



US 20160248146A1

(19) **United States**(12) **Patent Application Publication**  
**Wang et al.**(10) **Pub. No.: US 2016/0248146 A1**(43) **Pub. Date: Aug. 25, 2016**(54) **ANTENNA AND MOBILE TERMINAL**(71) Applicant: **HUAWEI DEVICE CO., LTD.**,  
Guangdong (CN)(72) Inventors: **Hanyang Wang**, Shenzhen (CN);  
**Jianming Li**, Taipei (TW)(21) Appl. No.: **15/025,714**(22) PCT Filed: **Mar. 28, 2014**(86) PCT No.: **PCT/CN2014/074299**

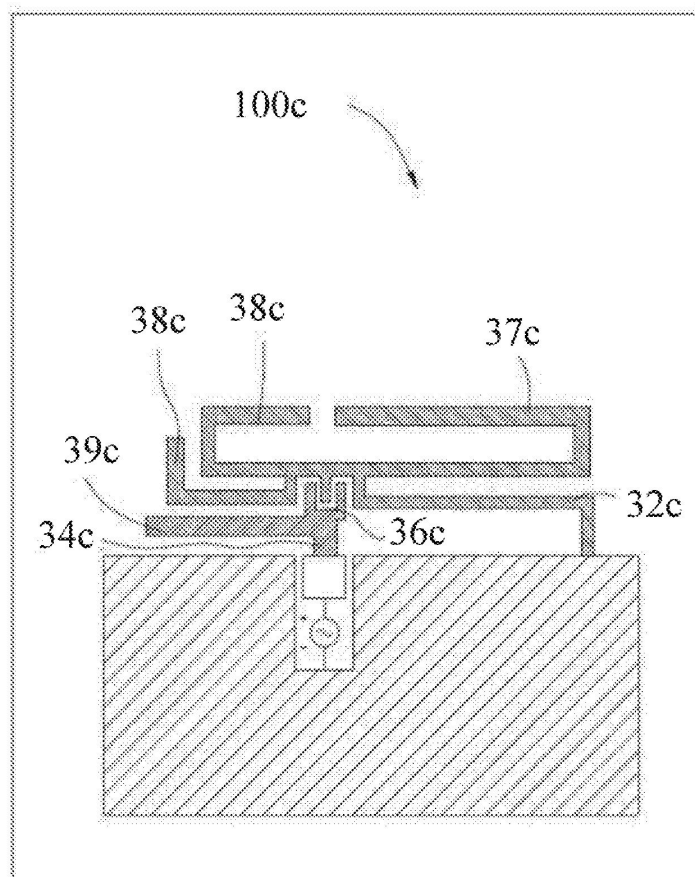
§ 371 (c)(1),

(2) Date: **Mar. 29, 2016****Publication Classification**(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H01Q 9/04** (2006.01)**H01Q 1/38** (2006.01)**H01Q 9/42** (2006.01)(52) **U.S. Cl.**CPC ..... **H01Q 1/243** (2013.01); **H01Q 9/42**  
(2013.01); **H01Q 9/0414** (2013.01); **H01Q 1/38**  
(2013.01)

(57)

**ABSTRACT**

An antenna, including a first radiation part, a matching circuit, and a feed source, where the first radiation part includes a first radiator, a second radiator, and a capacitor structure, a first end of the first radiator is connected to the feed source using the matching circuit, the feed source is connected to a grounding part, a second end of the first radiator is connected to a first end of the second radiator using the capacitor structure, a second end of the second radiator is connected to the grounding part, the first radiation part is configured to generate a first resonance frequency, and a length of the second radiator is one-eighth of a wavelength corresponding to the first resonance frequency which helps to reduce an antenna length, and a volume of a mobile terminal.





