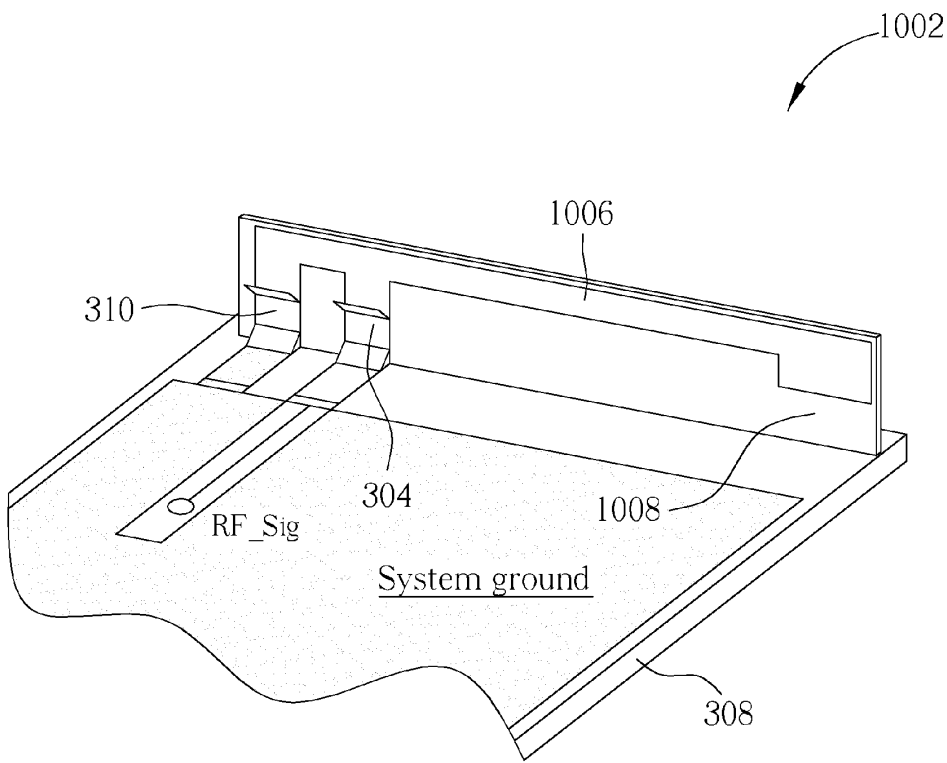
(73) Assignee: **RALINK TECHNOLOGY CORP.**,  
Hsinchu County (TW)

(57) **ABSTRACT**

(21) Appl. No.: **13/855,736**

The present invention discloses an antenna for a wireless communication device, including a radiator including a first fixing segment, and a first connecting unit including a first fixture unit and a second fixture unit for holding the first fixing segment such that the radiator is electrically connect to a circuit.

(22) Filed: **Apr. 3, 2013**





US 20140306848A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0306848 A1**  
(43) **Pub. Date: Oct. 16, 2014**

(54) **ANTENNA ASSEMBLY AND MOBILE TERMINAL USING SAME**

**Publication Classification**

(71) Applicants: **Ng Guan Hong**, Shenzhen (CN); **Tay Yew Siow**, Shenzhen (CN)

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

(72) Inventors: **Ng Guan Hong**, Shenzhen (CN); **Tay Yew Siow**, Shenzhen (CN)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/243** (2013.01)  
USPC ..... **343/702; 343/700 MS**

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

(57) **ABSTRACT**

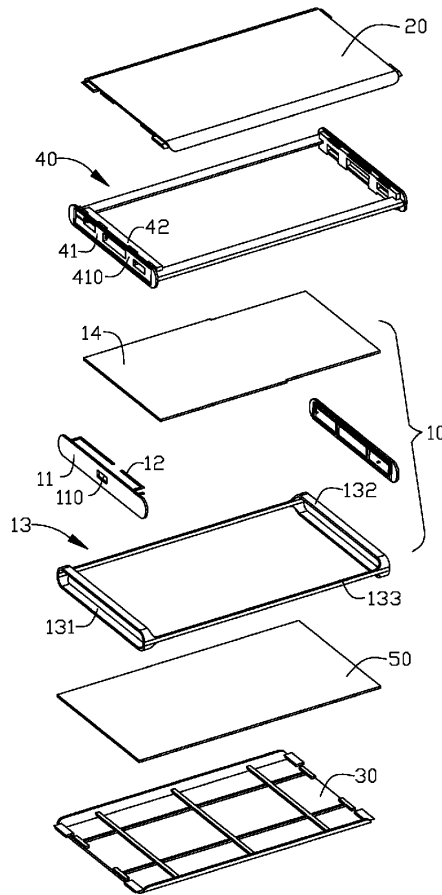
(21) Appl. No.: **14/198,990**

An antenna assembly of the present disclosure includes a grounding plate, a metal plate, a metal frame and an antenna body disposed between the grounding plate and the metal plate. The metal frame includes a closed annular portion, and the antenna body includes a feeding portion. One end of the feeding portion is electrically connected to the metal plate and the other end thereof is spaced apart from the grounding plate, and the closed annular portion is spaced apart from the metal plate. The antenna assembly of the present disclosure can improve the performances of the product and make the appearance of the product more aesthetic. Meanwhile, the present disclosure also provides a mobile terminal using the antenna assembly described above.

(22) Filed: **Mar. 6, 2014**

(30) **Foreign Application Priority Data**

Mar. 22, 2013 (CN) ..... 201310094784.4





US 20140306850A1

(19) **United States**

(12) **Patent Application Publication**  
**Enomoto**

(10) **Pub. No.: US 2014/0306850 A1**

(43) **Pub. Date: Oct. 16, 2014**

(54) **ELECTRONIC DEVICE**

**Publication Classification**

(71) Applicant: **Sony Corporation**, Tokyo (JP)

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

(72) Inventor: **Takashi Enomoto**, Nagano (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/24** (2013.01)  
USPC ..... **343/702**

(21) Appl. No.: **14/357,021**

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

(57) **ABSTRACT**

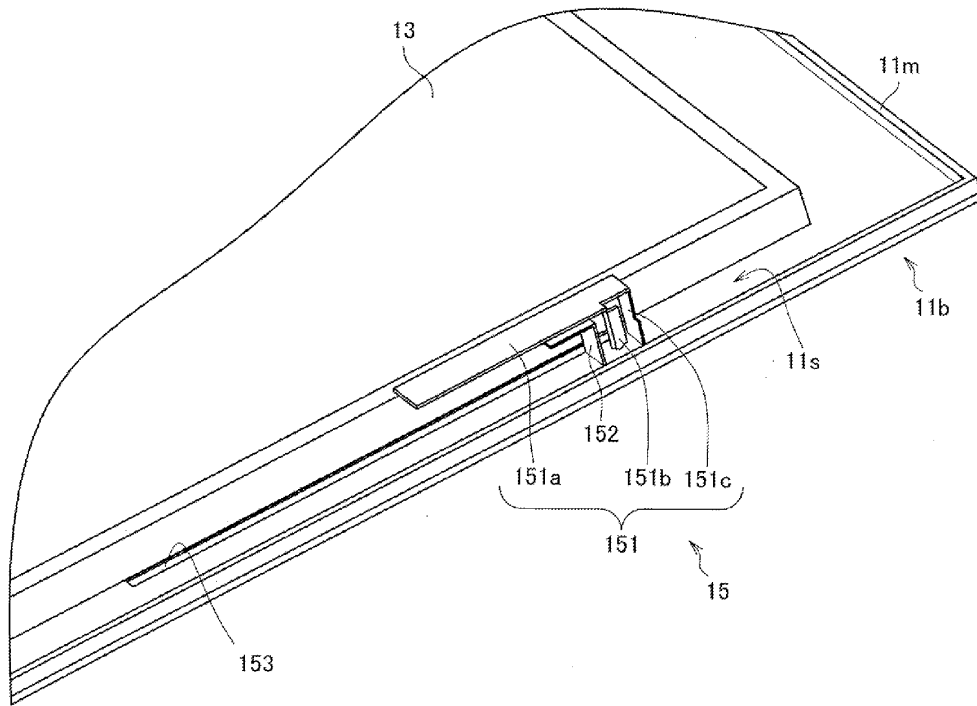
(86) PCT No.: **PCT/JP2012/077053**

§ 371 (c)(1),  
(2), (4) Date: **May 8, 2014**

Provided is an electronic device including a case including a conductor part, and an antenna that is provided on a case surface on an inner side of the conductor part and includes an antenna element extending in a first direction parallel to the case surface, the antenna element being grounded to the case surface. A slit extending in the first direction is formed in an area of the case surface, the area being parallel to the antenna element.

