US 20140022132A1

(19) **United States**

(12) **Patent Application Publication**

Badaruzzaman et al.

(10) **Pub. No.: US 2014/0022132 A1**

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

(54) **ANTENNA TUNING FOR MULTIBAND OPERATION**

(75) Inventors: **Firass Mirza Badaruzzaman**, Forest Park, IL (US); **Randy Alan Wiessner**, Palatine, IL (US); **Marshall Joseph Katz**, Palatine, IL (US)

(73) Assignee: **Research In Motion Limited**, Waterloo (CA)

(21) Appl. No.: **13/551,248**

(22) Filed: **Jul. 17, 2012**

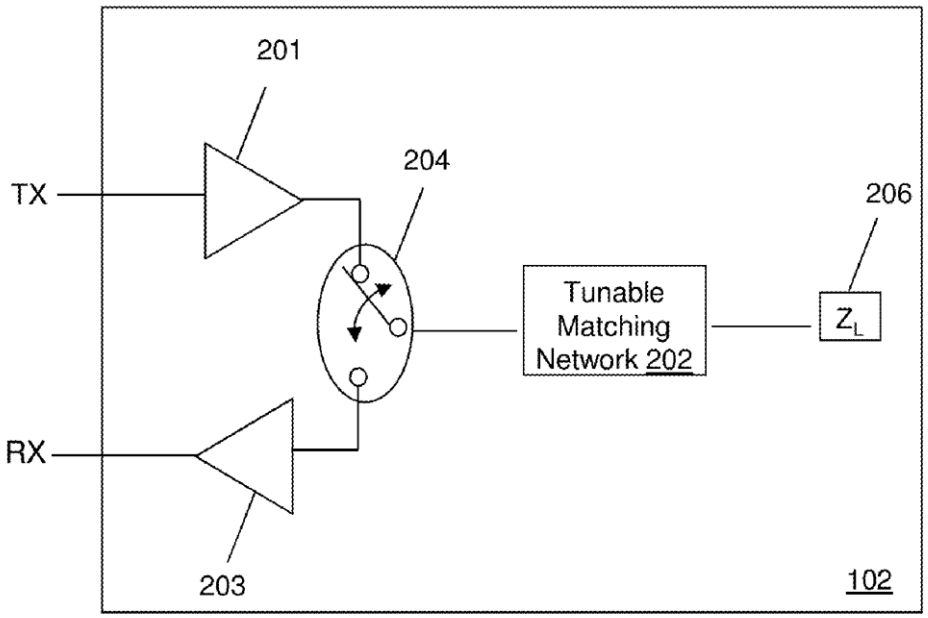
Publication Classification

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

(52) **U.S. Cl.**
USPC **343/745**

(57) **ABSTRACT**

A system and process that incorporates teachings of the subject disclosure may include, for example, a multiband antenna as may be used in mobile communications devices. The multiband antenna includes a feed port coupled to each of a first radiating portion and a second radiating portion. Each of the first and second radiating portions defines a respective resonant bandwidth. The multiband antenna also includes at least one adjustable tuning circuit disposed between physically isolated radiating segments of a respective one of the first and second radiating portions. Adjustment of the tuning circuit alters a corresponding resonant bandwidth allowing the corresponding resonant bandwidth to be tuned independently of the other resonant bandwidth and without affecting performance of the other resonant bandwidth. In at least some embodiments, the tuning circuit can include a tunable phase shifter having one or more components, each having a variable reactance. Other embodiments are disclosed.



US 20140022136A1

(19) **United States**

(12) **Patent Application Publication**

Hallivuori

(10) **Pub. No.: US 2014/0022136 A1**

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

(54) **LOW FREQUENCY DIFFERENTIAL MOBILE ANTENNA**

(75) Inventor: **Juha Samuel Hallivuori**, Tampere (FI)

(73) Assignee: **Nokia Corporation**

(21) Appl. No.: **13/554,058**

(22) Filed: **Jul. 20, 2012**

Publication Classification

(51) **Int. Cl.**

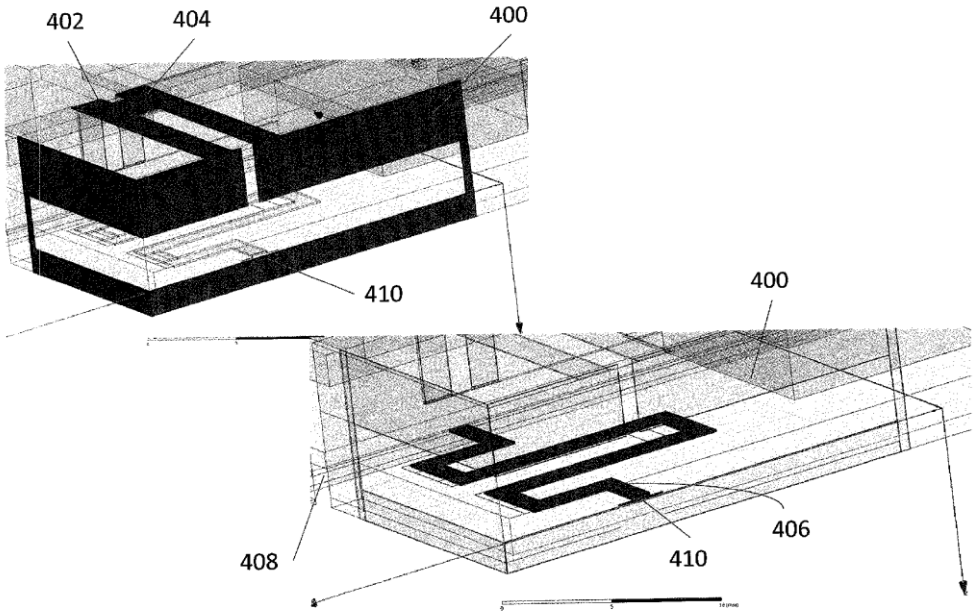
H01Q 9/04	(2006.01)
H01Q 7/00	(2006.01)
H01Q 9/26	(2006.01)

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

USPC ..... **343/803**; 343/700 MS; 343/866

(57) **ABSTRACT**

An antenna which is advantageous for low frequency communications and suitable for use in a portable electronic device comprises an antenna resonator element and a grounding line. The resonator element is configured to resonate at a frequency f, and comprises a first port and a second port that are configured to be differentially fed. The grounding line couples a virtual node of the resonator element to ground, where the virtual node defines a negligible current when the resonator element is resonant at the frequency f. In the specific examples the antenna could be a folded monopole, a folded dipole, a loop, or other type of differential antennas. Radiation efficiency is quantified for a long folded monopole implementation which shows a marked improvement over an identical antenna without such a grounding line, particularly when used with a radio receiver.



US 20140024417A1

(19) **United States**

(12) **Patent Application Publication**

MAN et al.

(10) **Pub. No.: US 2014/0024417 A1**

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

(54) **MOBILE WIRELESS DEVICE WITH MULTI FEED POINT ANTENNA AND AUDIO TRANSDUCER AND RELATED METHODS**

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

(72) Inventors: **YING TONG MAN**, WATERLOO (CA); **YIHONG QI**, WATERLOO (CA); **JOSHUA KWAN HO WONG**, WATERLOO (CA)

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

(21) Appl. No.: **14/034,601**

(22) Filed: **Sep. 24, 2013**

Related U.S. Application Data

(63) Continuation of application No. 12/902,393, filed on Oct. 12, 2010, now Pat. No. 8,571,599.

(60) Provisional application No. 61/250,934, filed on Oct. 13, 2009.

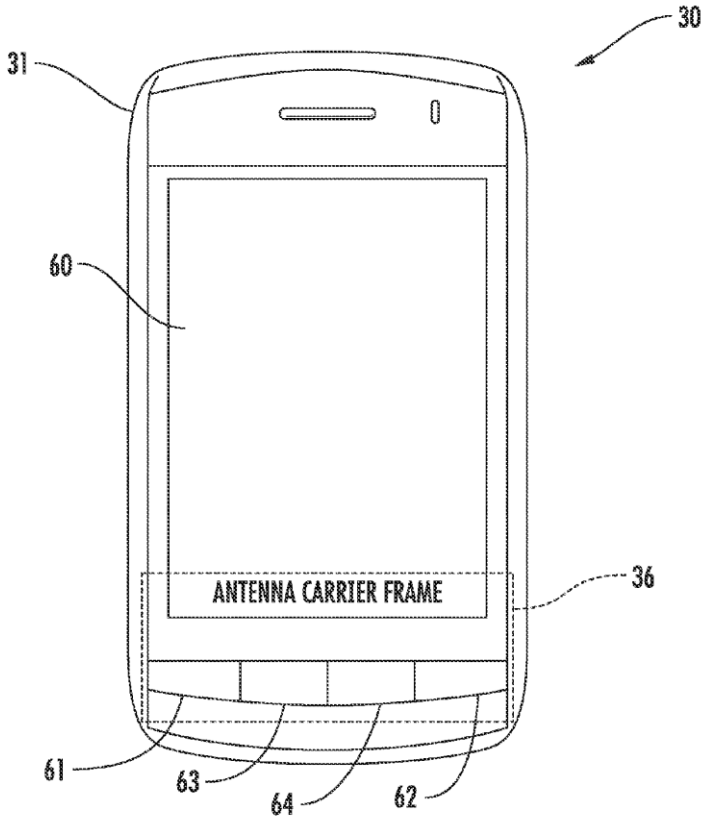
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H04B 1/3888*** (2013.01)
USPC **455/575.7**

(57) **ABSTRACT**

A mobile wireless communications device may include a portable housing, a circuit board carried by the portable housing, a wireless communications circuit carried by the circuit board, and an audio circuit carried by the circuit board. The mobile wireless communications device may further include an antenna assembly including an antenna carrier frame coupled to the circuit board and defining a cavity therein, and an antenna element carried on the antenna carrier frame and having a plurality of spaced apart signal feed points coupled to the wireless communications circuit. In addition, an audio transducer may be carried within the cavity of the antenna carrier frame and coupled to the audio circuit.



US 20140028503A1

(19) **United States**

(12) **Patent Application Publication**

CHIEN et al.