US 20160248147A1

(19) **United States**(12) **Patent Application Publication**  
**Zhang et al.**(10) **Pub. No.: US 2016/0248147 A1**(43) **Pub. Date: Aug. 25, 2016**(54) **MOBILE TERMINAL WITH NEW TYPE OF  
ANTENNA STRUCTURE**(52) **U.S. CL.**CPC . *H01Q 1/243* (2013.01); *H01Q 9/16* (2013.01)(71) Applicant: **HUAWEI DEVICE CO., LTD.**  
Guangdong (CN)

(57)

**ABSTRACT**(72) Inventors: **Xuefei Zhang**, Shenzhen (CN); **Yibo  
Chen**, Xi'an (CN)(21) Appl. No.: **15/025,883**(22) PCT Filed: **Nov. 28, 2013**(86) PCT No.: **PCT/CN2013/088026**

§ 371 (c)(1),

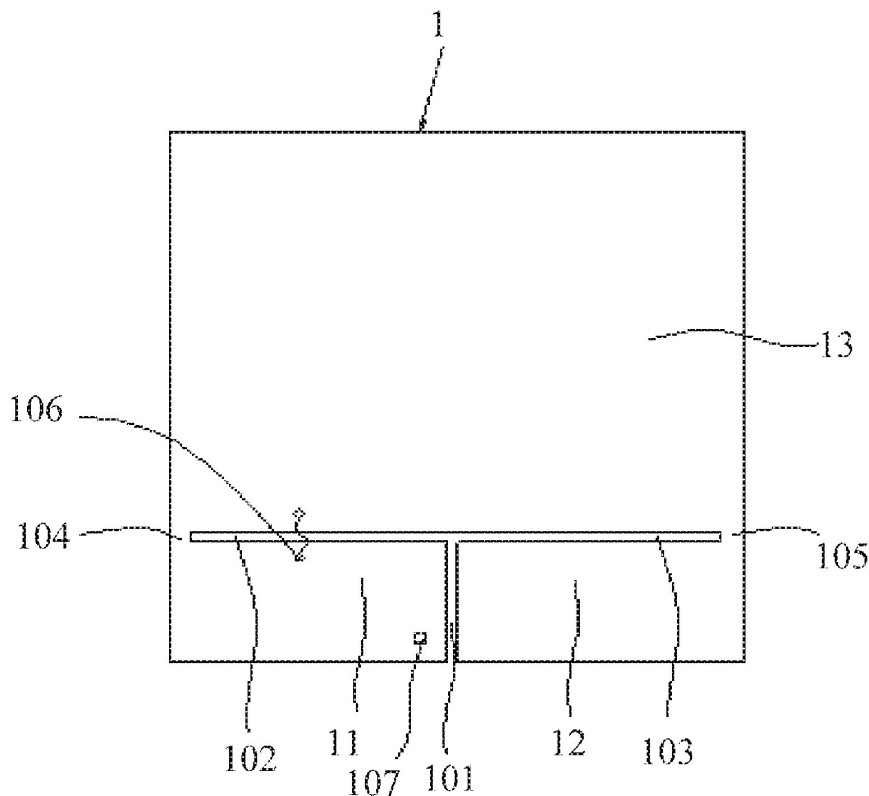
(2) Date: **Mar. 29, 2016****Publication Classification**(51) **Int. Cl.***H01Q 1/24*

(2006.01)

*H01Q 9/16*

(2006.01)

A mobile terminal with a antenna structure applicable to the field of communications equipment technologies, where the antenna structure includes a metal rear cover, a first slot which is disposed on the metal rear cover, and connects with the metal rear cover through one end, a second slot and a third slot which are disposed on the metal rear cover, and located on opposite sides of the first slot, and connects with the first slot through one end, and the metal rear cover includes a rear cover which is located on one side of the second slot and the third slot, and an antenna part located on the other side of the second slot and the third slot, and the antenna part includes a first antenna part located on one side of the first slot and a second antenna part located on the other side of the first slot.





