



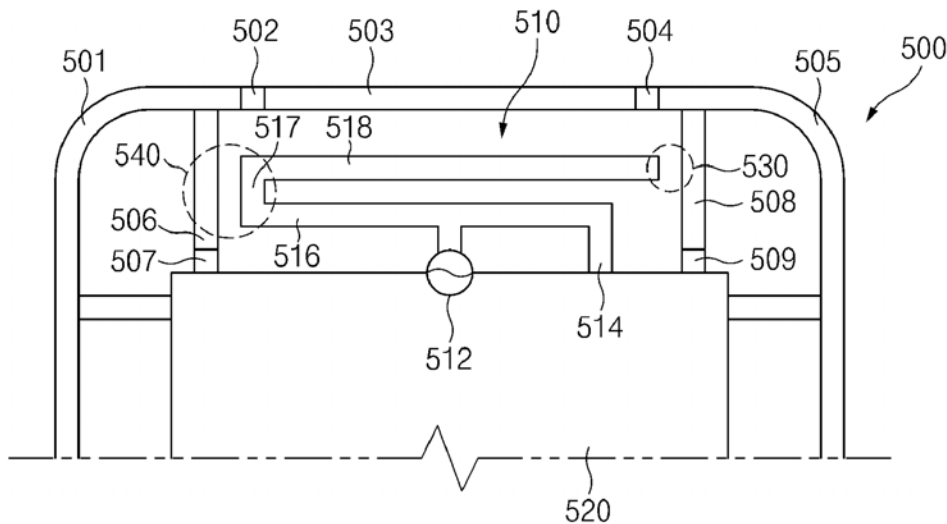
US 20160118710A1

(19) **United States**(12) **Patent Application Publication**
SHIN et al.(10) **Pub. No.: US 2016/0118710 A1**(43) **Pub. Date: Apr. 28, 2016**(54) **ANTENNA USING COUPLING AND
ELECTRONIC DEVICE INCLUDING THE
SAME**(30) **Foreign Application Priority Data**

Oct. 24, 2014 (KR) 10-2014-0145540

(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)**Publication Classification**(72) Inventors: **Dong Ryul SHIN**, Daegu (KR); **Min
SAKONG**, Gyeongsangbuk-do (KR);
Chae Up YOO, Seoul (KR); **Jin Woo
JUNG**, Seoul (KR); **Ho Saeng KIM**,
Gyeonggi-do (KR); **Byung Chan JANG**,
Gyeongsangbuk-do (KR)(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/48 (2006.01)
H01Q 9/04 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/22** (2013.01); **H01Q 9/0407**
(2013.01); **H01Q 1/48** (2013.01)(73) Assignee: **Samsung Electronics Co., Ltd.**(57) **ABSTRACT**(21) Appl. No.: **14/922,967**

An electronic device is provided. The electronic device includes a housing including a segment part used to insulate a portion of the housing and an antenna disposed at a position corresponding to the segment part.

(22) Filed: **Oct. 26, 2015**



US 20160118718A1

(19) **United States**(12) **Patent Application Publication****Guterman et al.**(10) **Pub. No.: US 2016/0118718 A1**(43) **Pub. Date: Apr. 28, 2016**

(54) **ANTENNA STRUCTURES HAVING
RESONATING ELEMENTS AND PARASITIC
ELEMENTS WITHIN SLOTS IN
CONDUCTIVE ELEMENTS**

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

(72) Inventors: **Jerzy S. Guterman**, Mountain View, CA (US); **Hao Xu**, Cupertino, CA (US); **Douglas Blake Kough**, San Jose, CA (US); **Eduardo Lopez Camacho**, Watsonville, CA (US); **Mattia Pascolini**, San Francisco, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Ruben Caballero**, San Jose, CA (US)

(21) Appl. No.: **14/992,213**(22) Filed: **Jan. 11, 2016****Related U.S. Application Data**

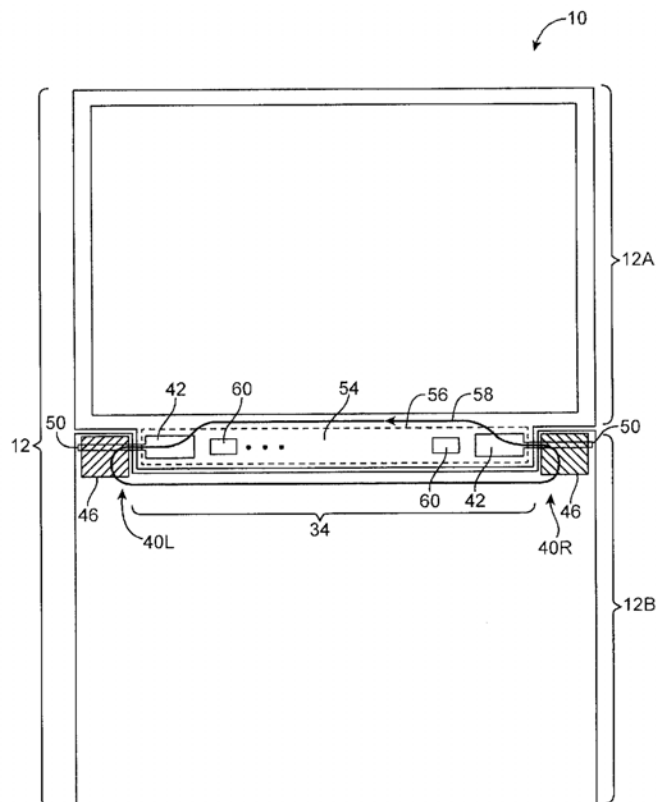
(63) Continuation of application No. 12/888,350, filed on Sep. 22, 2010, now Pat. No. 9,236,648.