(30) **Foreign Application Priority Data**

Nov. 17, 2011 (JP) ..... 2011-251696





US 20140306855A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0306855 A1**

(43) **Pub. Date: Oct. 16, 2014**

(54) **TUNABLE MULTIBAND ANTENNA**

**Publication Classification**

(71) Applicant: **QUANTA COMPUTER INC.**, Tao Yuan Hsien (TW)

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

(72) Inventors: **Chin-Lung TSAI**, Chiayi City (TW);  
**Men-Hsueh TSAI**, New Taipei City (TW)

(52) **U.S. Cl.**  
CPC ..... *H01Q 5/0041* (2013.01)  
USPC ..... **343/745**

(73) Assignee: **QUANTA COMPUTER INC.**, Tao Yuan Hsien (TW)

(57) **ABSTRACT**

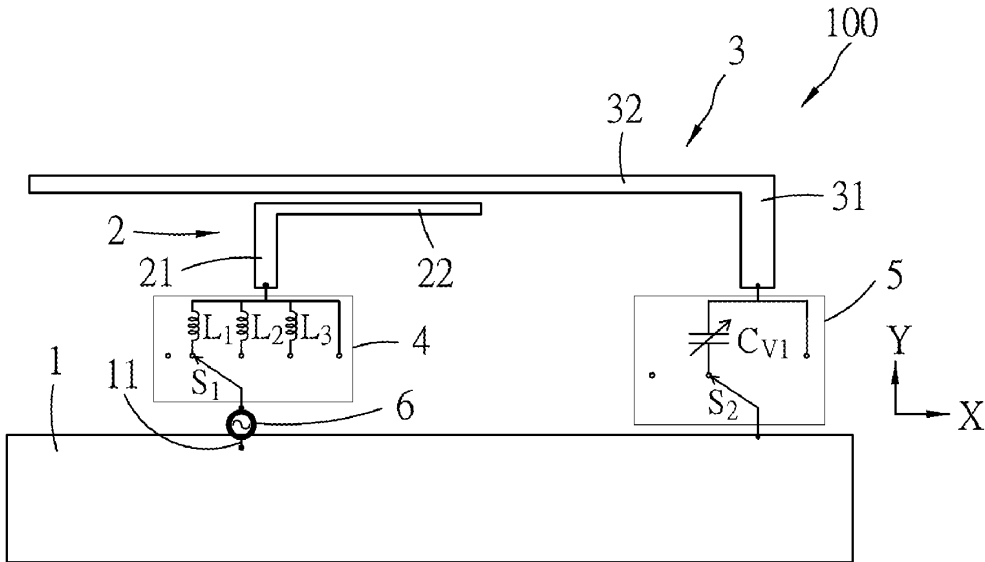
(21) Appl. No.: **14/102,703**

A tunable multiband antenna includes a first radiation conductor spaced apart from a grounding conductor, a second radiation conductor spaced apart from the grounding conductor and connected to the first radiation conductor, a first tuning unit electrically connected between a signal source and the first radiation conductor and operable to provide different impedances and a second tuning unit electrically connected between the grounding conductor and the second radiation conductor and operable to provide different impedances.

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

(30) **Foreign Application Priority Data**

Apr. 15, 2013 (TW) ..... 102113269





US 20140306856A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0306856 A1**

(43) **Pub. Date: Oct. 16, 2014**

(54) **ANTENNA AND MOBILE TERMINAL**

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

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

CPC ... **H01Q 1/50** (2013.01); **H01Q 9/04** (2013.01)  
USPC ..... **343/749**

(72) Inventors: **Yi Fan**, Shenzhen (CN); **Lina Chen**, Shenzhen (CN); **Yao Lan**, Shenzhen (CN); **Shuhui Sun**, Shenzhen (CN)

(57) **ABSTRACT**

(21) Appl. No.: **14/314,406**

(22) Filed: **Jun. 25, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/CN2013/071170, filed on Jan. 31, 2013.

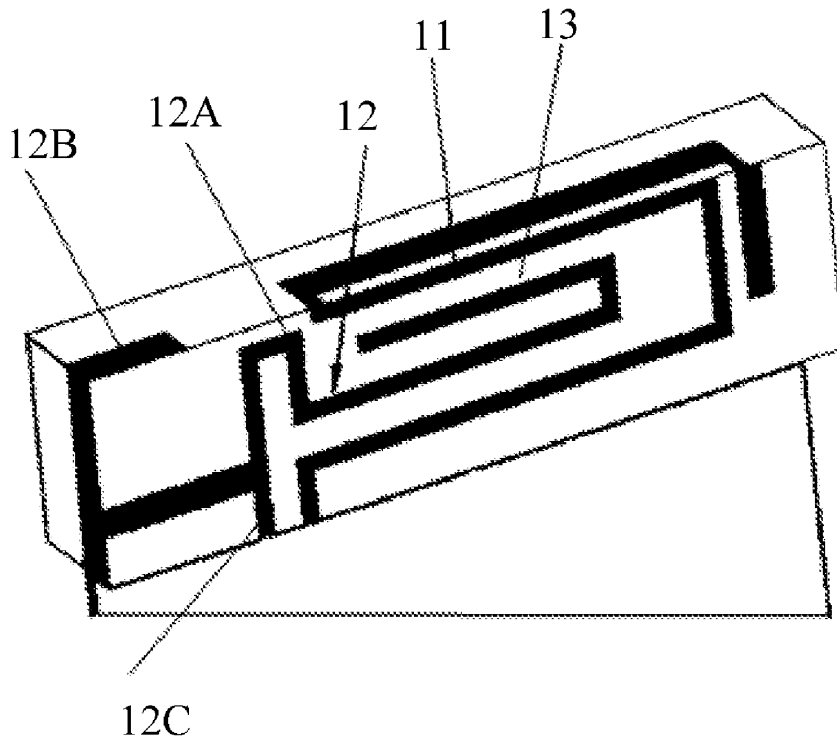
**Foreign Application Priority Data**

(30) Feb. 16, 2012 (CN) ..... 201220050433.4

**Publication Classification**

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

An antenna and a mobile terminal are disclosed that relate to the communications field. The antenna includes a ground cable and a feeder, where the feeder includes a low-frequency branch and a high-frequency branch; the low-frequency branch and the high-frequency branch have a common endpoint; the low-frequency branch is surrounded by the ground cable to form a coupled loading mode and an equivalent coupled feed loop antenna radiation mode; and the high-frequency branch is set outside the ground cable to complete a high-frequency monopole radiation mode. The mobile terminal includes a printed circuit board (PCB) and the antenna, and the antenna is printed on the PCB. An embodiment of the present invention resolves a problem of insufficient low-frequency bandwidth and insufficient high-frequency bandwidth in the prior art, effectively improves performance of the antenna, and can effectively disperse near-field energy to the PCB and the mobile terminal.