(10) **Pub. No.: US 2014/0028503 A1**

(43) **Pub. Date: Jan. 30, 2014**

(54) **MULTIBAND ANTENNA**

(71) Applicant: **ASKEY COMPUTER CORP.**, NEW TAIPEI CITY (TW)

(72) Inventors: **CHIH-CHENG CHIEN**, DAXI TOWNSHIP (TW); **CHIN-HSU LAI**, NEW TAIPEI CITY (TW)

(73) Assignee: **ASKEY COMPUTER CORP.**, NEW TAIPEI CITY (TW)

(21) Appl. No.: **13/673,139**

(22) Filed: **Nov. 9, 2012**

(30) **Foreign Application Priority Data**

Jul. 27, 2012 (TW) 101127175

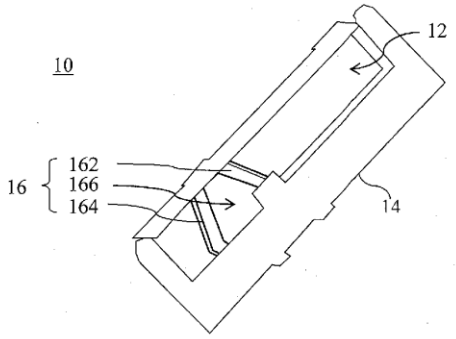
Publication Classification

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

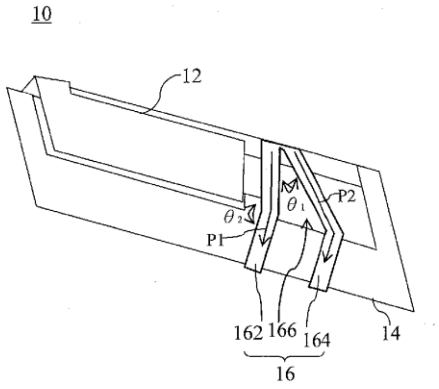
(52) **U.S. Cl.**
USPC ..... **343/700 MS**

(57) **ABSTRACT**

A multiband antenna for an electronic device includes a resonance radiation body, a grounding end, and a spread spectrum portion. The resonance radiation body receives a first electromagnetic wave signal at a first frequency (known as fundamental frequency). The grounding end and the electronic device are connected. The spread spectrum portion is disposed between the resonance radiation body and the grounding end. The spread spectrum portion includes first and second shunting bodies to form a loop bypass between the resonance radiation body and the grounding end and thereby decrease and increase the first frequency by a specific frequency value so as to define a bandwidth equal to two times the specific frequency value. Hence, the electronic device receives a second electromagnetic wave signal at any frequency within the bandwidth. Since the spread spectrum portion defines the bandwidth, the electronic device can receive the first and second electromagnetic wave signals.



a



b

US 20140028505A1

(19) **United States**

(12) **Patent Application Publication**

BALIARDA et al.

(10) **Pub. No.: US 2014/0028505 A1**

(43) **Pub. Date: Jan. 30, 2014**

(54) **SPACE-FILLING MINIATURE ANTENNAS**

(71) Applicant: **Fractus, S.A.**, Barcelona (ES)

(72) Inventors: **CARLES PUENTE BALIARDA**, BARCELONA (ES); **EDOUARD JEAN LOUIS ROZAN**, BARCELONA (ES); **JAUME ANGUERA PROS**, BARCELONA (ES)

(73) Assignee: **Fractus, S.A.**, Barcelona (ES)

(21) Appl. No.: **14/045,241**

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

Related U.S. Application Data

(60) Continuation of application No. 13/044,207, filed on Mar. 9, 2011, now Pat. No. 8,558,741, which is a continuation of application No. 12/498,090, filed on Jul. 6, 2009, now Pat. No. 8,207,893, which is a continuation of application No. 12/347,462, filed on Dec. 31, 2008, now Pat. No. 8,212,726, which is a continuation of application No. 11/686,804, filed on Mar. 15, 2007, now Pat. No. 7,554,490, which is a division of application No. 11/179,250, filed on Jul. 12, 2005, now Pat. No. 7,202,822, which is a continuation of application No. 11/110,052, filed on Apr. 20, 2005, now Pat. No. 7,148,850, which is a continuation of application No. 10/182,635, filed on Nov. 1, 2002, now abandoned, filed as application No. PCT/EP00/00411 on Jan. 19, 2000.

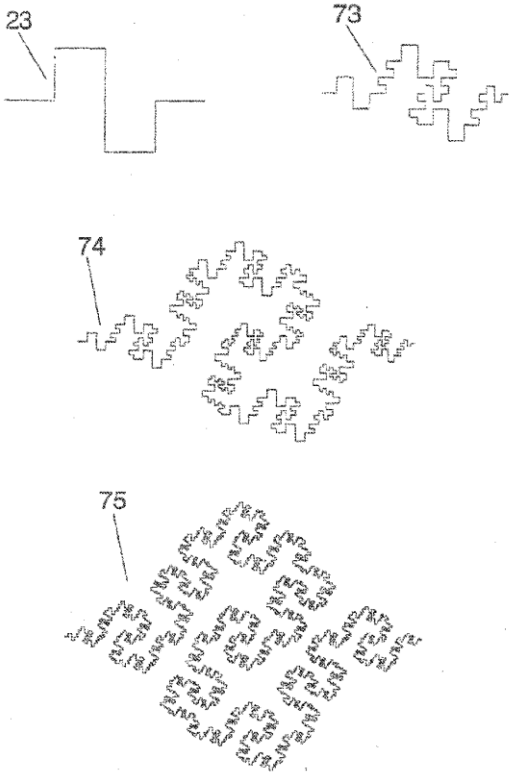
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 1/36*** (2013.01)
USPC **343/702**

(57) **ABSTRACT**

A novel geometry, the geometry of Space-Filling Curves (SFC) is defined in the present invention and it is used to shape a part of an antenna. By means of this novel technique, the size of the antenna can be reduced with respect to prior art, or alternatively, given a fixed size the antenna can operate at a lower frequency with respect to a conventional antenna of the same size.



US 20140028510A1

(19) **United States**

(12) **Patent Application Publication**

Yoon et al.

(10) **Pub. No.: US 2014/0028510 A1**

(43) **Pub. Date: Jan. 30, 2014**

(54) **MULTIPLE ANTENNA HIGH ISOLATION APPARATUS AND APPLICATION THEREOF**

(71) Applicant: **BROADCOM CORPORATION**, Irvine, CA (US)

(72) Inventors: **Seunghwan Yoon**, Irvine, CA (US); **Nicolaos G. Alexopoulos**, Irvine, CA (US)

(73) Assignee: **BROADCOM CORPORATION**, Irvine, CA (US)

(21) Appl. No.: **14/041,824**

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

Related U.S. Application Data

(63) Continuation of application No. 12/772,129, filed on Apr. 30, 2010, now Pat. No. 8,570,229, which is a continuation-in-part of application No. 12/642,360, filed on Dec. 18, 2009, now Pat. No. 8,570,222.

(60) Provisional application No. 61/145,049, filed on Jan. 15, 2009, provisional application No. 61/253,958, filed on Oct. 22, 2009.

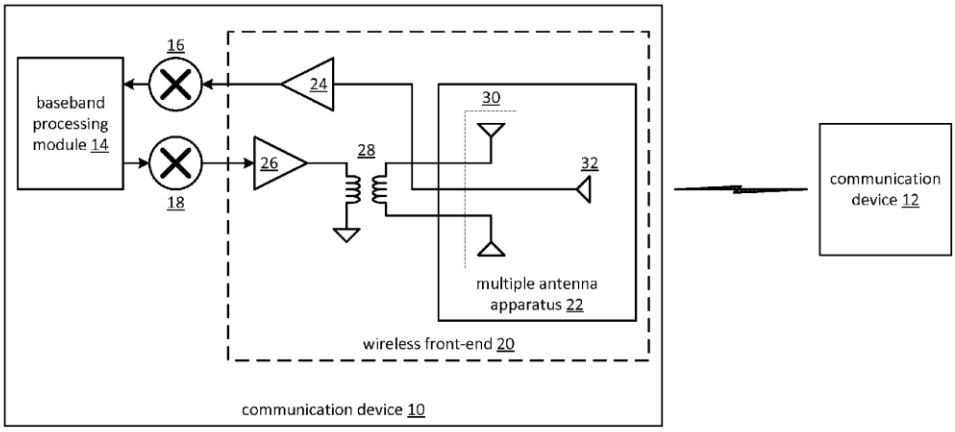
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 1/38*** (2013.01)
USPC **343/727**

(57) **ABSTRACT**

A multiple antenna apparatus includes a substrate, a first antenna structure, and a second antenna structure. The first antenna structure includes a first metal trace that has a first pattern confined in a first geometric shape and has a near-zero electric field plane. The second antenna structure includes a second metal trace that has a first pattern confined to a second geometric shape. The second antenna structure is positioned on the substrate in substantial alignment with the near-zero electric field plane of the first antenna structure.



US 20140028511A1

(19) **United States**

(12) **Patent Application Publication**

RAO

(10) **Pub. No.: US 2014/0028511 A1**

(43) **Pub. Date: Jan. 30, 2014**

(54) **COMPACT MULTIPLE-BAND ANTENNA FOR WIRELESS DEVICES**

(71) Applicant: **BlackBerry Limited**, Waterloo (CA)

(72) Inventor: **Qinjiang RAO**, Kanata (CA)

(73) Assignee: **BlackBerry Limited**, Waterloo (CA)

(21) Appl. No.: **13/948,845**

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

Related U.S. Application Data

(62) Division of application No. 12/615,267, filed on Nov. 10, 2009, now Pat. No. 8,514,132.

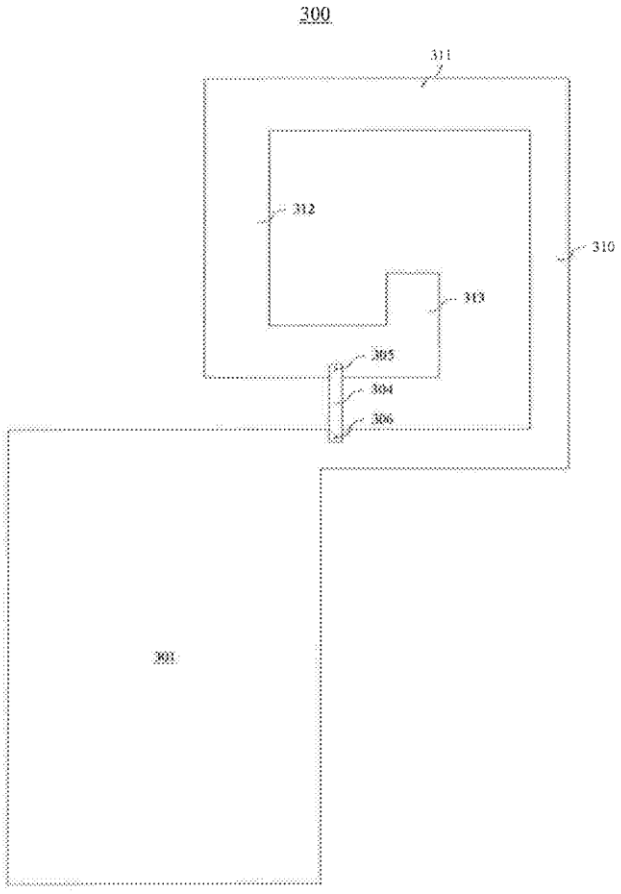
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 5/0024*** (2013.01)
USPC **343/729**

(57) **ABSTRACT**

A device in a wireless communications system, comprising a transmitter for transmitting information over a plurality of frequency bands, a receiver for receiving information over a plurality of frequency bands and a multiple-band antenna electrically connected to said transmitter and said receiver, wherein said multiple band antenna is comprised of a first feed point configured to electrically connect said multiple band antenna to said transmitter and said receiver, wherein said multiple band antenna forms a first antenna type and a second feed point configured to electrically connect said multiple-band antenna to said transmitter and said receiver, wherein said multiple band antenna forms a second antenna type.