US 20160248148A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0248148 A1**

(43) **Pub. Date: Aug. 25, 2016**

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

**Publication Classification**

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

(51) **Int. Cl.**

**H01Q 1/24** (2006.01)

**H01Q 1/48** (2006.01)

**H01Q 9/04** (2006.01)

**H01Q 13/10** (2006.01)

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

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

CPC ..... **H01Q 1/243** (2013.01); **H01Q 13/103**  
(2013.01); **H01Q 1/48** (2013.01); **H01Q 9/0407**  
(2013.01)

(21) Appl. No.: **15/141,693**

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

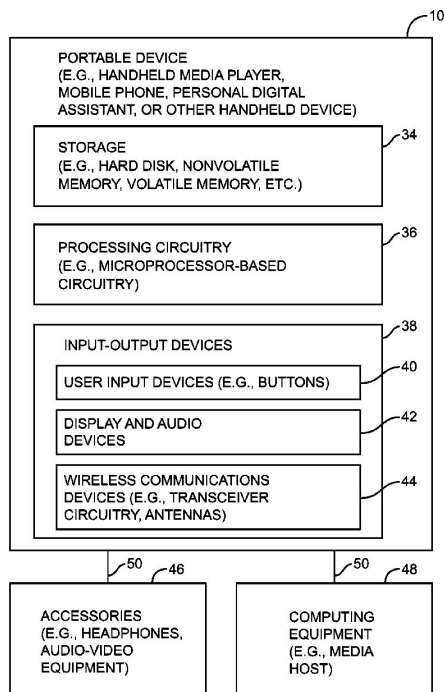
**Related U.S. Application Data**

(60) Continuation of application No. 14/064,589, filed on Oct. 28, 2013, now Pat. No. 9,356,355, which is a continuation of application No. 13/286,612, filed on Nov. 1, 2011, now Pat. No. 8,907,852, 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.

(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 using 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 20160248155A1

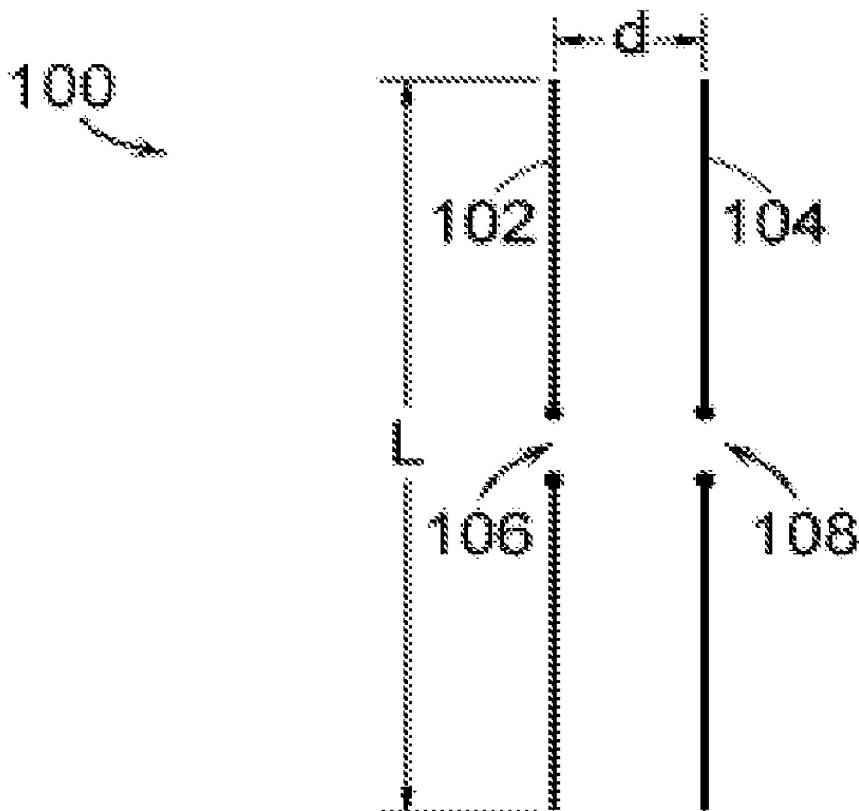
(19) **United States**(12) **Patent Application Publication**  
**MONTGOMERY et al.**(10) **Pub. No.: US 2016/0248155 A1**(43) **Pub. Date: Aug. 25, 2016**(54) **ANTENNA STRUCTURES AND METHODS  
THEREOF FOR ADJUSTING AN OPERATING  
FREQUENCY RANGE OF AN ANTENNA****Publication Classification**

(51) **Int. Cl.**  
*H01Q 3/24* (2006.01)  
*H01Q 1/24* (2006.01)  
*H01Q 1/50* (2006.01)