US 20140306857A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0306857 A1**

(43) **Pub. Date: Oct. 16, 2014**

(54) **ANTENNA SYSTEM WITH RETURN PATH TUNING AND LOOP ELEMENT**

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

CPC ..... **H01Q 1/50** (2013.01)

USPC ..... **343/750; 343/700 MS**

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

(57) **ABSTRACT**

(72) Inventors: **Peter Bevelacqua**, San Jose, CA (US);  
**Hao Xu**, Cupertino, CA (US); **Jayesh Nath**, Milpitas, CA (US); **Jennifer M. Edwards**, San Francisco, CA (US);  
**Mattia Pascolini**, Campbell, CA (US)

Electronic devices may include radio-frequency transceiver circuitry and antenna structures. The antenna structures may include a dual arm inverted-F antenna resonating element and an antenna ground. An antenna feed may be coupled between the inverted-F antenna resonating element and the antenna ground. An adjustable component such as an adjustable inductor may be coupled between the inverted-F antenna resonating element and the antenna ground in parallel with the antenna feed. The adjustable component may be operable in multiple states such as an open circuit state, a short circuit state, and a state in which the adjustable component exhibits a non-zero inductance. Antenna bandwidth can be broadened by coupling a loop antenna resonating element across the antenna feed. A portion of the antenna ground may overlap the loop antenna resonating element to further enhance antenna bandwidth.

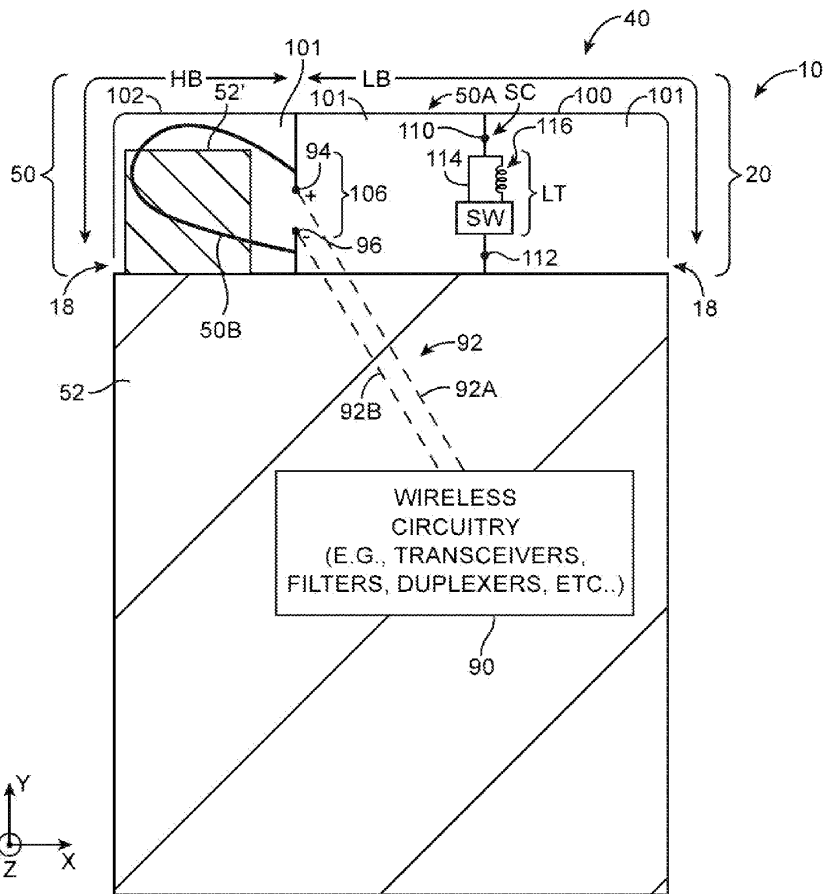
(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **13/860,396**

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

**Publication Classification**

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







US 20140306858A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0306858 A1**

(43) **Pub. Date: Oct. 16, 2014**

(54) **BROADBAND ANTENNA AND AN ANTENNA ASSEMBLY**

**Publication Classification**

(71) Applicant: **QUANTA COMPUTER INC.**, Tao Yuan Hsien (TW)

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

(72) Inventors: **Chin-Lung TSAI**, Chiayi City (TW);  
**Men-Hsueh TSAI**, New Taipei City (TW)

(52) **U.S. Cl.**  
CPC ..... *H01Q 9/145* (2013.01)  
USPC ..... **343/750**

(73) Assignee: **QUANTA COMPUTER INC.**, Tao Yuan Hsien (TW)

(57) **ABSTRACT**

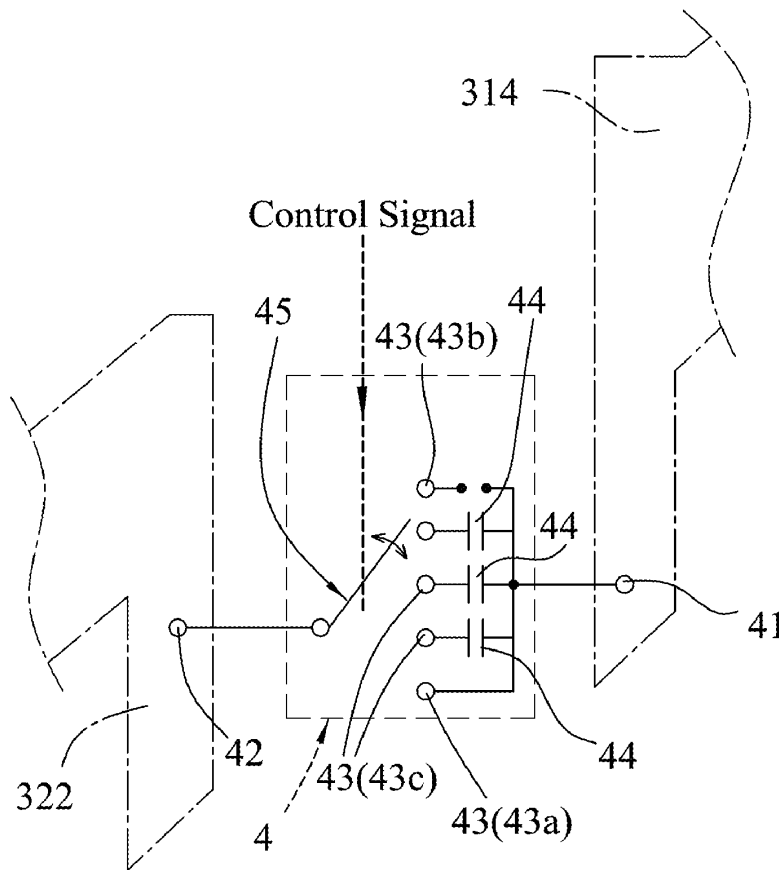
(21) Appl. No.: **14/104,171**

A broadband antenna includes a grounding plane, a radiation unit which has first and second radiation components disposed adjacent to the grounding plane, and an impedance adjusting unit which is operable to adjust an impedance upon receipt of and according to a control signal. A length of a resonance path of the antenna is equal to an overall electrical length of from the first radiation component, the impedance adjusting unit, to the second terminal.

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

(30) **Foreign Application Priority Data**

Apr. 16, 2013 (TW) ..... 102113451





US 20140306859A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0306859 A1**

(43) **Pub. Date: Oct. 16, 2014**

(54) **ACTIVE ANTENNA ADAPTED FOR IMPEDANCE MATCHING AND BAND SWITCHING USING A SHARED COMPONENT**

(60) Provisional application No. 61/684,088, filed on Aug. 16, 2012.