US 20140028519A1

(19) **United States**

(12) **Patent Application Publication**

Kim et al.

(10) **Pub. No.: US 2014/0028519 A1**

(43) **Pub. Date: Jan. 30, 2014**

(54) **INTERNAL ANTENNA HAVING WIDEBAND CHARACTERISTIC**

(71) Applicant: **LS Mtron Ltd.**, Anyang-si (KR)

(72) Inventors: **Tae-Hyung Kim**, Gunpo-Si (KR); **Ki-Hyun Kong**, Gunpo-Si (KR); **Suk-Ki Koo**, Gwangmyeong-Si (KR); **Byung-Je Lee**, Seoul (KR); **Hyun-Ho Wi**, Seoul (KR); **Byeong-Kwan Kim**, Seoul (KR)

(21) Appl. No.: **13/951,749**

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

(30) **Foreign Application Priority Data**

Jul. 27, 2012 (KR) 10-2012-0082510

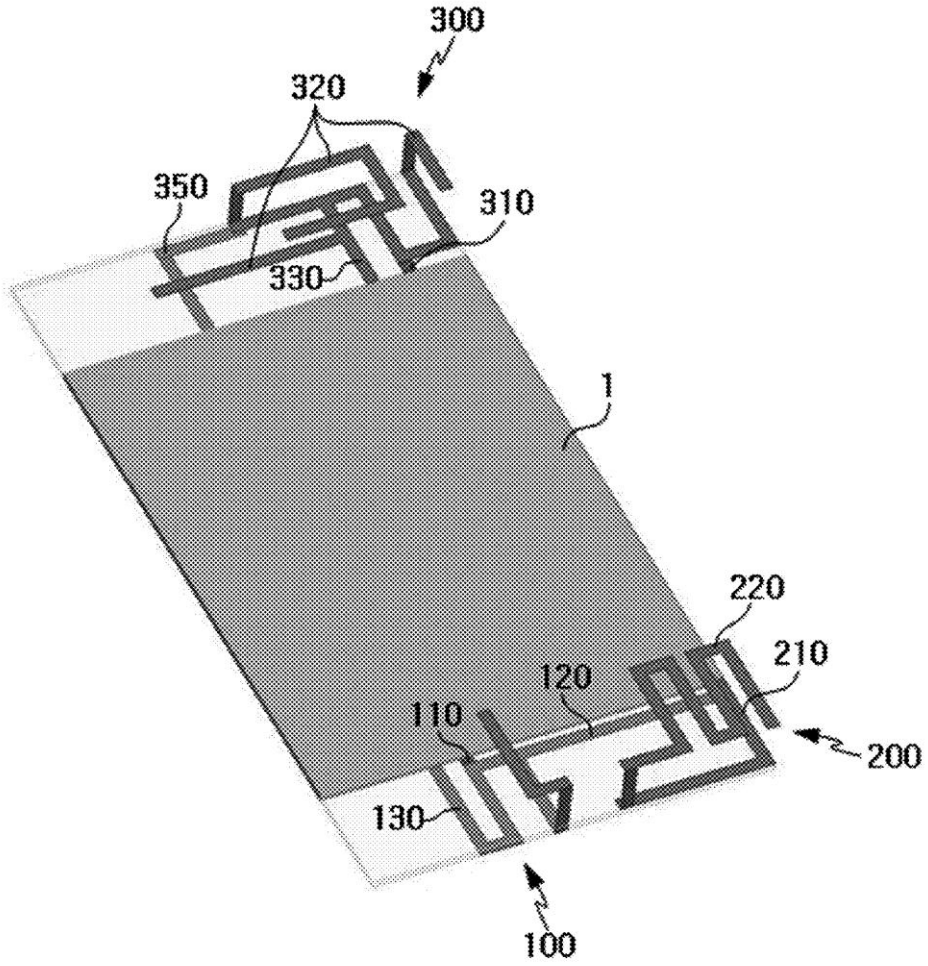
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 21/0075*** (2013.01)
USPC **343/844**

(57) **ABSTRACT**

An internal antenna having a wideband characteristic includes a printed circuit board, a first antenna unit fed with electricity from a feeding unit of the printed circuit board, and a second antenna unit spaced apart from the first antenna unit by a predetermined distance and indirectly fed with electricity by means of coupling to the first antenna unit, wherein the second antenna unit is indirectly fed with electricity with a phase difference from the first antenna unit due to an electric distance from a feeding point of the first antenna unit.



US 20140028525A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2014/0028525 A1**

(43) **Pub. Date: Jan. 30, 2014**

Ying

(54) **WIRELESS ELECTRONIC DEVICES WITH MULTIPLE CURVED ANTENNAS ALONG AN END PORTION, AND RELATED ANTENNA SYSTEMS**

(75) Inventor: **Zhinong Ying**, Lund (SE)

(73) Assignee: **Sony Mobile Communications AB**

(21) Appl. No.: **13/559,018**

(22) Filed: **Jul. 26, 2012**

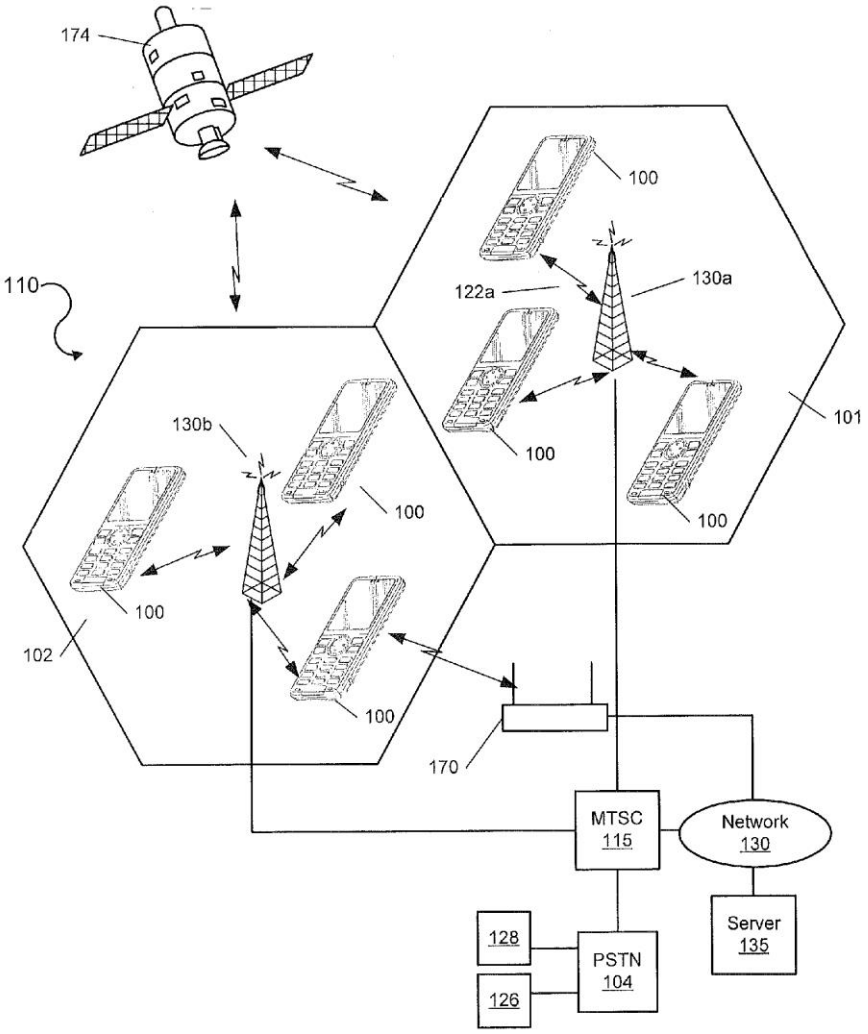
Publication Classification

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

(52) **U.S. Cl.**
USPC **343/893**

(57) **ABSTRACT**

Wireless electronic devices may include a backplate and first and second curved antennas spaced apart from each other along an end portion of the backplate. Each of the first and second curved antennas may include a radiating element and a parasitic element electrically coupled to the radiating element. Related systems are also described.



US 20140028530A1

(19) **United States**

(12) **Patent Application Publication**

Flores-Cuadras

(10) **Pub. No.: US 2014/0028530 A1**

(43) **Pub. Date: Jan. 30, 2014**

(54) **BANDWIDTH-ADJUSTABLE DUAL-BAND ANTENNAS WITH ELECTROMAGNETIC WAVE-GUIDING LOOP, METHODS OF MANUFACTURE AND KITS THEREFOR**

(75) Inventor: **Javier Ruben Flores-Cuadras**, Tijuana (MX)

(73) Assignee: **Taoglas Group Holdings**, San Diego, CA (US)

(21) Appl. No.: **13/878,210**

(22) PCT Filed: **Nov. 18, 2011**

(86) PCT No.: **PCT/US11/61372**

§ 371 (c)(1),
(2), (4) Date: **Oct. 11, 2013**

Related U.S. Application Data

(60) Provisional application No. 61/415,946, filed on Nov. 22, 2010.