(52) **U.S. Cl.**  
CPC . *H01Q 3/24* (2013.01); *H01Q 1/50* (2013.01);  
*H01Q 1/243* (2013.01)

(71) Applicant: **SKYCROSS, INC.**, San Jose, CA (US)(72) Inventors: **MARK T. MONTGOMERY**,  
Melbourne Beach, FL (US); **FRANK M.  
CAIMI**, Vero Beach, FL (US)(21) Appl. No.: **15/145,839**(22) Filed: **May 4, 2016****Related U.S. Application Data**(63) Continuation of application No. 14/467,915, filed on  
Aug. 25, 2014, now Pat. No. 9,362,619.(60) Provisional application No. 61/896,233, filed on Oct.  
28, 2013, provisional application No. 61/932,831,  
filed on Jan. 29, 2014, provisional application No.  
61/941,888, filed on Feb. 19, 2014.(57) **ABSTRACT**

A system that incorporates the subject disclosure may include, for example, a circuit for obtaining a desired bandwidth of operation of the antenna structure, adjusting a bandwidth of the antenna to achieve the desired bandwidth of operation of the antenna structure, and tuning the antenna to a new resonant frequency to accommodate transmitting or receiving RF signals at a desired band of operation. The antenna at the new resonant frequency is at least approximately at the desired bandwidth of operation of the antenna structure. Other embodiments are disclosed.





US 20160248162A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0248162 A1**

(43) **Pub. Date: Aug. 25, 2016**

(54) **HIGH EFFICIENCY ANTENNA**

**Publication Classification**

(71) Applicant: **Netgear, Inc.**, San Jose, CA (US)

(51) **Int. Cl.**  
**H01Q 9/28** (2006.01)

(72) Inventors: **Chia-Wei LIU**, Cupertino, CA (US);  
**Joseph Amalan Arul EMMANUEL**,  
Cupertino, CA (US)

**H01Q 1/38** (2006.01)  
**H01Q 5/371** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H01Q 9/285** (2013.01); **H01Q 5/371**  
(2015.01); **H01Q 1/38** (2013.01)

(21) Appl. No.: **14/942,982**

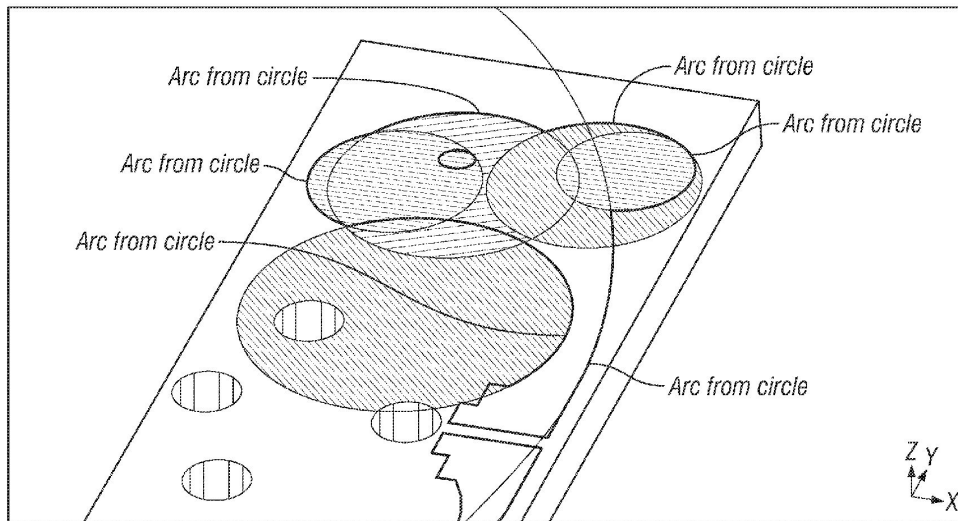
(22) Filed: **Nov. 16, 2015**

**Related U.S. Application Data**

(63) Continuation of application No. 13/480,132, filed on  
May 24, 2012, now Pat. No. 9,190,729.