**Publication Classification**

(71) Applicant: **Ethertronics, Inc.**, San Diego, CA (US)

(51) **Int. Cl.**  
**H01R 13/6473** (2006.01)  
**H01Q 1/50** (2006.01)

(72) Inventors: **Laurent Desclos**, San Diego, CA (US);  
**Chun Su Yoon**, Seoul (KR); **Sung-soo Nam**, Gyeonggi-do (KR); **MK Chun**, Gyeonggi-do (KR); **Ji-Chul Lee**, Gyeonggi-do (KR)

(52) **U.S. Cl.**  
CPC ..... **H01R 13/6473** (2013.01); **H01Q 1/50** (2013.01)  
USPC ..... **343/822; 343/861**

(73) Assignee: **ETHERTRONICS, INC.**, San Diego, CA (US)

(57) **ABSTRACT**

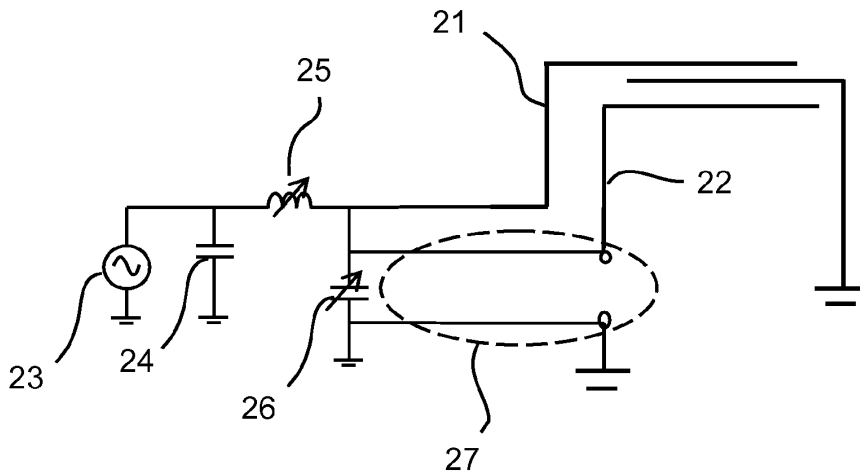
(21) Appl. No.: **14/314,559**

(22) Filed: **Jun. 25, 2014**

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 14/200,012, filed on Mar. 6, 2014, which is a continuation-in-part of application No. 13/969,489, filed on Aug. 16, 2013, now abandoned.

An active antenna and associated circuit topology is adapted to provide active impedance matching and band switching of the antenna using a shared tunable component. Using a shared tunable component, such as a tunable capacitor or other tunable component, the antenna provides a low cost and effective active antenna solution. In certain embodiments, one or more passive components can be further utilized to design band switching of the antenna from a first frequency to a second desired frequency.





US 20140311767A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0311767 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **SYSTEMS AND METHODS FOR COUPLING SECTIONS OF AN ELECTRONIC DEVICE**

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

(72) Inventors: **Nicholas Merz**, Cupertino, CA (US);  
**Daniel Jarvis**, Cupertino, CA (US)

(21) Appl. No.: **14/323,566**

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

**Related U.S. Application Data**

(63) Continuation of application No. 12/987,741, filed on Jan. 10, 2011, now Pat. No. 8,772,650.

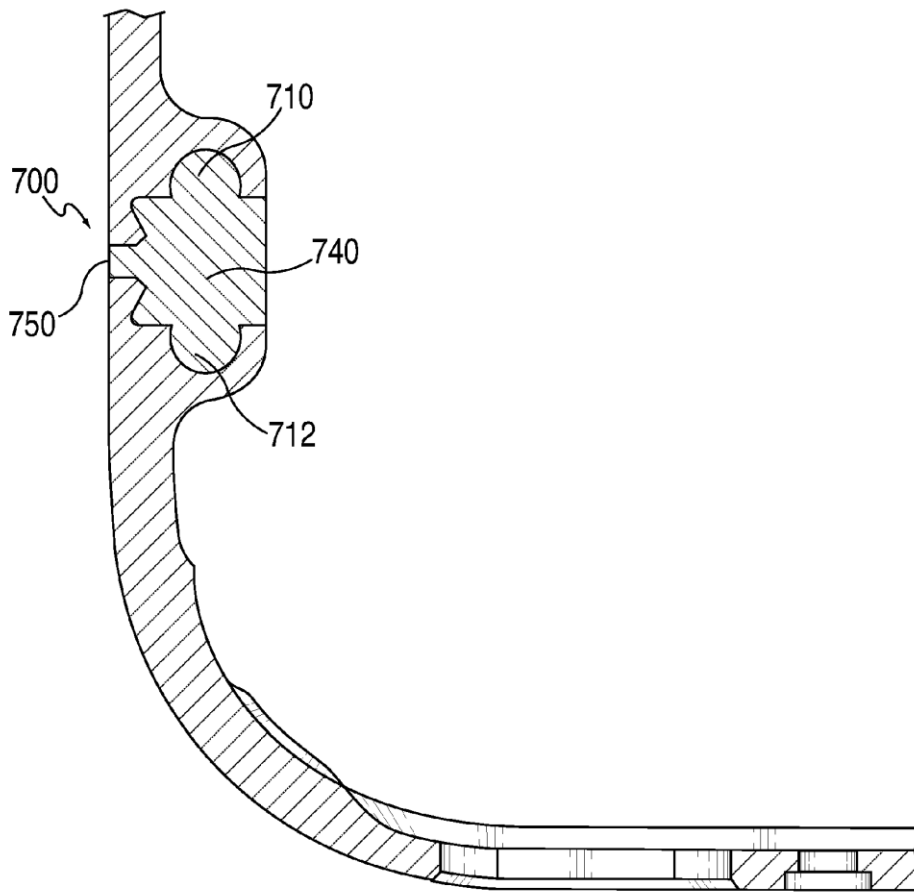
**Publication Classification**

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

(52) **U.S. Cl.**  
CPC ..... **H05K 5/0247** (2013.01); **H05K 5/0217** (2013.01)  
USPC ..... **174/50**; 29/592.1

(57) **ABSTRACT**

This is directed to systems and methods for coupling sections of an electronic device together. Sections of an electronic device can be coupled together via "knuckles." The particular shape and structure of the knuckles can be based on various design considerations. For example, in some embodiments each section can function as an individual antenna. In this case, the knuckles can be designed in order to provide electrical isolation between the sections, thus allowing proper operation of the antennas. For example, the knuckles can be formed from a dielectric material, etc. As another design example, the knuckles can be designed in order to provide increased strength in areas of high strain, and/or to counteract torsional twisting in areas of high impact. As yet another design example, the knuckle can be designed in a manner that is aesthetically pleasing or which otherwise meets cosmetic requirements.





US 20140313082A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0313082 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **HYBRID ANTENNA**

(71) Applicant: **MEDIA TEK INC.**, Hsin-Chu (TW)

(72) Inventors: **Kuo-Fong HUNG**, Changhua City (TW); **Chia-Wei CHI**, Taipei City (TW)

(73) Assignee: **Media Tek Inc.**, Hsin-Chu (TW)

(21) Appl. No.: **13/868,383**

(22) Filed: **Apr. 23, 2013**

**Publication Classification**

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

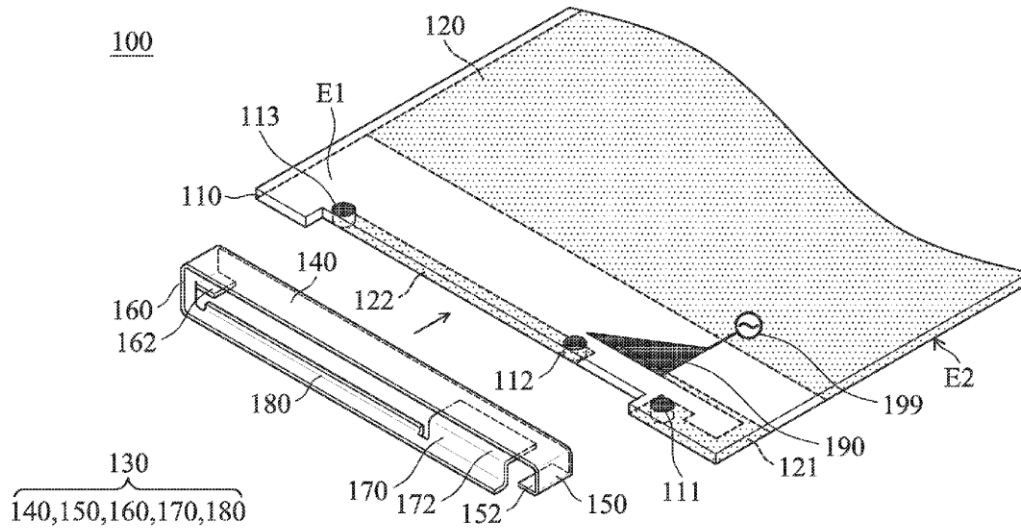
(52) **U.S. Cl.**

CPC ..... **H01Q 1/38** (2013.01)

USPC ..... **343/700 MS; 29/600**

(57) **ABSTRACT**

A hybrid antenna includes a dielectric substrate and a stamping element. The stamping element includes a main radiator, a first holder, a second holder, a feeding element, and an extension branch. The main radiator is substantially disposed above the dielectric substrate. The first holder is coupled to a first end of the main radiator. The second holder is coupled to a second end of the main radiator. The feeding element is coupled to a signal source. The extension branch is substantially disposed below the dielectric substrate, and is coupled between the second holder and the feeding element.