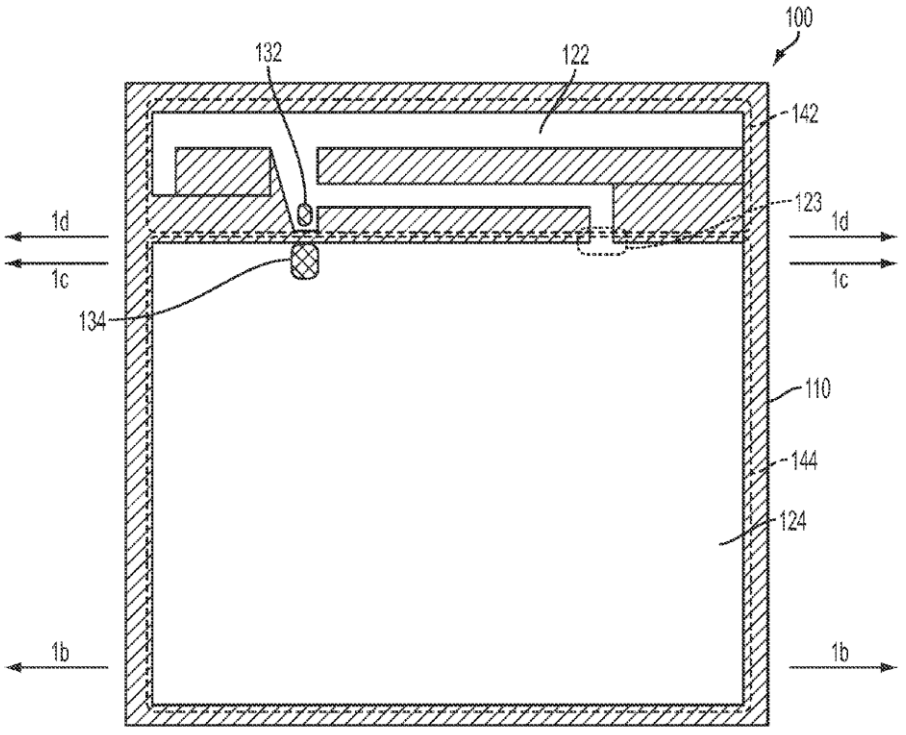
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 5/001*** (2013.01)
USPC ..... **343/904**; 343/700 MS

(57) **ABSTRACT**

A monopole planar inverted-F antenna (PiFA) for dual-band Wi-Fi application is disclosed. The dual band includes a first frequency from 2400-2500 MHz and a second frequency from 4900-6000 MHz. The antenna has a ground copper and a radiation copper. The ground copper is adhered to a substrate having a width of approximately 31 mm and a height of approximately 24 mm. The radiation copper is adhered to the substrate and has a PiFA copper geometry with a width of approximately 31 mm and a height of approximately 6.5 mm. The radiation copper includes a radiation control section that is electrically connected to the ground copper by a short-circuit copper wherein the radiation control section has a length of approximately 15 mm and a width of approximately 0.8 mm.



US 20140029213A1

(19) **United States**

(12) **Patent Application Publication**

KANJ et al.

(10) **Pub. No.: US 2014/0029213 A1**

(43) **Pub. Date: Jan. 30, 2014**

(54) **TRANSMISSION LINE FOR MOBILE ELECTRONIC DEVICE**

(76) Inventors: **Houssam KANJ**, Waterloo (CA); **Huanhuan GU**, Kitchener (CA); **James Paul WARDEN**, Fort Worth, TX (US)

(21) Appl. No.: **13/556,945**

(22) Filed: **Jul. 24, 2012**

Publication Classification

(51) **Int. Cl.**

H05K 7/02 (2006.01)

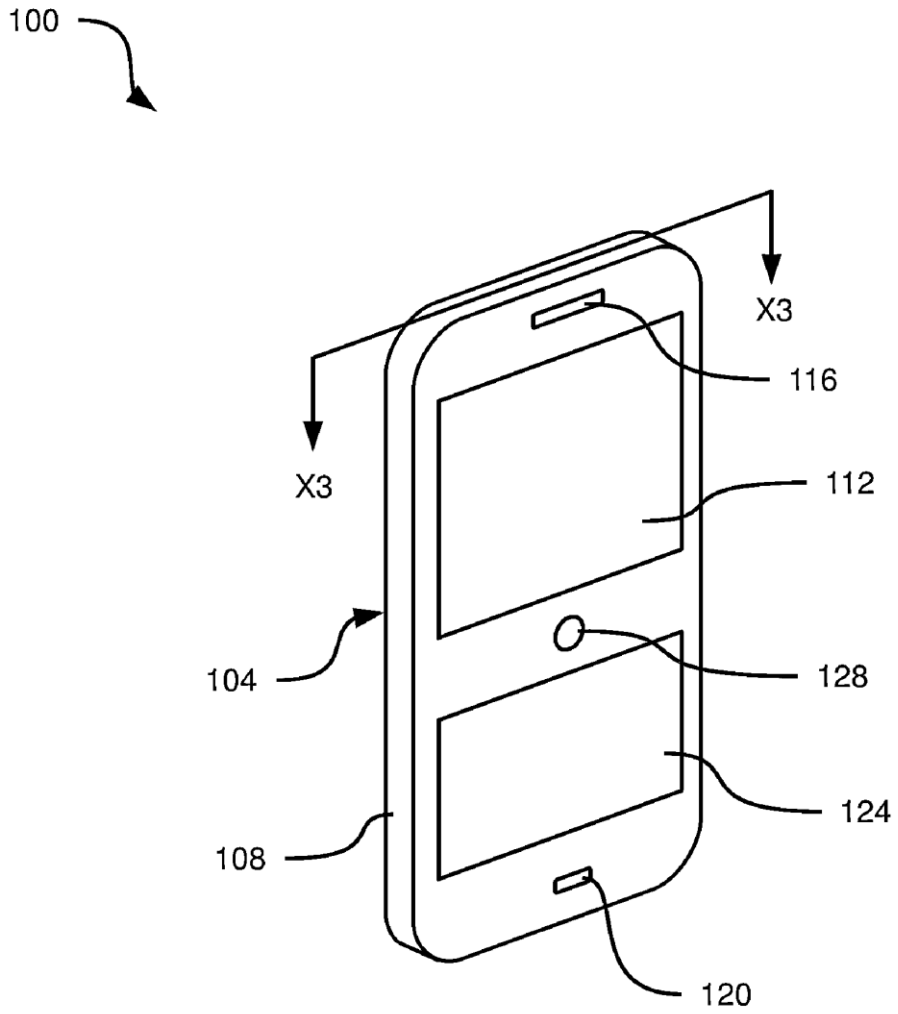
H01R 43/00 (2006.01)

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

USPC **361/752**; 361/679.01; 29/825

(57) **ABSTRACT**

According to embodiments described in the specification, a method and mobile electronic device are provided for tuning an antenna. The mobile electronic device comprises an electrical ground member supporting at least one antenna; a housing containing the electrical ground member and having a conductive ring defining the perimeter of the housing; and a conductive tuning member disposed between the conductive ring and the electrical ground member, for transforming an impedance between the electrical ground member and the conductive ring; wherein the conductive tuning member is connected to the conductive ring by a first short, and to the electrical ground member by a second short.



US 20140035788A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2014/0035788 A1**

(43) **Pub. Date: Feb. 6, 2014**

CHOI et al.

(54) **GROUND RADIATION ANTENNA**

(71) Applicants: **Hyeng-Cheul CHOI**, Seoul (KR); **Jaeseok LEE**, Seoul (KR); **Oul CHO**, Suwon-si (KR); **Xinxin LU**, Seoul (KR); **Jin-hyuk JANG**, Cheonan-si (KR)

(72) Inventors: **Hyeng-Cheul CHOI**, Seoul (KR); **Jaeseok LEE**, Seoul (KR); **Oul CHO**, Suwon-si (KR); **Xinxin LU**, Seoul (KR); **Jin-hyuk JANG**, Cheonan-si (KR)

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

(21) Appl. No.: **14/048,052**

(22) Filed: **Oct. 8, 2013**

Related U.S. Application Data

(63) Continuation of application No. 13/081,063, filed on Apr. 6, 2011, now Pat. No. 8,581,799, which is a continuation of application No. PCT/KR2010/009339, filed on Dec. 24, 2010.

(30) **Foreign Application Priority Data**

Feb. 11, 2010	(KR)	10-2010-0012775
Apr. 9, 2010	(KR)	10-2010-0032922
May 7, 2010	(KR)	10-2010-0043186
May 7, 2010	(KR)	10-2010-0043189
May 7, 2010	(KR)	10-2010-0043190
Jun. 14, 2010	(KR)	10-2010-0056207
Dec. 23, 2010	(KR)	10-2010-0133920

Publication Classification

(51) **Int. Cl.**

H01Q 1/48 (2006.01)

H01P 11/00 (2006.01)

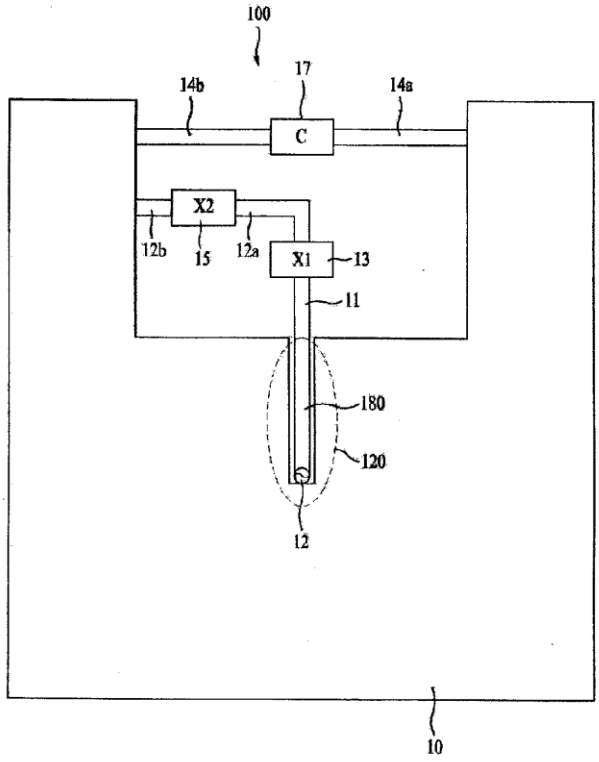
(52) **U.S. Cl.**

CPC . ***H01Q 1/48*** (2013.01); ***H01P 11/00*** (2013.01)

USPC **343/749**; 29/600

(57) **ABSTRACT**

A ground radiation antenna is disclosed. Herein, the ground radiation antenna provides a radiator-forming circuit, which is formed to have a simple structure using a capacitive element, as well as a feeding circuit suitable for the provided radiator-forming circuit. Thus, the structure of the antenna becomes simpler and the size of the antenna becomes smaller. Accordingly, the fabrication process of the antenna is simplified, thereby largely reducing the fabrication cost.



US 20140043192A1

(19) **United States**

(12) **Patent Application Publication**

PARK et al.