Publication Classification

(51) **Int. Cl.**
H01Q 5/357 (2006.01)
H01Q 5/378 (2006.01)
H01Q 1/22 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 5/357* (2015.01); *H01Q 1/2266* (2013.01); *H01Q 5/378* (2015.01)

(57) **ABSTRACT**

Electronic devices may include radio-frequency transceiver circuitry and antenna structures. The antenna structures may include antenna resonating elements such as dual-band antenna resonating elements that resonate in first and second communications bands. The antenna structures may also contain parasitic antenna elements such as elements that are operative in only the first or second communications band and elements that are operative in both the first and second communications bands. The antenna resonating elements and parasitic elements may be mounted on a common dielectric carrier. The dielectric carrier may be mounted within a slot or other opening in a conductive element. The conductive element may be formed from conductive housing structures in an electronic device such as a portable computer. The portable computer may have a clutch barrel with a dielectric cover. The dielectric cover may overlap and cover the slot and the dielectric carrier.





US 20160126620A1

(19) **United States**(12) **Patent Application Publication**
LIOU et al.(10) **Pub. No.: US 2016/0126620 A1**(43) **Pub. Date: May 5, 2016**(54) **ANTENNA ASSEMBLY AND WIRELESS
COMMUNICATION DEVICE EMPLOYING
SAME**(52) **U.S. CL.**CPC *H01Q 1/50* (2013.01); *H01Q 5/307*
(2015.01); *H01Q 1/24* (2013.01)(71) Applicant: **Chiun Mai Communication Systems,
Inc.**, New Taipei (TW)

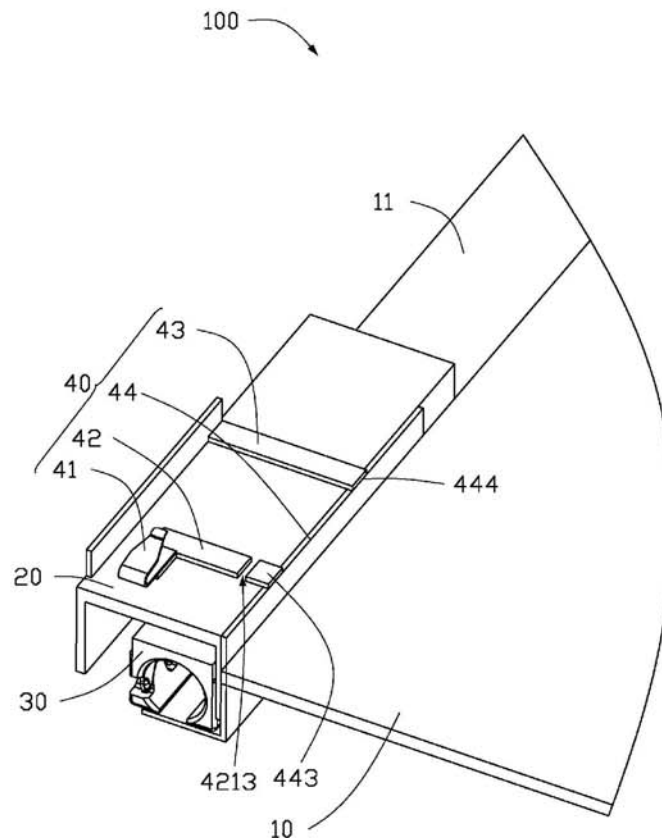
(57)

ABSTRACT(72) Inventors: **GENG-HONG LIOU**, Tu-Cheng (TW);
YEN-HUI LIN, Tu-Cheng (TW)(21) Appl. No.: **14/677,727**(22) Filed: **Apr. 2, 2015**(30) **Foreign Application Priority Data**

Oct. 31, 2014 (CN) 201410600735.8

Publication Classification(51) **Int. Cl.**
H01Q 1/50 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/307 (2006.01)

An antenna assembly includes an elastic piece, a connecting portion, a first radiating portion, and a second radiating. The connecting portion is coupled to the base board and includes a feeding point and a ground point. The first radiating portion is electrically connected to the feeding point and the elastic piece. The second radiating portion is electrically connected to the ground point and spaced from the first radiating portion. The first radiating portion, the elastic piece, and the second radiating portion are configured to operate at a first frequency band; the first radiating portion and the elastic piece generate a frequency-doubled effect to operate at a second frequency band. A wireless communication device employing the antenna assembly is also provided.