US 20140313083A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0313083 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **MULTIBAND ANTENNA**

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

(71) Applicant: **CHIUN MAI COMMUNICATION SYSTEMS, INC.**, New Taipei (TW)

CPC ..... **H01Q 5/0062** (2013.01)

USPC ..... **343/700 MS**

(72) Inventors: **CHO-KANG HSU**, New Taipei (TW);  
**CHE-YEN LIN**, New Taipei (TW)

(57) **ABSTRACT**

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

A multiband antenna includes a feed end, a first ground end, a second ground end, a ground path, parasitic member, a first resonating member, and a second resonating member. The ground path is connected between the feed end and the first ground end. The first resonating member operates at a low frequency resonating mode. The second resonating member operates at a high frequency resonating mode. The second resonating member includes a first bent portion and a second bent portion. The first bent portion is coupled with the parasitic member to widen a bandwidth of the second resonating member at the high frequency resonating mode. The second bent portion is coupled with the first resonating member to reduce an electrical length of the first resonating member.

(21) Appl. No.: **14/014,623**

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

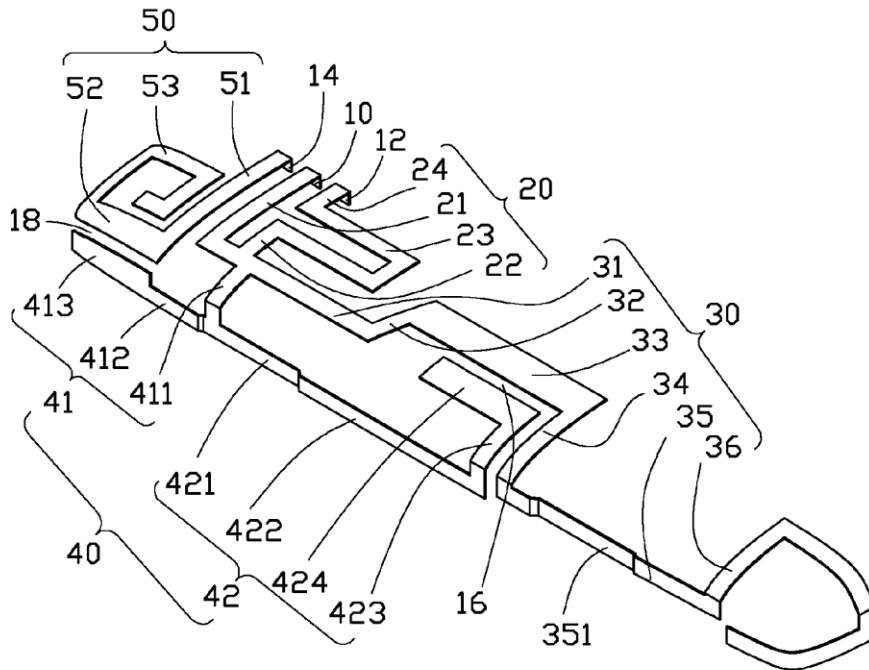
(30) **Foreign Application Priority Data**

Apr. 19, 2013 (TW) ..... 102113874

**Publication Classification**

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

100





US 20140313084A1

(19) **United States**

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

(10) **Pub. No.:** US 2014/0313084 A1

(43) **Pub. Date:** Oct. 23, 2014

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

**Publication Classification**

(71) Applicant: **CHIUN MAI COMMUNICATION SYSTEMS, INC.**, New Taipei (TW)

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

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

(52) **U.S. Cl.**  
CPC ..... *H01Q 9/06* (2013.01)  
USPC ..... **343/700 MS**

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

(57) **ABSTRACT**

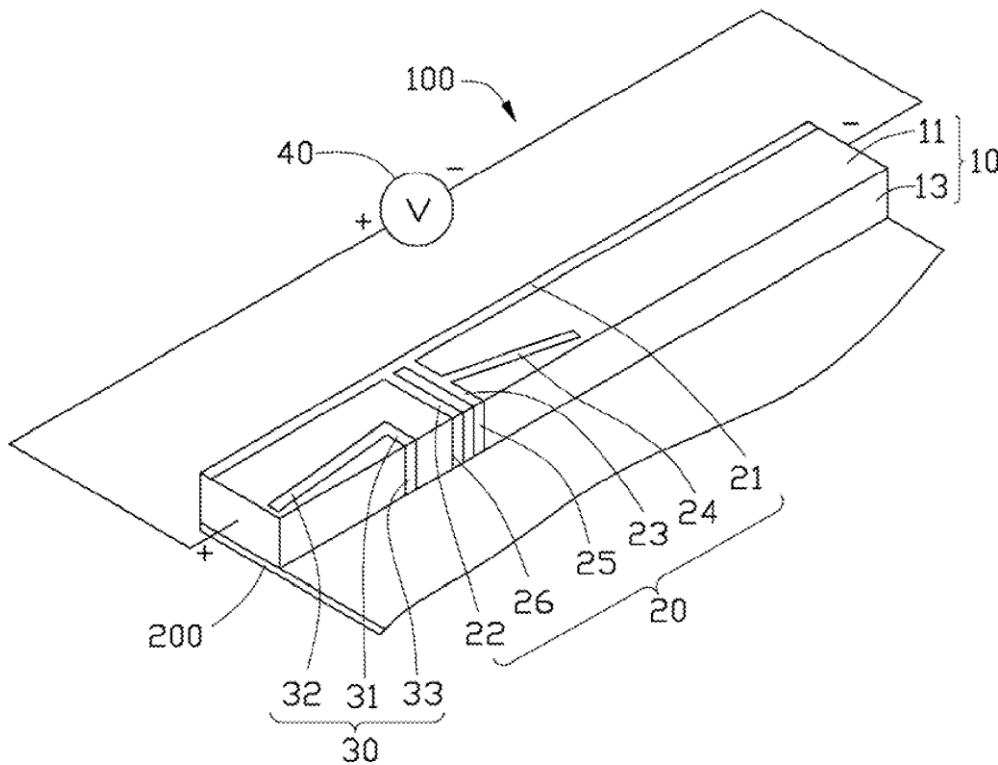
A tunable antenna including a dielectric substrate, a main antenna, and a resonating antenna is disclosed. The dielectric substrate is made of dielectric constant-tunable material. The main antenna is positioned on the dielectric substrate, the main antenna includes a feeding arm and a first grounding arm. The main antenna generates a low-frequency mode and at least one high-frequency mode. The resonating antenna is positioned on the dielectric substrate. The resonating antenna resonates with the main antenna to generate another high-frequency mode. The central frequencies of the low-frequency mode and the high-frequency modes of the tunable antenna are adjusted by adjusting a dielectric constant of the dielectric substrate.