(10) **Pub. No.: US 2014/0043192 A1**

(43) **Pub. Date: Feb. 13, 2014**

(54) **INTERNAL ANTENNA OF MOBILE TERMINAL**

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

(72) Inventors: **Jeongwan PARK**, Gyeongsangbuk-do (KR); **Byungchan JANG**, Gyeongsangbuk-do (KR); **Sukho KIM**, Gyeonggi-do (KR); **Seunghwan KIM**, Seoul (KR); **Joonho BYUN**, Gyeonggi-do (KR)

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

(21) Appl. No.: **13/954,256**

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

(30) **Foreign Application Priority Data**

Aug. 13, 2012 (KR) 10-2012-0088376

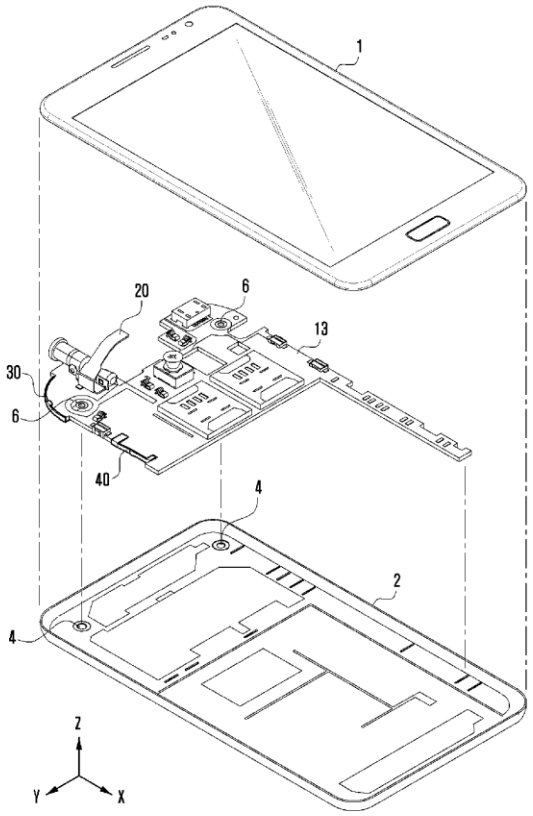
Publication Classification

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

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

(57) **ABSTRACT**

An antenna of a mobile includes at least two internal antennas and a printed circuit board disposed between a front cover and a rear cover. The printed circuit board includes at least one first antenna mounted on an upper surface and the printed circuit board having at least one fastening opening therein. A second antenna is mounted in an upper portion of a side surface of the printed circuit board and included a protruded portion of one end protruded from a body and in which the protruded portion is fastened to the fastening opening to be fastened to a side surface of the printed circuit board and the mobile terminal can be produced having a reduced thickness.



US 20140043198A1

(19) **United States**

(12) **Patent Application Publication**

Shimura

(10) **Pub. No.: US 2014/0043198 A1**

(43) **Pub. Date: Feb. 13, 2014**

(54) **MULTI-BAND ANTENNA**

(71) Applicant: **CANON KABUSHIKI KAISHA**, Tokyo (JP)

(72) Inventor: **Hajime Shimura**, Tokyo (JP)

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

(21) Appl. No.: **13/951,815**

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

(30) **Foreign Application Priority Data**

Aug. 8, 2012 (JP) 2012-176372
May 17, 2013 (JP) 2013-105627

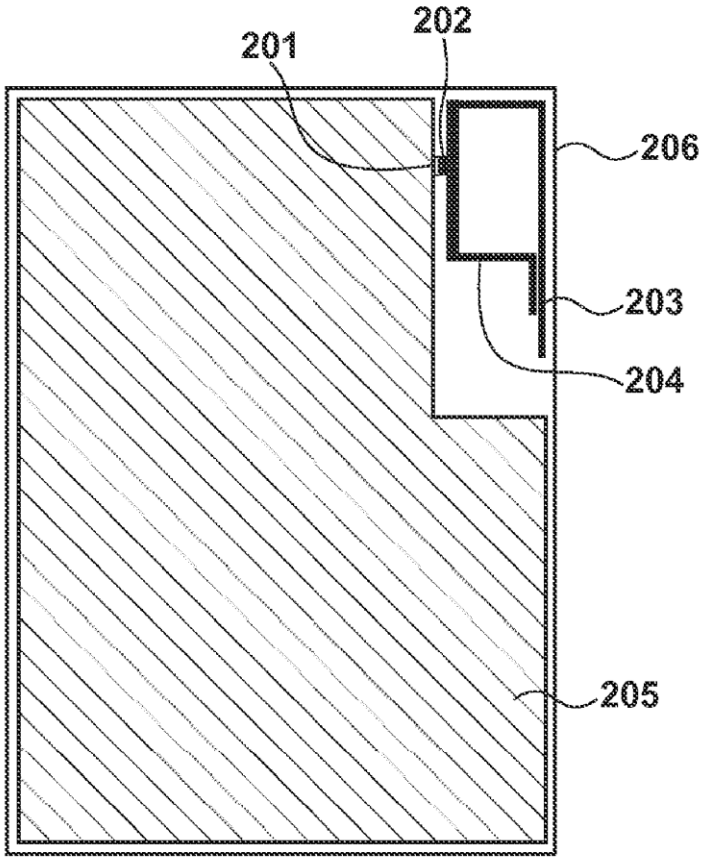
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 5/0027*** (2013.01)
USPC ..... **343/843**; 343/700 MS

(57) **ABSTRACT**

An antenna which operates in a plurality of frequency bands includes a feeding point, a first conductor which is connected to the feeding point, and at least two second conductors which are branched from the first conductor, have a linear shape, and include open ends as ends on a side opposite to the first conductor. The open ends of the two second conductors face in almost the same direction substantially parallel to a side closest to the feeding point out of the sides of an antenna region. The two second conductors include a part at which the distance between the two conductors at a portion parallel to the side is a first distance, and another part at which the distance is a second distance shorter than the first distance, and are electromagnetically coupled at, at least the other part.



US 20140043200A1

(19) **United States**

(12) **Patent Application Publication**

WEI et al.

(10) **Pub. No.: US 2014/0043200 A1**

(43) **Pub. Date: Feb. 13, 2014**

(54) **MULTI-BAND ANTENNA**

(71) Applicant: **HON HAI PRECISION INDUSTRY CO., LTD.**, New Taipei (TW)

(72) Inventors: **Cheng-Fan WEI**, New Taipei (TW); **Lung-Sheng TAI**, New Taipei (TW); **Wen-Fong SU**, New Taipei (TW)

(73) Assignee: **HON HAI PRECISION INDUSTRY CO., LTD.**, New Taipei (TW)

(21) Appl. No.: **13/964,127**

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

(30) **Foreign Application Priority Data**

Aug. 10, 2012 (TW) 101128889

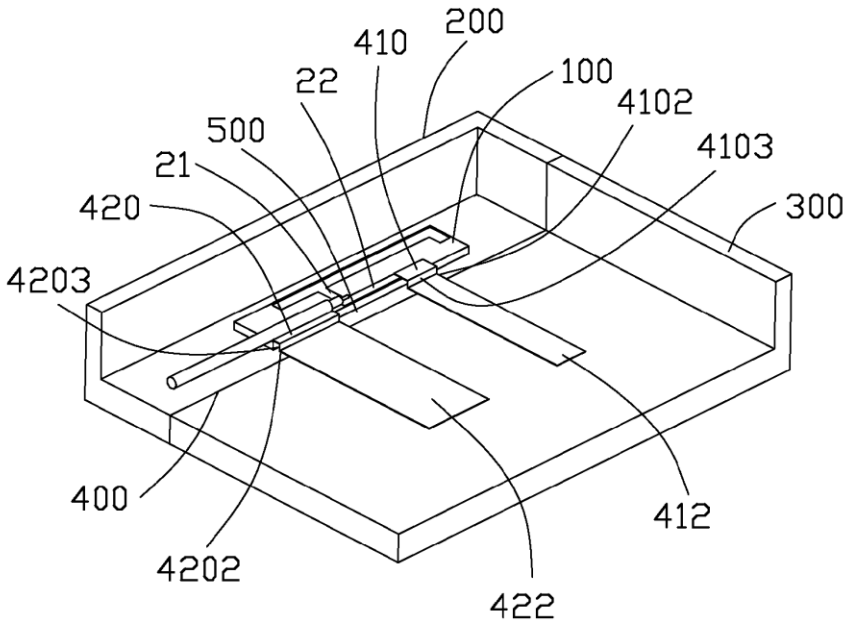
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 1/48*** (2013.01)
USPC **343/846**

(57) **ABSTRACT**

A multi-band antenna for assembling to an insulation base and metal base of an electronic device comprises: a radiating element; a first connecting element; a second connecting element; a grounding element; and a first grounding foil and a second grounding foil respectively electrically connected to the second connecting element and the grounding element along a longitudinal direction perpendicular to the transversal direction and extending to the metal base. The first grounding foil and the second grounding foil has a first part respectively extending from the second connecting and grounding element to a joint line between the insulation and the metal base and a second part attached to the metal base. A slot is formed among the first part of the first grounding foil, the first part of the second grounding foil, the second connecting element, and the joint line between the insulation base and the metal base.



US 20140043201A1

(19) **United States**

(12) **Patent Application Publication**

Pelosi et al.

(10) **Pub. No.: US 2014/0043201 A1**

(43) **Pub. Date: Feb. 13, 2014**

(54) **ANTENNA SYSTEM, METHOD AND MOBILE COMMUNICATION DEVICE**

(75) Inventors: **Mauro Pelosi**, Aalborg (DK); **Alexandru Daniel Tatomirescu**, Aalborg (DK); **Mikael Bergholz Knudsen**, Gistrup (DK); **Gert F. Pedersen**, Storvorde (DK); **Osama Nafeth Alrabadi**, Aalborg (DK); **Samantha Caporal Del Barrio**, Aalborg (DK); **Poul Olesen**, Stovring (DK); **Peter Bundgaard**, Aalborg (DK)

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

(21) Appl. No.: **13/570,327**

(22) Filed: **Aug. 9, 2012**

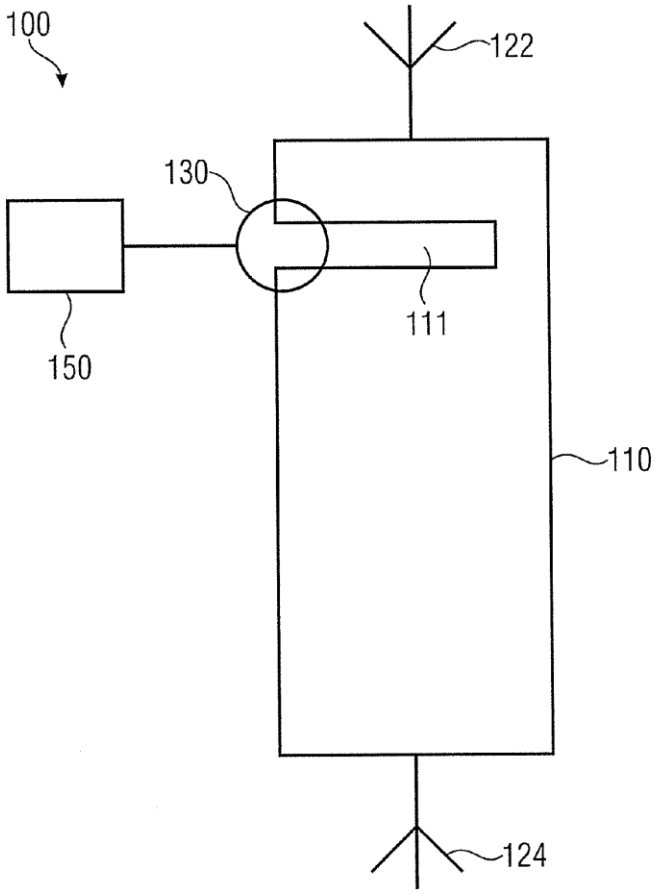
Publication Classification

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

(52) **U.S. Cl.**
USPC **343/848**

(57) **ABSTRACT**

An antenna system includes a ground plane including at least one slot, a first antenna element coupled to a first portion of the ground plane, a second antenna element coupled to a second portion of the ground plane which is spaced apart from the first portion and a tuner configured to change the influence of the slot to a current flow through the ground plane from the first portion to the second portion.