(57) **ABSTRACT**

Antenna designs are disclosed that exhibit both high bandwidth and efficiency. A first aspect of the invention concerns the form factor of the antenna; a second aspect of the invention concerns the ease with which the antenna is manufactured; and a third aspect concerns the superior performance exhibits by the antenna across a large bandwidth.





US 20160248163A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0248163 A1**

(43) **Pub. Date: Aug. 25, 2016**

(54) **ANTENNA FOR ACHIEVING EFFECTS OF  
MIMO ANTENNA**

**Publication Classification**

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

(51) **Int. Cl.**  
**H01Q 9/42** (2006.01)  
**H01Q 1/50** (2006.01)  
**H01Q 5/35** (2006.01)

(72) Inventors: **CHUN-JUI PAN**, New Taipei (TW);  
**SHENG-HSIUNG YANG**, New Taipei  
(TW); **WEN-CHIEH TSAI**, New Taipei  
(TW)

(52) **U.S. Cl.**  
CPC . **H01Q 9/42** (2013.01); **H01Q 5/35** (2015.01);  
**H01Q 1/50** (2013.01)

(21) Appl. No.: **15/142,621**

(57) **ABSTRACT**

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

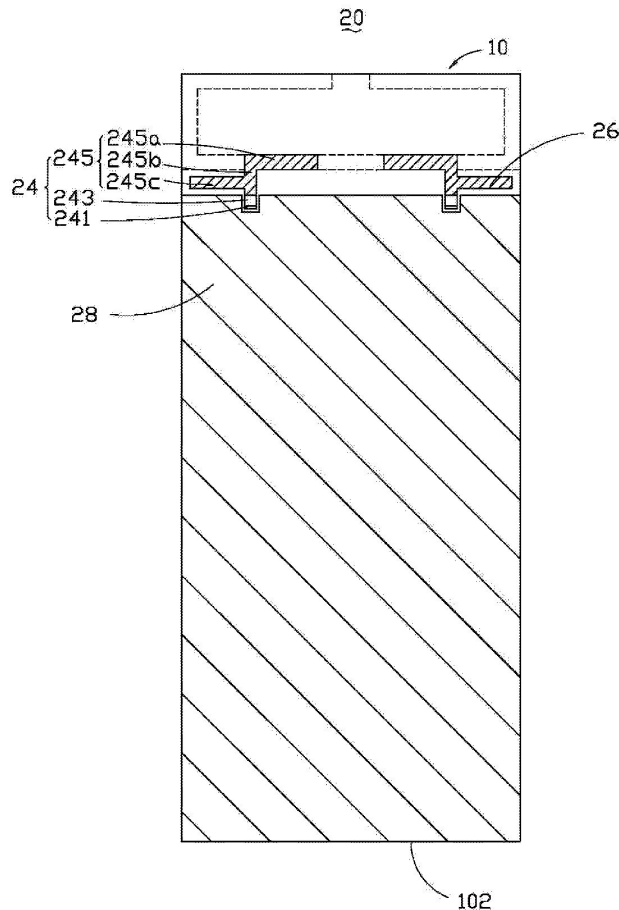
**Related U.S. Application Data**

(62) Division of application No. 13/656,753, filed on Oct.  
22, 2012.

(30) **Foreign Application Priority Data**

Oct. 28, 2011 (TW) ..... 100139312

An antenna disposed on a substrate includes a radiating portion, a first coupling and feeding portion, and a second coupling and feeding portion. A length of the radiating portion is substantially equal to a half wavelength of electromagnetic signals radiated by the radiating portion. Each coupling and feeding portion includes a feeding part and a coupling part. The feeding part feeds the electromagnetic signals to the radiating portion via the coupling part so as to achieve effects of a multiple-input multiple-output (MIMO) antenna.