(21) Appl. No.: **14/068,240**

(22) Filed: **Oct. 31, 2013**

(30) **Foreign Application Priority Data**

Apr. 23, 2013 (TW) ..... 102114282





US 20140313085A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0313085 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **ANTENNA PATTERN FRAME AND METHOD AND MOLD FOR MANUFACTURING THE SAME**

(30) **Foreign Application Priority Data**

Apr. 23, 2009 (KR) ..... 10-2009-0035633

(71) Applicant: **SAMSUNG ELECTRO-MECHANICS CO., LTD.**, Suwon-Si (KR)

**Publication Classification**

(72) Inventors: **Jae Suk SUNG**, Yongin (KR); **Ha Ryong HONG**, Hwaseong (KR); **Yong Shik NA**, Hwaseong (KR); **Dae Seong JEON**, Suwon (KR); **Duk Woo LEE**, Suwon (KR); **Dae Kyu LEE**, Suwon (KR); **Sang Woo BAE**, Suwon (KR); **Dae Ki LIM**, Seongnam (KR); **Sung Eun CHO**, Suwon (KR); **Nam Il SEO**, Seoul (KR)

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

(52) **U.S. Cl.**  
CPC ..... **H01Q 9/045** (2013.01)  
USPC ..... **343/700 MS**

(57) **ABSTRACT**

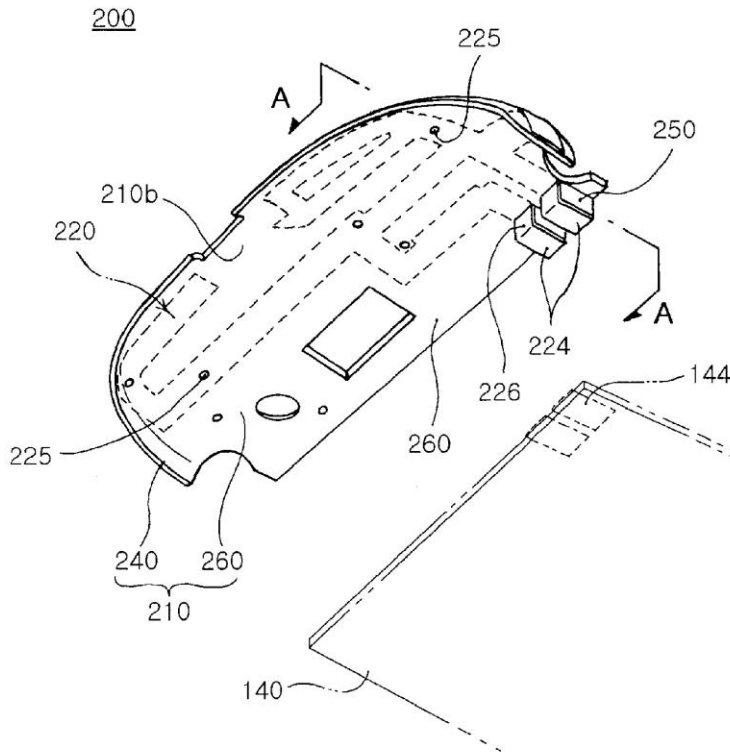
An antenna pattern frame according to an aspect of the invention may include: a radiator having an antenna pattern portion transmitting and receiving a signal and a connection terminal portion allowing the signal to be transmitted to and received from a circuit board of an electronic device; a connection portion partially forming the radiator and connecting the antenna pattern portion and the connection terminal portion to be arranged in different planes; and a radiator frame manufactured by injection molding on the radiator so that the antenna pattern portion is provided on one side of the radiator frame and the connection terminal portion is provided on the other side thereof while the antenna pattern portion is embedded in the electronic device case.

(21) Appl. No.: **14/321,451**

(22) Filed: **Jul. 1, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. 12/649,912, filed on Dec. 30, 2009.





US 20140313086A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0313086 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **PORTABLE ELECTRONIC DEVICE  
HOUSING HAVING INSERT MOLDING  
AROUND ANTENNA**

**Publication Classification**

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

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

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

(72) Inventors: **Anthony S. Montevirgen**, San Francisco, CA (US); **Emery A. Sanford**, San Francisco, CA (US); **Stephen B. Lynch**, Portola Valley, CA (US)

(57) **ABSTRACT**

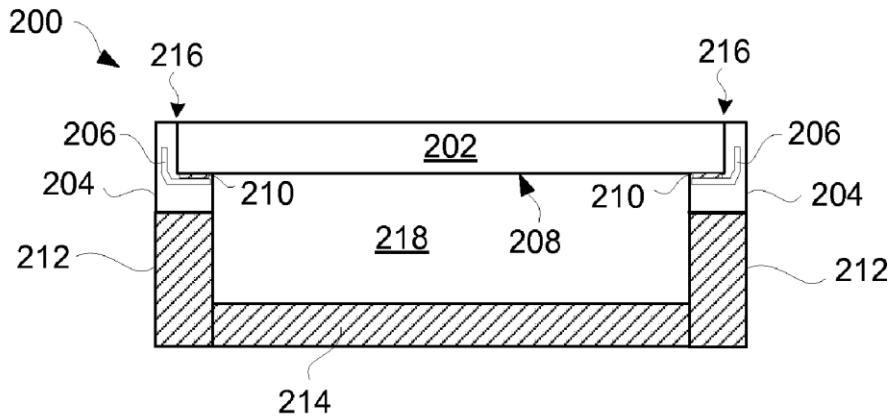
Embodiments are described herein in the context of housings for electronic devices. In one embodiment, a housing can make use of an outer member, which can be formed of glass. The outer member can be secured with respect to other portions of the housing for the electronic device. The outer member can also be protected at its edges by a protective side member. Still further, one or more antenna can be provided at least partially internal to the protective side member. The electronic devices can be portable and in some cases handheld.

(21) Appl. No.: **14/322,817**

(22) Filed: **Jul. 2, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. 13/250,668, filed on Sep. 30, 2011.







US 20140313087A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0313087 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **TUNABLE MULTIBAND ANTENNA WITH PASSIVE AND ACTIVE CIRCUITRY**

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

CPC ..... **H01Q 3/22** (2013.01)

USPC ..... **343/745; 343/700 MS**

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

(57) **ABSTRACT**

(72) Inventors: **Yi Jiang**, Sunnyvale, CA (US); **Siwen Yong**, Santa Clara, CA (US); **Gordon Coutts**, Santa Clara, CA (US); **Lijun Zhang**, San Jose, CA (US); **Qingxiang Li**, Mountain View, CA (US); **Robert W. Schlub**, Cupertino, CA (US)

An electronic device may have an antenna for providing coverage in wireless communications bands of interest such as a low frequency communications band and a high frequency communications band. The antenna may have an antenna ground and an antenna resonating element. The antenna resonating element may have a high band arm that contributes to a first high band resonance in the high band and may have a low band arm that exhibits a low band resonance in the low band. A passive filter that is coupled between first and second portions of the antenna resonating element may be configured to exhibit a short circuit impedance associated with a bypass path that allows the antenna resonating element to contribute to a second high band resonance in the high band. A tunable inductor coupled to the antenna resonating element may be used to tune the low band resonance.