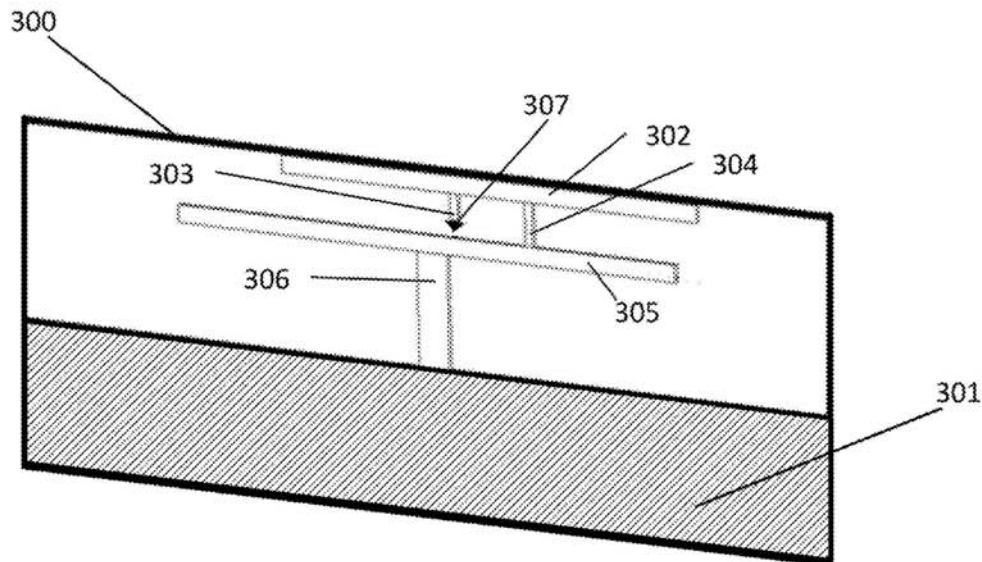




US 20160126632A1

(19) **United States**(12) **Patent Application Publication**
Ying(10) **Pub. No.: US 2016/0126632 A1**(43) **Pub. Date: May 5, 2016**(54) **INVERTED-F ANTENNA WITH A CHOKE NOTCH FOR WIRELESS ELECTRONIC DEVICES**(52) **U.S. CL.**CPC *H01Q 9/045* (2013.01); *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01); *H01Q 9/285* (2013.01)(71) Applicant: **SONY CORPORATION**, Tokyo (JP)(72) Inventor: **Zhinong Ying**, Lund (SE)(57) **ABSTRACT**(21) Appl. No.: **14/529,397**(22) Filed: **Oct. 31, 2014****Publication Classification**(51) **Int. Cl.***H01Q 9/04* (2006.01)*H01Q 1/48* (2006.01)*H01Q 9/28* (2006.01)*H01Q 1/24* (2006.01)

A wireless electronic device includes an inverted-F antenna (IFA) having an IFA exciting element, an IFA feed, and a grounding pin. The IFA exciting element is configured to resonate at a resonant frequency when excited by a signal received through the IFA feed. The wireless electronic device includes a choke notch having a length defined based on the resonant frequency of the IFA exciting element. The choke notch is electrically coupled to the IFA exciting element through the grounding pin. A ground patch is electrically coupled between the choke notch and the ground plane.



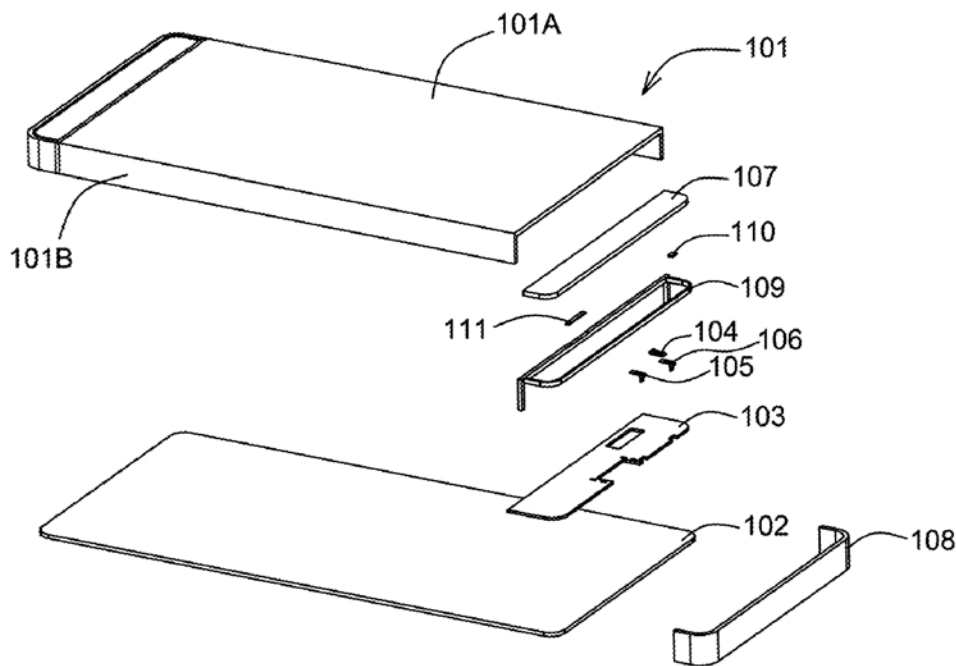


US 20160134010A1

(19) **United States**(12) **Patent Application Publication**
Yan(10) **Pub. No.: US 2016/0134010 A1**(43) **Pub. Date: May 12, 2016**(54) **MOBILE COMMUNICATION DEVICE AND
METHOD FOR MANUFACTURING SAME****Publication Classification**(71) Applicant: **Wei Yan**, Shenzhen (CN)(51) **Int. Cl.**
H01Q 1/24 (2006.01)(72) Inventor: **Wei Yan**, Shenzhen (CN)(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01)(73) Assignee: **AAC TECHNOLOGIES PTE. LTD.**,
Singapore city (SG)(57) **ABSTRACT**(21) Appl. No.: **14/613,811**(22) Filed: **Feb. 4, 2015**(30) **Foreign Application Priority Data**

Nov. 12, 2014 (CN) 201420672845.0

A mobile communication device includes a metallic rear cover, a circuit board arranged within the rear cover and an antenna, the antenna including a radiation source connecting to the metallic rear cover and a circuitry portion on the circuit board, the circuitry portion including a feed portion connecting to the radiation source, a grounding portion, and a controlling circuitry for controlling the grounding portion to connect or disconnect to the radiation source. A corresponding method for manufacturing the mobile communication device is also presented.