US 20140043202A1

(19) **United States**

(12) **Patent Application Publication**

WONG et al.

(10) **Pub. No.: US 2014/0043202 A1**

(43) **Pub. Date: Feb. 13, 2014**

(54) **COMMUNICATION DEVICE AND ANTENNA SYSTEM THEREIN**

(71) Applicant: **ACER INCORPORATED**, Hsichih (TW)

(72) Inventors: **Kin-Lu WONG**, Hsichih (TW); **Huan-Jyun JIANG**, Hsichih (TW)

(73) Assignee: **ACER INCORPORATED**, Hsichih (TW)

(21) Appl. No.: **13/764,344**

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

(30) **Foreign Application Priority Data**

Aug. 9, 2012 (TW) 101128726

Publication Classification

(51) **Int. Cl.**

H01Q 21/28 (2006.01)

H01Q 5/00 (2006.01)

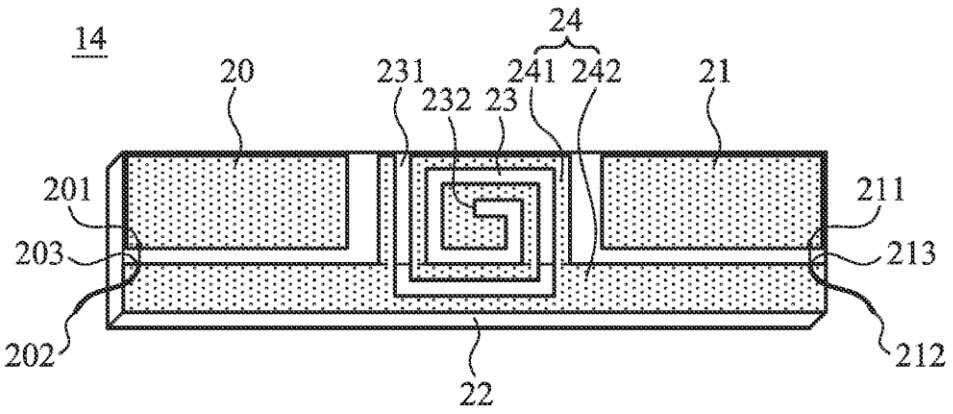
(52) **U.S. Cl.**

CPC ***H01Q 21/28*** (2013.01); ***H01Q 5/001*** (2013.01)

USPC **343/848**

(57) **ABSTRACT**

A communication device including a first conductive plate and an antenna system is provided. The antenna system includes a first antenna, a second antenna, a ground plane, and an open slot. Both the first antenna and the second antenna operate in at least a first band and a second band. The ground plane substantially has an inverted-T shape, and includes a main ground plane and a protruded ground plane. The main ground plane is coupled to the first conductive plate. The protruded ground plane is substantially located between the first antenna and the second antenna. The open slot is formed on the ground plane, and an open end of the open slot is located at an edge of the protruded ground plane. The open slot increases the isolation between the first antenna and the second antenna in the first band and the second band.



US 20140043203A1

(19) **United States**

(12) **Patent Application Publication**

Sabouri

(10) **Pub. No.: US 2014/0043203 A1**

(43) **Pub. Date: Feb. 13, 2014**

(54) **FRONT END PARALLEL RESONANT SWITCH**

(75) Inventor: **Faramarz Sabouri**, San Diego, CA (US)

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

(21) Appl. No.: **13/570,895**

(22) Filed: **Aug. 9, 2012**

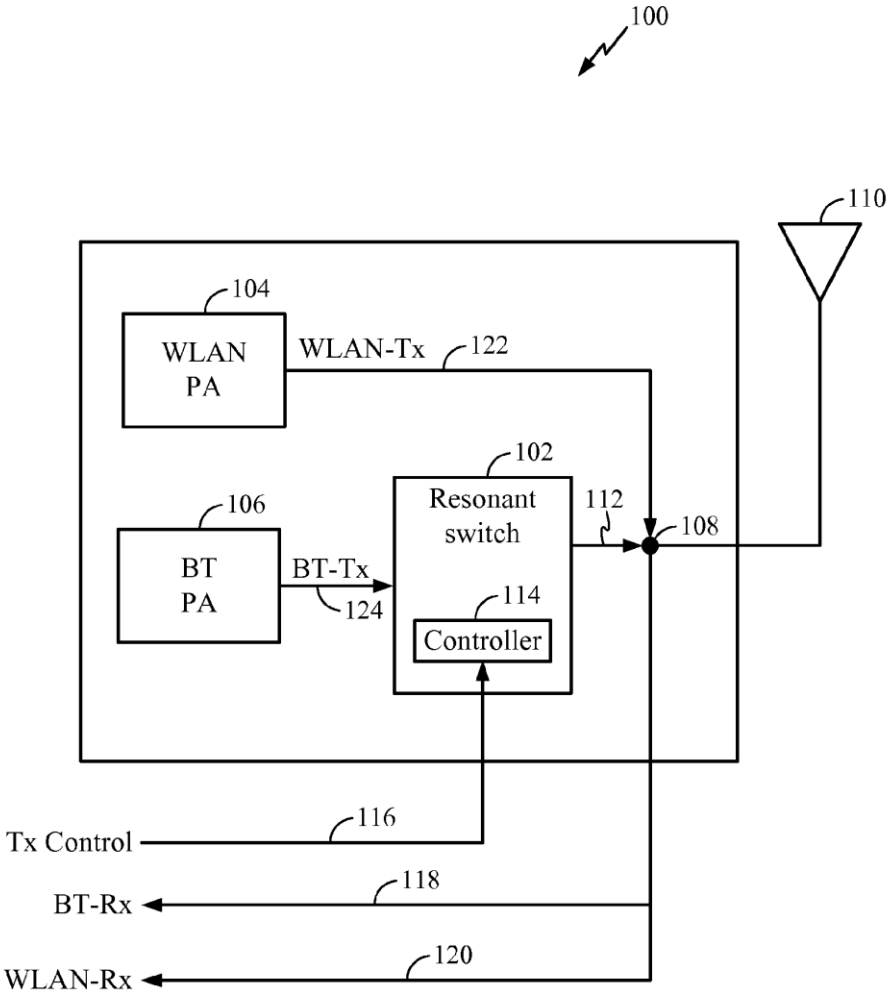
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 1/50*** (2013.01)
USPC **343/860**

(57) **ABSTRACT**

A front end parallel resonant switch is disclosed. In an exemplary embodiment, an apparatus includes an inductor and a capacitor configured to couple a first RF transmission to an antenna, and at least one switch configured to connect the inductor to the capacitor to form a matching network when transmitting the first RF transmission from the antenna, and to connect the inductor to capacitor to form a parallel resonant circuit when transmitting a second RF transmission from the antenna.



US 20140049431A1

(19) **United States**

(12) **Patent Application Publication**

TAI

(10) **Pub. No.: US 2014/0049431 A1**

(43) **Pub. Date: Feb. 20, 2014**

(54) **MULTI-BAND ANTENNA**

(71) Applicant: **HON HAI PRECISION INDUSTRY CO., LTD.**, New Taipei (TW)

(72) Inventor: **LUNG-SHENG TAI**, New Taipei (TW)

(73) Assignee: **HON HAI PRECISION INDUSTRY CO., LTD.**, New Taipei (TW)

(21) Appl. No.: **13/971,815**

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

(30) **Foreign Application Priority Data**

Aug. 20, 2012 (TW) 101130066

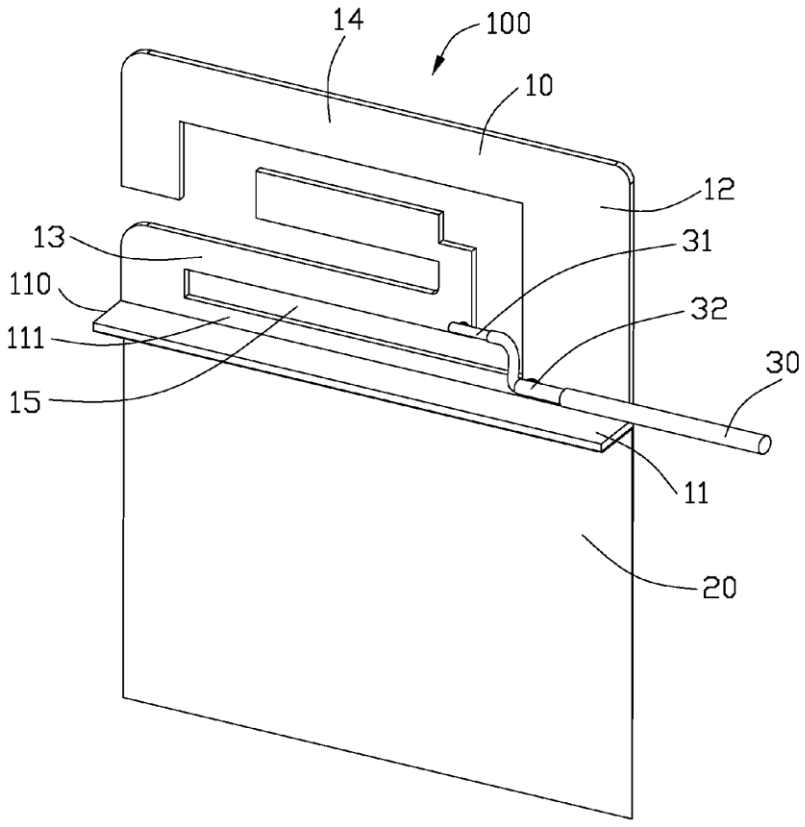
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 1/36*** (2013.01)
USPC ..... **343/700 MS**

(57) **ABSTRACT**

An antenna includes a grounding portion with a grounding feed point, a radiating plane and a coaxial cable. The grounding portion extends in a lengthwise direction defining two ends opposite to each other in the lengthwise direction. The radiating plane extends upwardly from a lengthwise edge of the grounding portion. The radiating plane includes a first arm extending from one end of the lengthwise edge and a second arm extending from the opposite end. The first arm defines a signal feed point and a first radiating portion while the second arm is defined as a second radiating portion. The coaxial cable includes a core linking to the signal feed point and a shielding layer linking to the grounding feed point. The second arm surrounds the first arm in the radiating plane.