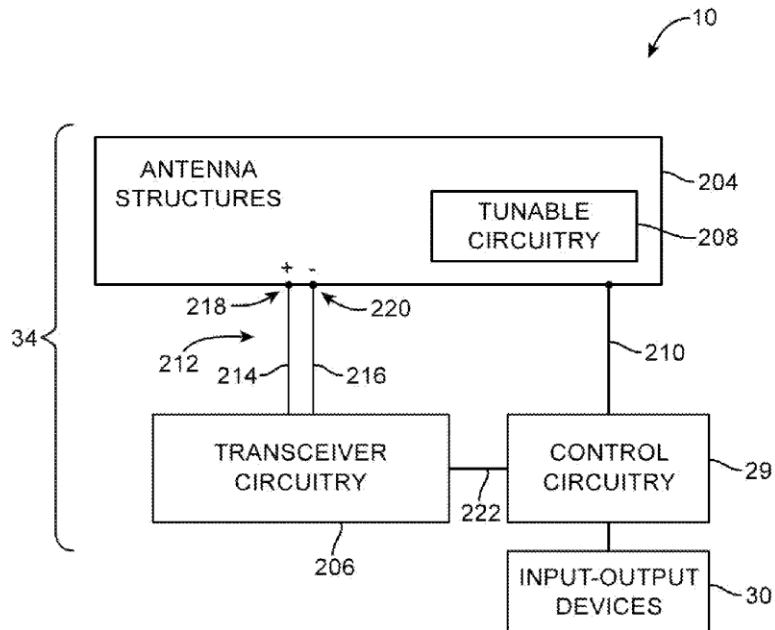
(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **13/864,968**

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

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 3/22** (2006.01)





US 20140313089A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0313089 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **MULTI-ANTENNA SYSTEM**

(71) Applicant: **Industrial Technology Research Institute, Hsinchu (TW)**

(72) Inventors: **Chun-Yih Wu, Taipei City (TW); Wei-Ji Chen, Tainan City (TW); Chin-Hung Wang, Hsinchu City (TW)**

(21) Appl. No.: **13/933,133**

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

(30) **Foreign Application Priority Data**

Apr. 18, 2013 (TW) ..... 102113806

**Publication Classification**

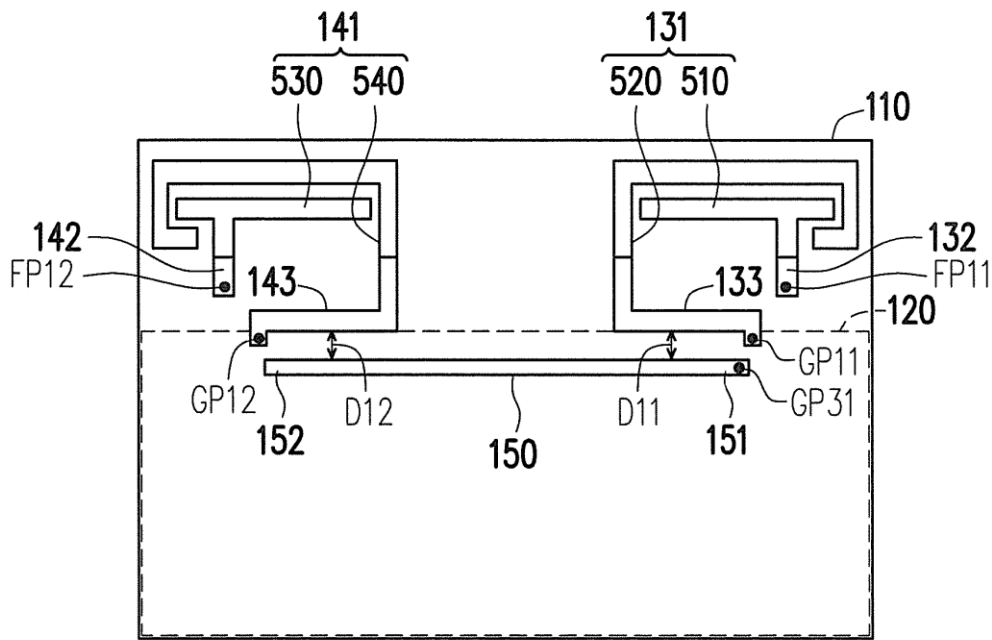
(51) **Int. Cl.**  
**H01Q 3/30** (2006.01)  
**H01Q 5/01** (2006.01)

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

CPC ... **H01Q 3/30** (2013.01); **H01Q 5/01** (2013.01)  
USPC ..... **343/745; 343/893**

(57) **ABSTRACT**

A multi-antenna system including a substrate, a ground element, a first antenna element, a second antenna element and a decoupling element is provided. The ground element is disposed on a first surface of the substrate, and the decoupling element is disposed on a second surface of the substrate. Ground portions of the two antenna elements and a first connection terminal of the decoupling element are electrically connected to the ground element. The decoupling element is spaced a first decoupling distance from a part of the first ground portion, and the decoupling element is spaced a second decoupling distance from a part of the second ground portion. A phase difference relative to the two antenna elements is generated by the decoupling element, the first decoupling distance and the second decoupling distance so as to eliminate interference energy between the two antenna elements.





US 20140313091A1

(19) **United States**

(12) **Patent Application Publication**  
**Lee**

(10) **Pub. No.: US 2014/0313091 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **SLOT-TYPE AUGMENTED ANTENNA**

**Publication Classification**

(75) Inventor: **Joo Yeol Lee**, Seoul (KR)

(51) **Int. Cl.**  
**H01Q 13/10** (2006.01)  
**H01Q 9/16** (2006.01)

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

(52) **U.S. Cl.**  
CPC . **H01Q 13/10** (2013.01); **H01Q 9/16** (2013.01)  
USPC ..... **343/770**

(21) Appl. No.: **14/354,166**

(22) PCT Filed: **Nov. 23, 2011**

(57) **ABSTRACT**

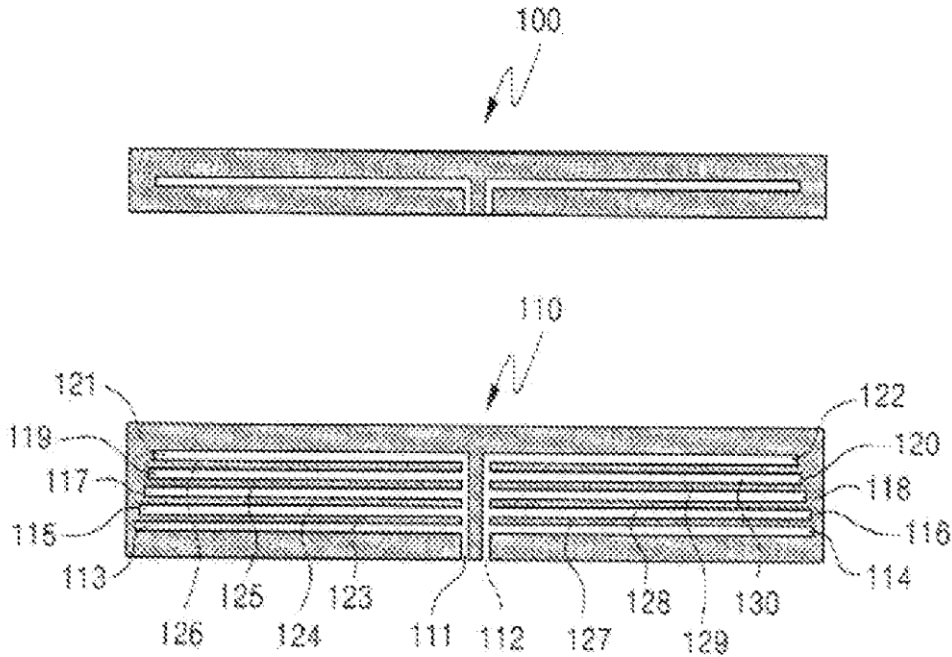
(86) PCT No.: **PCT/KR2011/008977**

§ 371 (c)(1),  
(2), (4) Date: **Apr. 25, 2014**

The present invention relates to an augmented antenna capable of operating in a wider frequency band, and receiving and reradiating radio signals. The augmented antenna includes radiation patterns formed using a plurality of radiation slots having multiple coupling regions. The radiation patterns are symmetrically connected and impedance-matched to transmit and receive radio signals, thereby improving a radio wave propagation environment.