US 20160134011A1

(19) **United States**(12) **Patent Application Publication**
KIM et al.(10) **Pub. No.: US 2016/0134011 A1**(43) **Pub. Date: May 12, 2016**(54) **ANTENNA MODULE AND ANTENNA
ASSEMBLY INCLUDING THE SAME**(71) Applicant: **Samsung Electro-Mechanics Co., Ltd.**,
Suwon-si (KR)(72) Inventors: **Nam Ki KIM**, Suwon-si (KR); **Chan
Gwang AN**, Suwon-si (KR); **Dae Ki
LIM**, Suwon-si (KR); **Hyeon Gil NAM**,
Suwon-si (KR); **Sang Woo BAE**,
Suwon-si (KR); **Ha Ryong HONG**,
Suwon-si (KR); **Sung Eun CHO**,
Suwon-si (KR); **Dae Kyu LEE**,
Suwon-si (KR); **Dae Seong JEON**,
Suwon-si (KR); **Hyun Do PARK**,
Suwon-si (KR)(73) Assignee: **Samsung Electro-Mechanics Co., Ltd.**,
Suwon-si (KR)(21) Appl. No.: **14/886,677**(22) Filed: **Oct. 19, 2015**(30) **Foreign Application Priority Data**

Nov. 10, 2014 (KR) 10-2014-0155545

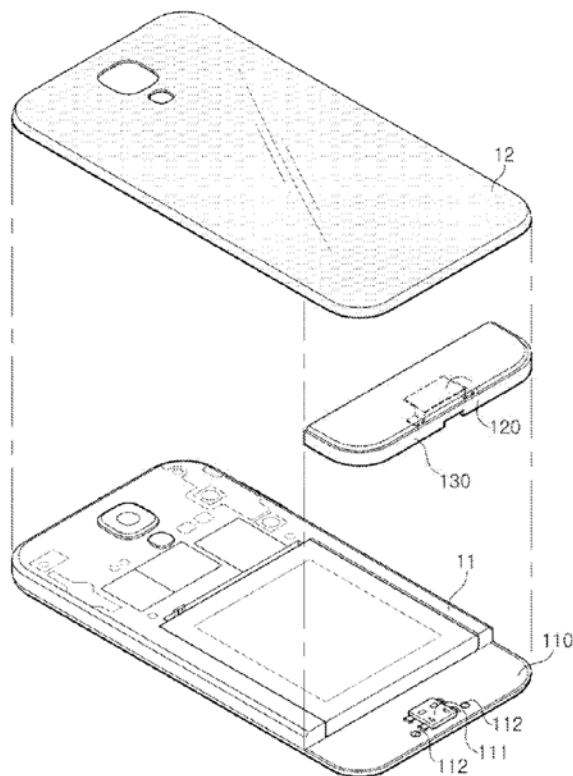
Publication Classification(51) **Int. Cl.****H01Q 1/24** (2006.01)**H01Q 13/10** (2006.01)**H01Q 1/50** (2006.01)(52) **U.S. Cl.**CPC **H01Q 1/243** (2013.01); **H01Q 1/50**
(2013.01); **H01Q 13/106** (2013.01)

(57)

ABSTRACT

An antenna module includes: a circuit board including a connector; a metal frame including an antenna pattern part configured to transmit or receive a signal, and a connection terminal part electrically connecting the antenna pattern part and the circuit board to each other; and a molding frame disposed around the metal frame such that the connection terminal part is exposed to one surface of the molding frame, wherein the connector is disposed between the metal frame and the circuit board.

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US 20160134016A1

(19) **United States**(12) **Patent Application Publication****Hsu et al.**(10) **Pub. No.: US 2016/0134016 A1**(43) **Pub. Date: May 12, 2016**(54) **ANTENNA EFFICIENCY ENHANCEMENT BY ACTIVE DETUNING OF DIVERSITY ANTENNA****Publication Classification**(71) Applicant: **CAVENDISH KINETICS, INC.**, San Jose, CA (US)(51) **Int. Cl.**
H01Q 3/34 (2006.01)
H01Q 21/29 (2006.01)(72) Inventors: **Chih-Hao Hsu**, New Taipei City (TW);
Paul Anthony Tornatta, Melbourne, FL (US);
Roberto Gaddi, s-Hertogenbosch (NL)(52) **U.S. Cl.**
CPC . **H01Q 3/34** (2013.01); **H01Q 21/29** (2013.01)(57) **ABSTRACT**(21) Appl. No.: **14/899,040**(22) PCT Filed: **Jun. 26, 2014**(86) PCT No.: **PCT/US2014/044392**

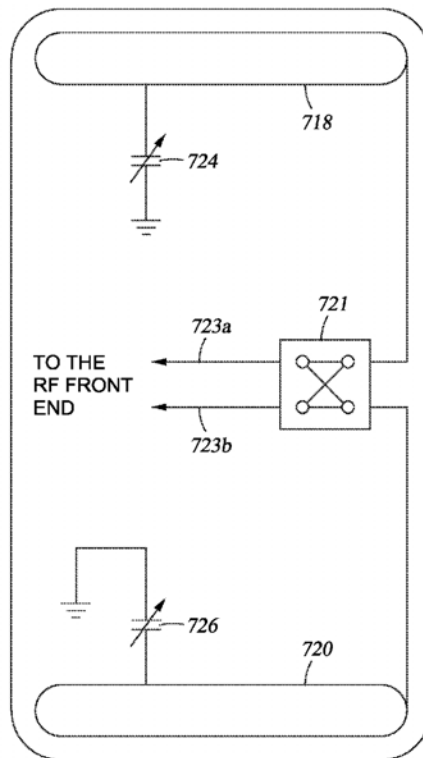
§ 371 (c)(1),

(2) Date: **Dec. 16, 2015****Related U.S. Application Data**

(60) Provisional application No. 61/839,456, filed on Jun. 26, 2013.