US 20140049432A1

(19) **United States**

(12) **Patent Application Publication**

Hill et al.

(10) **Pub. No.: US 2014/0049432 A1**

(43) **Pub. Date: Feb. 20, 2014**

(54) **ANTENNAS FOR HANDHELD ELECTRONIC DEVICES**

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

(72) Inventors: **Robert J. Hill**, Salinas, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Ruben Caballero**, San Jose, CA (US)

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

(21) Appl. No.: **14/064,589**

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

Related U.S. Application Data

(60) Continuation of application No. 13/286,612, filed on Nov. 1, 2011, which is a division of application No. 13/083,487, filed on Apr. 8, 2011, now Pat. No. 8,169,374, which is a continuation of application No. 12/941,006, filed on Nov. 5, 2010, now Pat. No. 7,924,231, which is a continuation of application No. 12/564,803, filed on Sep. 22, 2009, now Pat. No. 7,843,396, which is a continuation of application No. 11/821,192, filed on Jun. 21, 2007, now Pat. No. 7,612,725.

Publication Classification

(51) **Int. Cl.**

H01Q 13/10 (2006.01)

H01Q 1/24 (2006.01)

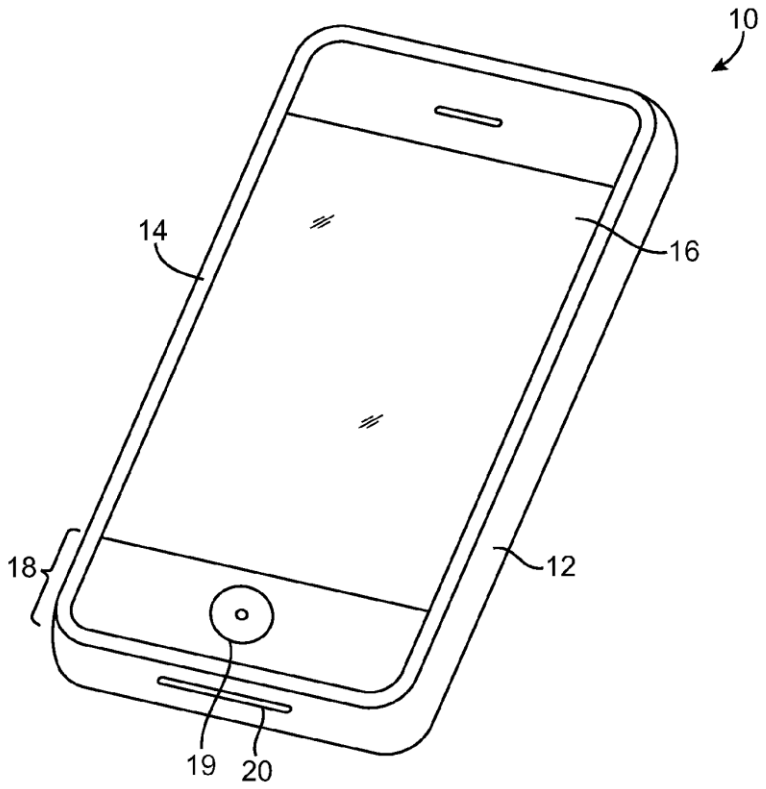
(52) **U.S. Cl.**

CPC ***H01Q 13/10*** (2013.01); ***H01Q 1/243*** (2013.01)

USPC **343/702**

(57) **ABSTRACT**

A handheld electronic device may be provided that contains wireless communications circuitry. The handheld electronic device may have a housing and a display. The display may be attached to the housing a conductive bezel. The handheld electronic device may have one or more antennas for supporting wireless communications. A ground plane in the handheld electronic device may serve as ground for one or more of the antennas. The ground plane and bezel may define an opening. A rectangular slot antenna or other suitable slot antenna may be formed from or within the opening. One or more antenna resonating elements may be formed above the slot. An electrical switch that bridges the slot may be used to modify the perimeter of the slot so as to tune the communications bands of the handheld electronic device.



US 20140049438A1

(19) **United States**

(12) **Patent Application Publication**

KRUPA et al.

(10) **Pub. No.: US 2014/0049438 A1**

(43) **Pub. Date: Feb. 20, 2014**

(54) **DISTRIBUTED COUPLING ANTENNA**

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

(72) Inventors: **Steve KRUPA**, Tiberias (IL); **Snir AZULAY**, Tiberias (IL)

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

(21) Appl. No.: **14/064,919**

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

Related U.S. Application Data

(63) Continuation of application No. 13/203,109, filed on Nov. 4, 2011, now Pat. No. 8,593,348, filed as application No. PCT/IL2010/000291 on Apr. 7, 2010.

(60) Provisional application No. 61/167,247, filed on Apr. 7, 2009.

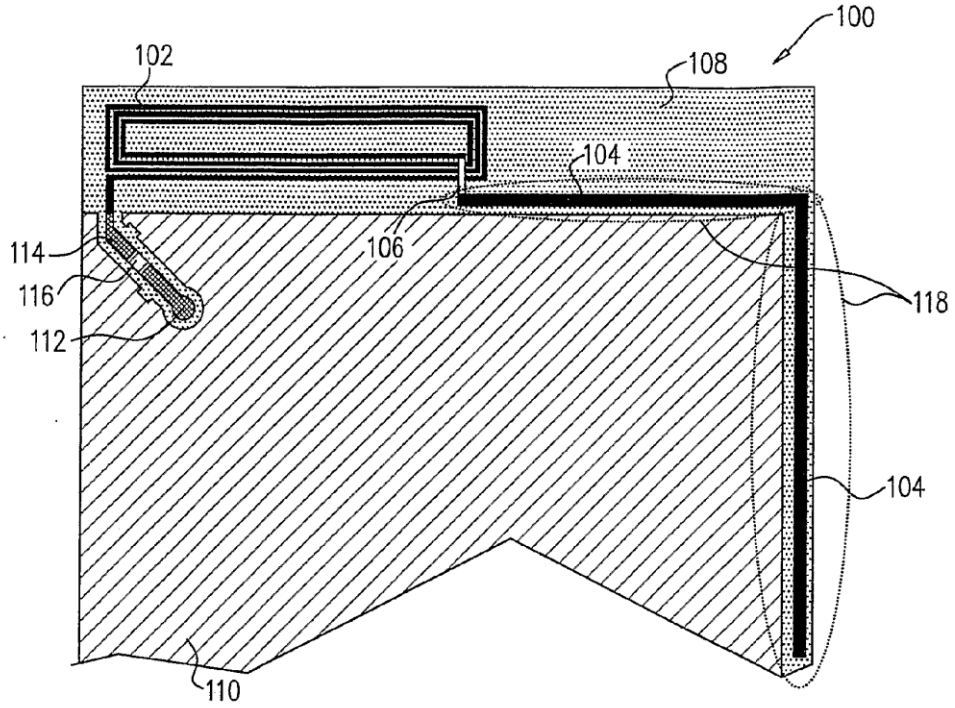
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 1/50*** (2013.01)
USPC **343/850**

(57) **ABSTRACT**

An antenna including a ground plane region, a feed element having associated with it a first reactance and a coupling element having associated with it a second reactance, the second reactance being of opposite sign to the first reactance, the coupling element being coupled to the feed element and to the ground plane region and being located in close proximity to the ground plane region, wherein an impedance and hence a resonant frequency of the antenna depend on the first and second reactances.



US 20140049439A1

(19) **United States**

(12) **Patent Application Publication**

HO

(10) **Pub. No.: US 2014/0049439 A1**

(43) **Pub. Date: Feb. 20, 2014**

(54) **COMPACT DUAL-POLARIZED MULTIPLE DIRECTLY FED & EM COUPLED STEPPED PROBE ELEMENT FOR ULTRA WIDEBAND PERFORMANCE**

(76) Inventor: **Jimmy HO**, Hickory, NC (US)

(21) Appl. No.: **13/588,730**

(22) Filed: **Aug. 17, 2012**

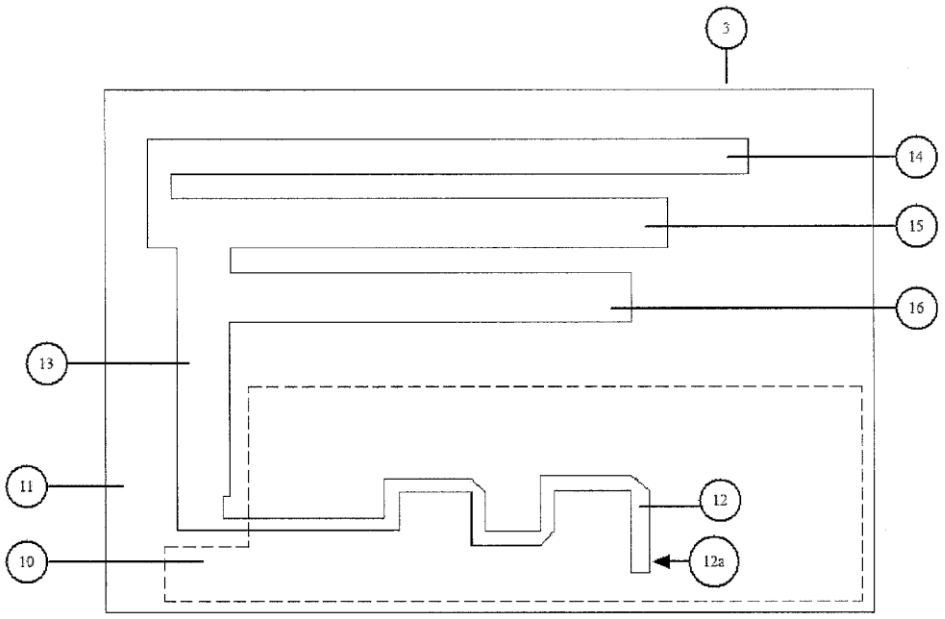
Publication Classification

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

(52) **U.S. Cl.**
USPC **343/852**; 343/858

(57) **ABSTRACT**

A compact antenna element and assembly using a directly fed and electromagnetically coupled step probe element for ultra wideband application. It achieves very good impedance match, isolation and pattern stability across a wide frequency band. The compact ultra wideband radiating element covers all known radio frequency bands in the mobile base station industry to date.



US 20140049440A1

(19) **United States**

(12) **Patent Application Publication**

UEKI et al.