(30) **Foreign Application Priority Data**

Nov. 4, 2011 (KR) ..... 10-2011-0114304





US 20140313094A1

(19) **United States**

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

(10) **Pub. No.: US 2014/0313094 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **MULTIBAND ANTENNA AND SLOTTED  
GROUND PLANE THEREFORE**

**Publication Classification**

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

(51) **Int. Cl.**  
**H01Q 21/06** (2006.01)

(72) Inventors: **Anatoly BEREZIN**, Tiberias (IL);  
**Yaniv ZIV**, Tiberias (IL); **Haim YONA**,  
Tiberias (IL); **Sharon HAREL**, Tiberias  
(IL)

(52) **U.S. Cl.**  
CPC ..... **H01Q 21/062** (2013.01)  
USPC ..... **343/810**

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

(57) **ABSTRACT**

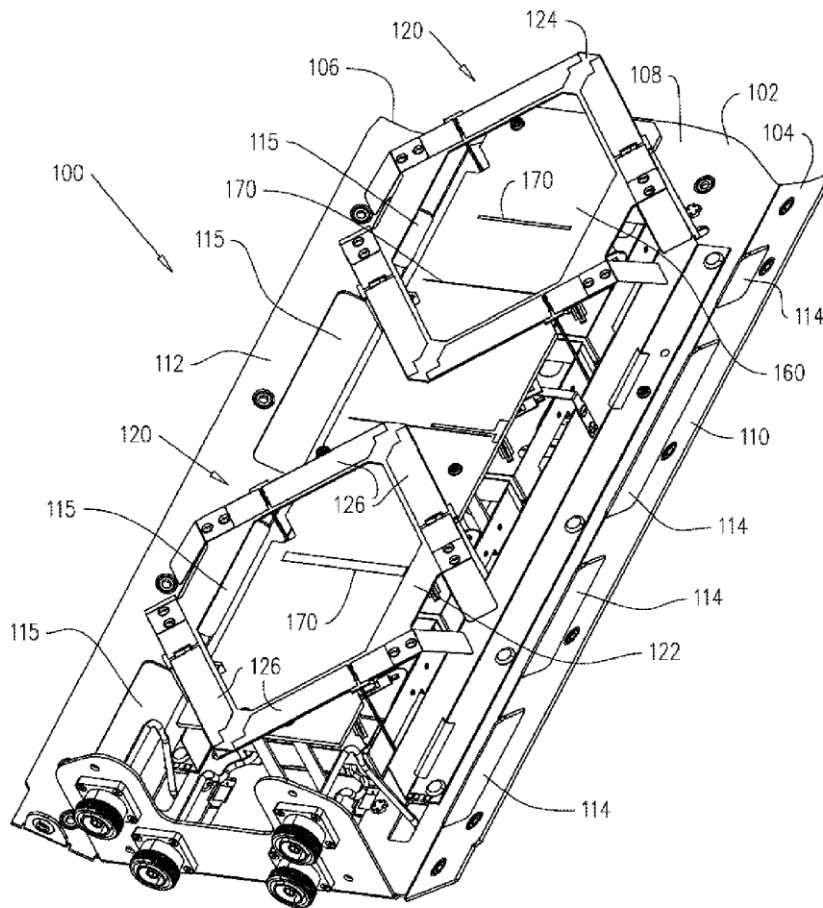
(21) Appl. No.: **14/254,477**

(22) Filed: **Apr. 16, 2014**

**Related U.S. Application Data**

(60) Provisional application No. 61/814,399, filed on Apr.  
22, 2013, provisional application No. 61/894,964,  
filed on Oct. 24, 2013.

A multiband antenna including a ground plane having at least one periphery, at least one non-radiative slot being formed along the at least one periphery, a first plurality of radiating elements mounted on the ground plane adjacent to the at least one periphery and radiating in a first frequency band and a second plurality of radiating elements mounted on the ground plane adjacent to the at least one periphery and radiating in a second frequency band, the second frequency band being higher than the first frequency band.







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(19) **United States**

(12) **Patent Application Publication**  
LIN

(10) **Pub. No.: US 2014/0313098 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **ANTENNA ASSEMBLY AND ELECTRONIC DEVICE USING THE ANTENNA ASSEMBLY**

**Publication Classification**

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

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

(72) Inventor: **YEN-HUI LIN**, New Taipei (TW)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/48** (2013.01)  
USPC ..... **343/848**

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

(57) **ABSTRACT**

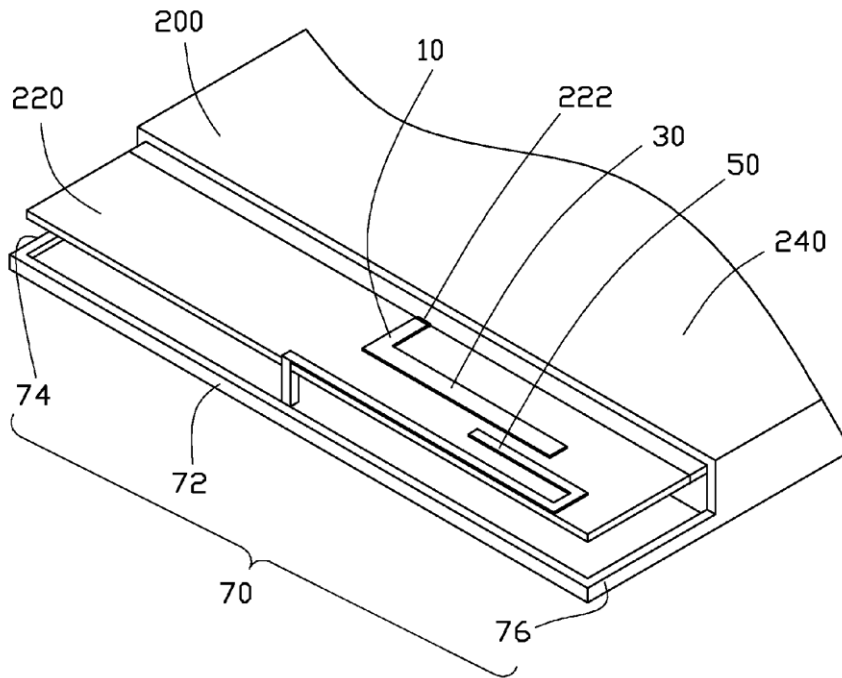
(21) Appl. No.: **14/014,633**

An antenna assembly which can be adapted for the metal housing of any wireless device includes a feeding terminal, a first radiator connecting to the feeding terminal, a second radiator positioned parallel and adjacent to the first radiator, and a metal element connecting to the second radiator. The wireless signal fed to the first radiator can be coupled to the second radiator, and flows through the metal element to ground, thus utilizing the metal housing itself in the wireless transmission and reception process. An electronic device using the antenna assembly is also described.

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

(30) **Foreign Application Priority Data**

Apr. 23, 2013 (TW) ..... 102114467





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(19) **United States**

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

(10) **Pub. No.: US 2014/0315592 A1**

(43) **Pub. Date: Oct. 23, 2014**

(54) **WIRELESS DEVICE WITH DYNAMICALLY ADJUSTED MAXIMUM TRANSMIT POWERS**

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

CPC ..... *H04B 1/3838* (2013.01); *H04W 52/221* (2013.01)

USPC ..... **455/522**; 455/90.2

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

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**Qingxiang Li**, Mountain View, CA (US);  
**Digvijay Jadhav**, Sunnyvale, CA (US);  
**Matthew Fong**, Sunnyvale, CA (US);  
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(57) **ABSTRACT**

An electronic device may be provided with antenna structures. Proximity sensors and other sensors may be used in determining how the electronic device is being operated. Wireless circuitry such as a radio-frequency transmitter associated with a cellular telephone communications band, a wireless local area network band, or other communications band may be used in transmitting radio-frequency signals through the antenna structures at a transmit power. Control circuitry may adjust the wireless circuitry to ensure that the transmit power is capped at a maximum transmit power. The maximum transmit power may be adjusted dynamically by the control circuitry based on data from the proximity sensors, data from a magnetic sensor that detects whether a cover is present on the device, a connector sensor that detects whether the device is coupled to a dock or other accessory, and other sensors.

(21) Appl. No.: **13/865,578**

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

**Publication Classification**

(51) **Int. Cl.**  
*H04B 1/38* (2006.01)  
*H04W 52/22* (2006.01)