The present invention generally relates to cellular phones having multiple antennas. The invention relates to how two antennas in a diversity or MIMO antenna system interact through mutual coupling. The mutual coupling is due to proximity of the two antennas, their antenna pattern and efficiency. The performance of the system can be optimized by adjusting the mutual coupling between the antennas. The primary and secondary antennas can be "tuned" and "de-tuned" respectively to enhance system performance. In this invention, the primary and secondary antennas are tuned independently using MEMS capacitor configured in the antenna aperture for frequency tuning.

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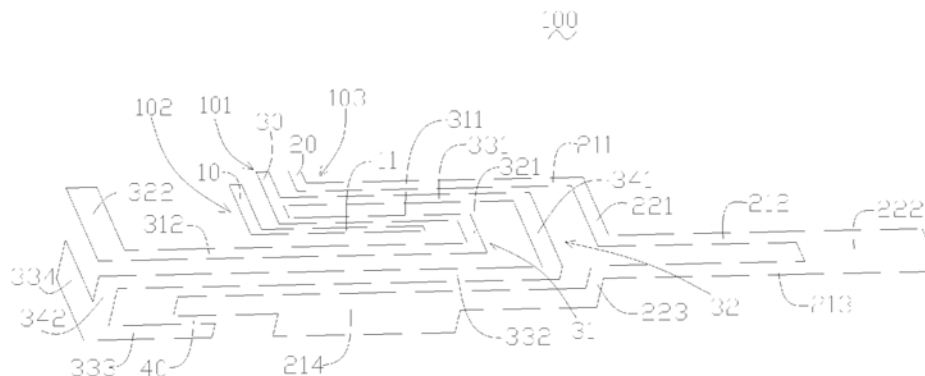
US 20160134018A1

(19) **United States**(12) **Patent Application Publication**
Wu(10) **Pub. No.: US 2016/0134018 A1**(43) **Pub. Date: May 12, 2016**(54) **MULTI-BAND ANTENNA**(71) Applicant: **Jing Wu**, Shenzhen (CN)(72) Inventor: **Jing Wu**, Shenzhen (CN)(73) Assignee: **AAC TECHNOLOGIES PTE. LTD.**,
Singapore city (SG)(21) Appl. No.: **14/597,362**(22) Filed: **Jan. 15, 2015**(30) **Foreign Application Priority Data**

Nov. 10, 2014 (CN) 201420668356.8

Publication Classification(51) **Int. Cl.**
H01Q 5/385 (2006.01)
H01Q 5/392 (2006.01)
H01Q 19/00 (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/385** (2015.01); **H01Q 19/005**
(2013.01); **H01Q 5/392** (2015.01)(57) **ABSTRACT**

A multi-band antenna includes a radiating antenna member, a first parasitic antenna member, and a second parasitic antenna member. The radiating antenna member includes a feeding unit, a high frequency (HF) radiating unit and a low frequency (LF) radiating unit, the HF radiating unit and the LF radiating unit extend from the feeding unit. The first parasitic antenna member includes an HF grounding part, and an HF parasitic unit extending from the HF grounding part and adjacent to the HF radiating unit. The second parasitic antenna member includes an LF grounding part, and an LF parasitic unit extending from the LF grounding part and electromagnetically coupled to the LF radiating unit. The feeding unit is arranged between the HF grounding part and the LF grounding part; the feeding unit and the HF radiating unit define a receiving slot, and the HF parasitic unit is arranged in the receiving slot.





US 20160134731A1

(19) **United States**(12) **Patent Application Publication**
Odagiri et al.(10) **Pub. No.: US 2016/0134731 A1**(43) **Pub. Date: May 12, 2016**(54) **WIRELESS COMMUNICATION DEVICE****Publication Classification**(71) Applicant: **Sony Computer Entertainment Inc.**,
Tokyo (JP)(51) **Int. Cl.**
H04M 1/02 (2006.01)
H04B 1/3827 (2006.01)(72) Inventors: **Kazuya Odagiri**, Kanagawa (JP); **Issei Chigusa**, Tokyo (JP)(52) **U.S. Cl.**
CPC **H04M 1/0274** (2013.01); **H04B 1/3827**
(2013.01)(21) Appl. No.: **14/896,832**(22) PCT Filed: **Jun. 19, 2014**(86) PCT No.: **PCT/JP2014/066363**