(10) **Pub. No.: US 2014/0049440 A1**

(43) **Pub. Date: Feb. 20, 2014**

(54) **COUPLING DEGREE ADJUSTMENT CIRCUIT, ANTENNA DEVICE, AND WIRELESS COMMUNICATION DEVICE**

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

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

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

(21) Appl. No.: **14/071,682**

(22) Filed: **Nov. 5, 2013**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2012/061591, filed on May 2, 2012.

(30) **Foreign Application Priority Data**

May 9, 2011 (JP) 2011-103969

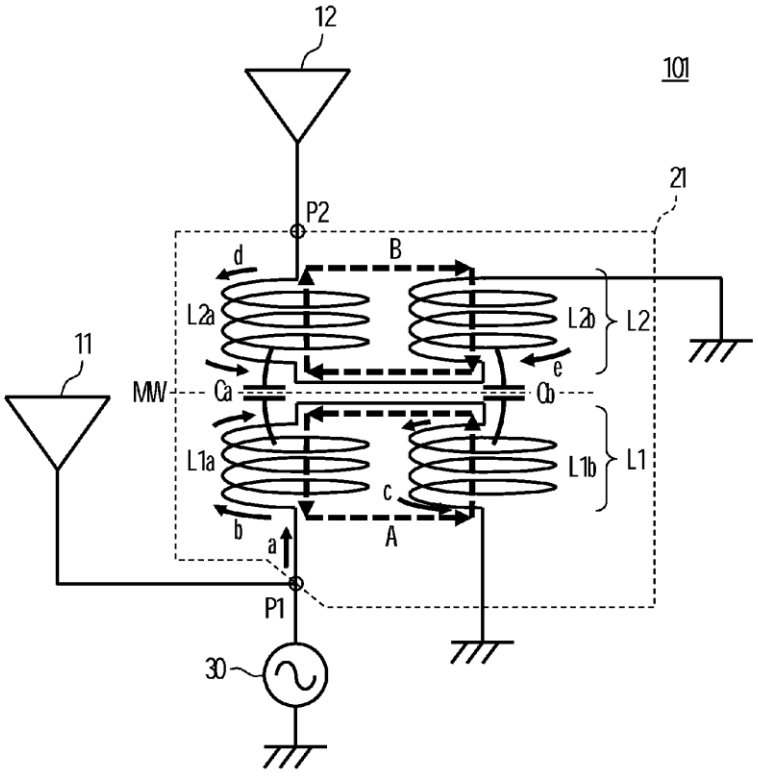
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 21/0006*** (2013.01)
USPC **343/852**; 343/853

(57) **ABSTRACT**

A dielectric body includes a first radiating element on a first side and a second radiating element on a second side. The first radiating element and the second radiating element are linear conductors that each extend from a first end to a second end (an open end), and are parallel or substantially parallel to each other in a direction from the first end to the second end. The first end of the first radiating element is connected to a first port of a coupling degree adjustment circuit, and the first end of the second radiating element is connected to a second port of the coupling degree adjustment circuit. The first radiating element and the second radiating element are mainly coupled to each other in the coupling degree adjustment circuit.



US 20140049441A1

(19) **United States**

(12) **Patent Application Publication**

Chen et al.

(10) **Pub. No.: US 2014/0049441 A1**

(43) **Pub. Date: Feb. 20, 2014**

(54) **SIGNAL CONVERTING CIRCUIT CAPABLE OF REDUCING/AVOIDING SIGNAL LEAKAGE AND RELATED SIGNAL CONVERTING METHOD**

(76) Inventors: **Hsien-Ku Chen**, Taoyuan County (TW); **Chia-Jun Chang**, Taipei City (TW); **Ka-Un Chan**, Hsinchu County (TW); **Ying-Hsi Lin**, Hsin-Chu City (TW)

(21) Appl. No.: **13/612,851**

(22) Filed: **Sep. 13, 2012**

(30) **Foreign Application Priority Data**

Aug. 15, 2012 (TW) 101129479

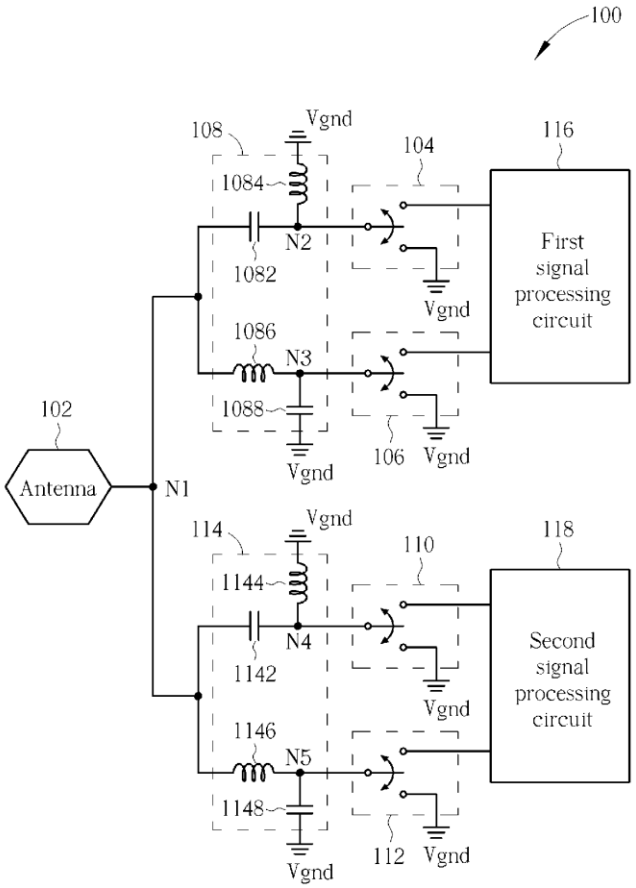
Publication Classification

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

(52) **U.S. Cl.**
USPC **343/859**

(57) **ABSTRACT**

A signal converting circuit includes: a first switching circuit; a second switching circuit; and a first balance-unbalance circuit (Balun) having a first signal terminal coupled to an antenna, a second signal terminal coupled to the first switching circuit, and a third signal terminal coupled to the second switching circuit; wherein when the first balance-unbalance circuit operates in a first signal converting mode, the first switching circuit and the second switching circuit are arranged to couple the second signal terminal and the third signal terminal, respectively, to a first signal processing circuit, and when the first balance-unbalance circuit does not operate in the first signal converting mode, the first switching circuit and the second switching circuit are arranged to couple the second signal terminal and the third signal terminal, respectively, to a reference voltage.



US 20140049442A1

(19) **United States**

(12) **Patent Application Publication**

Yen et al.

(10) **Pub. No.: US 2014/0049442 A1**

(43) **Pub. Date: Feb. 20, 2014**

(54) **TUNABLE IMPEDANCE MATCHING CIRCUIT**

(75) Inventors: **Yu-Meng Yen**, Taoyuan County (TW); **Chen-Fang Tai**, Taoyuan County (TW); **Pei-Zong Rao**, Taoyuan County (TW); **Wei-Shin Tung**, Taoyuan County (TW); **Wan-Ming Chen**, Taoyuan County (TW)

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

(21) Appl. No.: **13/590,178**

(22) Filed: **Aug. 20, 2012**

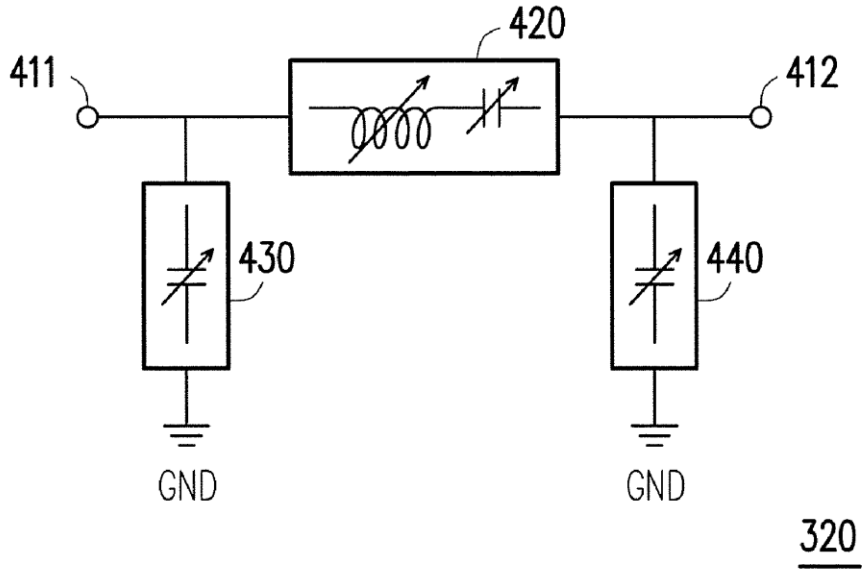
Publication Classification

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

(52) **U.S. Cl.**
USPC **343/861**

(57) **ABSTRACT**

A tunable impedance matching circuit is provided for matching a signal source to an impedance of an antenna. The tunable impedance matching circuit includes two terminals, a series path, and two shunt paths. The first terminal is coupled to the signal source, and the second terminal is coupled to the antenna. The series path is coupled between the first terminal and the second terminal and includes a first tunable capacitor and at least one tunable inductor. One of the two shunt paths is coupled between the first terminal and a ground end, and the other one of the two shunt paths is coupled between the second terminal and the ground end. Each of the shunt paths includes a second tunable capacitor.



US 20140049445A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2014/0049445 A1**

(43) **Pub. Date: Feb. 20, 2014**

TU

(54) **DUAL FREQUENCY ANTENNA MODULE**

(71) Applicant: **HON HAI PRECISION INDUSTRY CO., LTD.**, Tu-Cheng (TW)

(72) Inventor: **HSIN-LUNG TU**, Tu-Cheng (TW)

(73) Assignee: **HON HAI PRECISION INDUSTRY CO., LTD.**, Tu-Cheng (TW)

(21) Appl. No.: **13/626,854**

(22) Filed: **Sep. 25, 2012**

(30) **Foreign Application Priority Data**

Aug. 20, 2012 (TW) 101130178

Publication Classification

(51) **Int. Cl.**

H01Q 5/01 (2006.01)

H01Q 21/00 (2006.01)

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

USPC **343/893**

(57) **ABSTRACT**

A dual frequency antenna module is disposed on a substrate. The substrate includes a first surface and a second surface. The dual frequency antenna module includes a first antenna, a second antenna, a first connecting portion, and a second connecting portion. The antennas are in symmetry about a central line of the antenna module and disposed on the first surface. Each antenna includes a radiation portion and a feeding portion. The connecting portions are disposed on the first surface and connected to each other in symmetry. A width of each microstrip transmission line of the connecting portions is less than a width of each microstrip transmission line of the antennas. A wavelength of electromagnetic waves transmissible through the microstrip transmission lines of the connecting portions is equal to one half of a wavelength of electromagnetic waves transmissible through the microstrip transmission lines of the first and second antennas