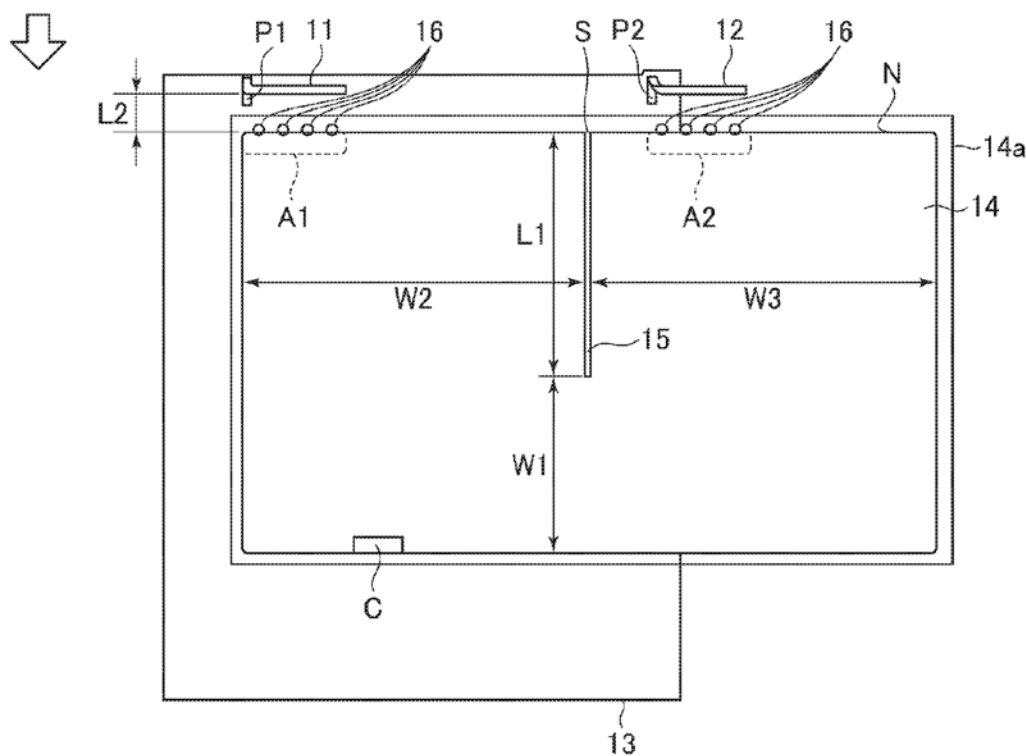
§ 371 (c)(1),

(2) Date: **Dec. 8, 2015**(30) **Foreign Application Priority Data**

Jun. 20, 2013 (JP) 2013-129398

(57) **ABSTRACT**

Provided is a wireless communication device that ensures reduced interference between a plurality of antennas without relatively separating the antennas. The wireless communication device includes a first antenna, a second antenna, and a planar conductor. The conductor is arranged adjacent to both of the first and second antennas on one side. A cutout portion is formed in the conductor. The cutout portion extends from an outer edge between positions adjacent to the first and second antennas.





US 20160141746A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0141746 A1**

(43) **Pub. Date: May 19, 2016**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/27 (2006.01)
H01Q 1/50 (2006.01)

(72) Inventors: **Geunwoo KIM**, Gyeonggi-do (KR);
Hyun KIM, Seoul (KR); **Minho SOH**,
Gyeonggi-do (KR); **Changgwon CHUNG**,
Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC . **H01Q 1/273** (2013.01); **H01Q 1/50** (2013.01)

(73) Assignee: **Samsung Electronics Co., Ltd.**

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a body including a communication module, and at least one first conductive contact configured to transmit electrical signals to and receive electrical signals from the communication module; and at least one strap removably connected to the body, the at least one strap including an antenna therein, and at least one second conductive contact configured to transmit electrical signals to and receive electrical signals from the antenna, the one strap being configured to removably connect to the body, such that at least a portion of the at least one first conductive contact is electrically connected to the at least one second conductive contact.

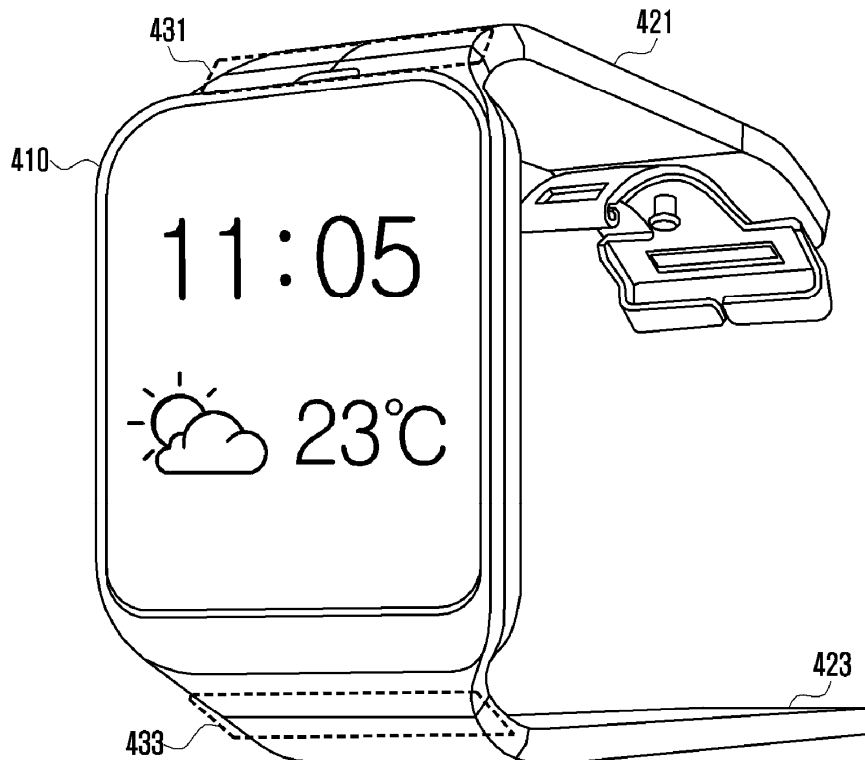
(21) Appl. No.: **14/940,402**

(22) Filed: **Nov. 13, 2015**

(30) **Foreign Application Priority Data**

Nov. 13, 2014 (KR) 10-2014-0157845

101





US 20160141751A1

(19) **United States**

(12) **Patent Application Publication**
Harper

(10) **Pub. No.: US 2016/0141751 A1**

(43) **Pub. Date: May 19, 2016**

(54) **ANTENNA ISOLATION USING A TUNED
GROUNDPLANE NOTCH**

Publication Classification

(71) Applicant: **Microsoft Corporation**, Redmond, WA
(US)

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

(21) Appl. No.: **14/481,699**

(22) PCT Filed: **Mar. 7, 2013**

(86) PCT No.: **PCT/GB2013/050567**

§ 371 (c)(1),

(2) Date: **Sep. 9, 2014**

(30) **Foreign Application Priority Data**

Mar. 13, 2012 (GB) 1204373.3

(51) **Int. Cl.**

H01Q 1/52 (2006.01)

H01Q 21/00 (2006.01)

H01Q 1/48 (2006.01)

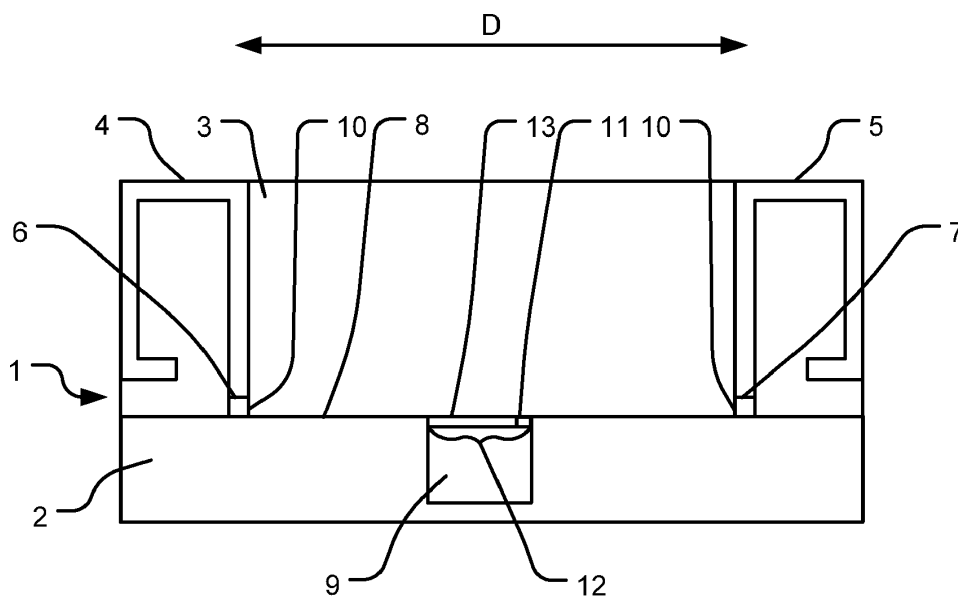
(52) **U.S. Cl.**

CPC **H01Q 1/521** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 21/00** (2013.01)

(57)

ABSTRACT

There is disclosed an antenna device relating to a single or dual band antenna system for use in mobile telecommunications devices, laptop and tablet computers, USB adapters and electrically small radio platforms comprising a pair of antennas attached to a conductive ground plane, the antennas being separated by free space in which at least one notch is formed in the conductive ground plane between the pair of antennas characterised in that the notch further includes an inductive component and a capacitive component providing good antenna isolation so as to enable MIMO operation or diversity operation.





US 20160141762A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0141762 A1**

(43) **Pub. Date: May 19, 2016**

(54) **ANTENNA**

(52) **U.S. CL.**

(71) Applicant: **ZTE CORPORATION**, Shenzhen City,
Guangdong Province (CN)

CPC **H01Q 13/103** (2013.01); **H01Q 5/20**
(2015.01)

(72) Inventors: **Wei LI**, Shenzhen (CN); **Lu ZHANG**,
Shenzhen (CN)

(57)

ABSTRACT

(21) Appl. No.: **14/895,497**

(22) PCT Filed: **Aug. 16, 2013**

(86) PCT No.: **PCT/CN2013/081670**

§ 371 (c)(1),

(2) Date: **Dec. 3, 2015**

(30) **Foreign Application Priority Data**

Jun. 5, 2013 (CN) 201310222144.7

Publication Classification

(51) **Int. Cl.**

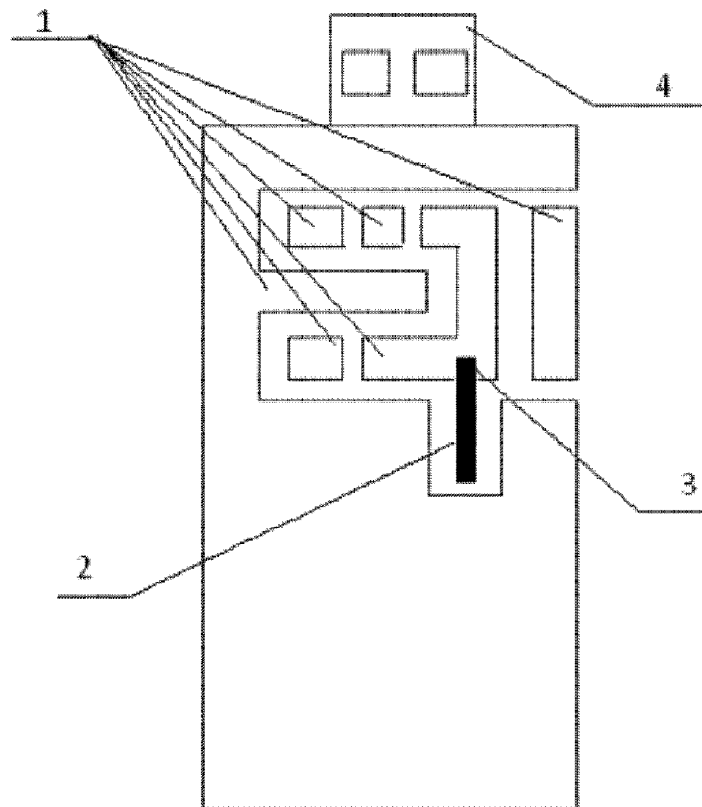
H01Q 13/10

(2006.01)

H01Q 5/20

(2006.01)

Disclosed is an antenna, the antenna includes a metal trace, an antenna feeder, and a power connector set on a printed circuit board (PCB), wherein the metal trace and the antenna feeder are connected at a feed point, the antenna is configured with a reactive element on one surface of the PCB board which is opposite to or the same with the surface where the feed point is located; and when a radio frequency signal of the antenna is at a low frequency, the reactive element is conducted, and when a radio frequency signal of the antenna is at a high frequency, the reactive element is disconnected, or when a radio frequency signal of the antenna is at a low frequency, the reactive element is disconnected, and when a radio frequency signal of the antenna is at a high frequency, a control switch of the reactive element is conducted.





US 20160141767A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0141767 A1**

(43) **Pub. Date: May 19, 2016**

(54) **MULTIPLE-ANTENNA SYSTEM AND
MOBILE TERMINAL**

Publication Classification

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

(51) **Int. Cl.**
H01Q 21/30 (2006.01)
H01Q 1/38 (2006.01)
H01Q 9/04 (2006.01)

(72) Inventors: **Huiqing Zhai**, Xi'an (CN); **Zhihui Ma**,
Xi'an (CN); **Zhenhua Li**, Xi'an (CN);
Changhong Liang, Xi'an (CN);
Rongdao Yu, Shenzhen (CN); **Sheng**
Liu, Shenzhen (CN)

(52) **U.S. Cl.**
CPC **H01Q 21/30** (2013.01); **H01Q 9/04**
(2013.01); **H01Q 1/38** (2013.01)

(21) Appl. No.: **14/979,368**

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

Related U.S. Application Data

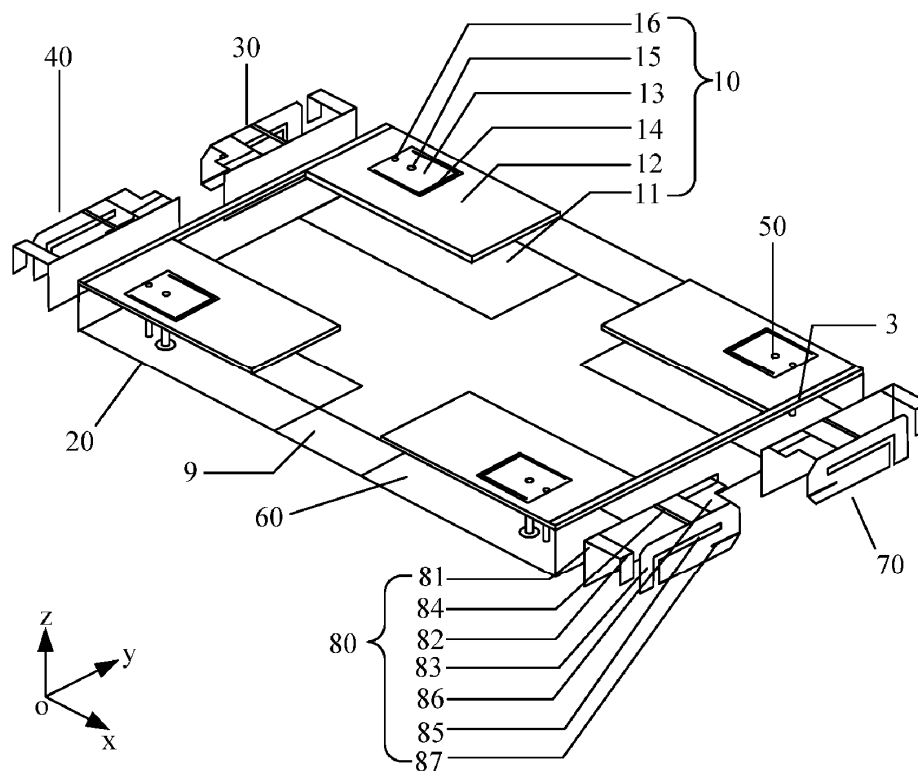
(63) Continuation of application No. PCT/CN2014/
073023, filed on Mar. 7, 2014.

(30) **Foreign Application Priority Data**

Jun. 28, 2013 (CN) 201310270549.8

(57) **ABSTRACT**

A multiple-antenna system includes a planar inverted-F antenna PIFA of a first type, which includes a metallic ground plane, a dielectric plate, a radiation patch, a probe-type feeding unit, and a metallic shorting pin. The system also includes a PIFA of a second type perpendicular to the PIFA of the first type and including a metallic ground plane, a radiation patch, a feeding unit, and a metallic shorted patch. The radiation patch is connected to the metallic ground plane by using the feeding unit and the metallic shorted patch. Isolation stub is located on an edge of a side, close to the PIFA of the second type, of the upper surface of the dielectric plate of the PIFA of the first type.





US 20160142083A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0142083 A1**

(43) **Pub. Date: May 19, 2016**

(54) **ELECTRONIC DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H04B 1/10 (2006.01)

(72) Inventors: **Gyu-Sub KIM**, Suwon-si (KR);
Se-Hyun PARK, Suwon-si (KR);
Ui-Chul JEONG, Anyang-si (KR);
Austin KIM, Seongnam-si (KR);
Yeon-Woo KIM, Seoul (KR); **Joon-Ho**
BYUN, Yongin-si (KR)

(52) **U.S. Cl.**
CPC **H04B 1/1009** (2013.01)

(57) **ABSTRACT**

(21) Appl. No.: **14/928,285**

(22) Filed: **Oct. 30, 2015**

(30) **Foreign Application Priority Data**

Nov. 13, 2014 (KR) 10-2014-0157986

An electronic device for communicating in a network is provided. The electronic device includes a circuit board, a frame, a feeding structure formed on the circuit board, and an antenna unit disposed in a plane at a predetermined angle with respect to a surface of the circuit board. In addition, the antenna unit is disposed apart from the frame in electrical connection with the feeding structure.