US 20160248893A1

(19) **United States**(12) **Patent Application Publication**  
**KIM**(10) **Pub. No.: US 2016/0248893 A1**(43) **Pub. Date: Aug. 25, 2016**(54) **WIRELESS COMMUNICATION TERMINAL**(52) **U.S. Cl.**(71) Applicant: **LG ELECTRONICS INC.**,  
Yeongdeungpo-gu Seoul (KR)CPC ..... **H04M 1/026** (2013.01); **H04B 1/036**  
(2013.01); **H01Q 1/2266** (2013.01)(72) Inventor: **Junhong KIM**, Seoul (KR)(57) **ABSTRACT**(21) Appl. No.: **15/032,094**(22) PCT Filed: **Sep. 3, 2014**(86) PCT No.: **PCT/KR2014/008259**

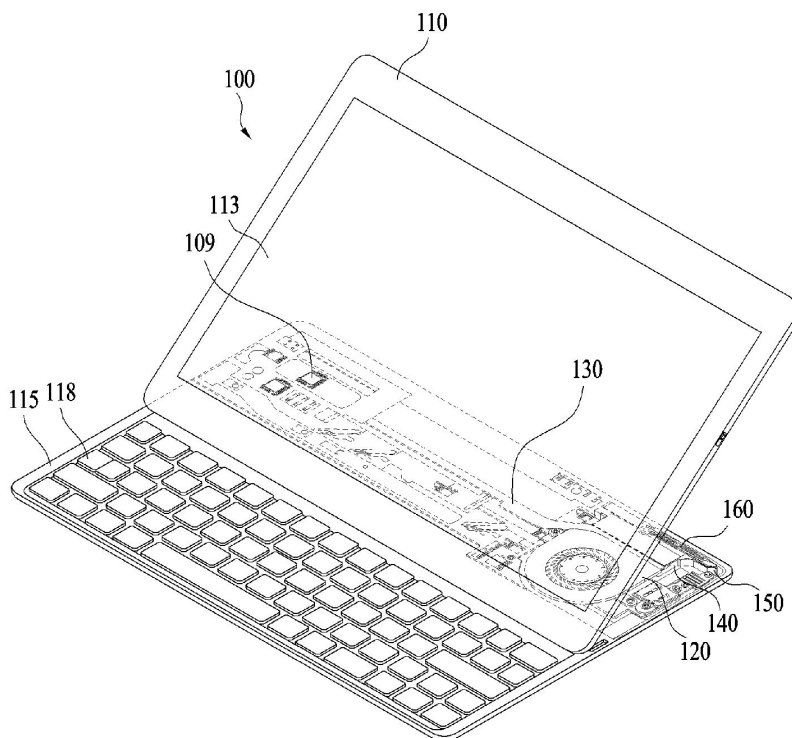
§ 371 (c)(1),

(2) Date: **Apr. 26, 2016**(30) **Foreign Application Priority Data**

Nov. 25, 2013 (KR) ..... 10-2013-0143870

**Publication Classification**(51) **Int. Cl.****H04M 1/02** (2006.01)**H01Q 1/22** (2006.01)**H04B 1/036** (2006.01)

To achieve the above objectives, a wireless communication terminal of the present invention comprises: a case having a bent hole formed in one side thereof; an antenna carrier disposed in the case such that a side thereof faces the bent hole, and including a duct passing through one side and the other side thereof; a fan disposed on the other side of the antenna carrier; and an antenna disposed on the antenna carrier and the top surface of the fan and having an antenna pattern for transmitting and receiving wireless signals, wherein the wireless communication terminal has the antenna and a heat dissipating structure disposed in proximity such that one member performs two or more functions, so as to provide a wireless communication terminal making good use of internal space.





US 20160254588A1

(19) **United States**(12) **Patent Application Publication**  
**KIM et al.**(10) **Pub. No.: US 2016/0254588 A1**(43) **Pub. Date: Sep. 1, 2016**(54) **ANTENNA DEVICE AND ELECTRONIC  
DEVICE INCLUDING SAME**(71) Applicant: **Samsung Electronics Co., Ltd.**,  
Gyeonggi-do (KR)(72) Inventors: **Ji-Won KIM**, Gyeonggi-do (KR); **Jinu  
KIM**, Seoul (KR); **Hui-Won CHO**,  
Gyeonggi-do (KR)(73) Assignee: **Samsung Electronics Co., Ltd.**(21) Appl. No.: **15/056,638**(22) Filed: **Feb. 29, 2016**(30) **Foreign Application Priority Data**

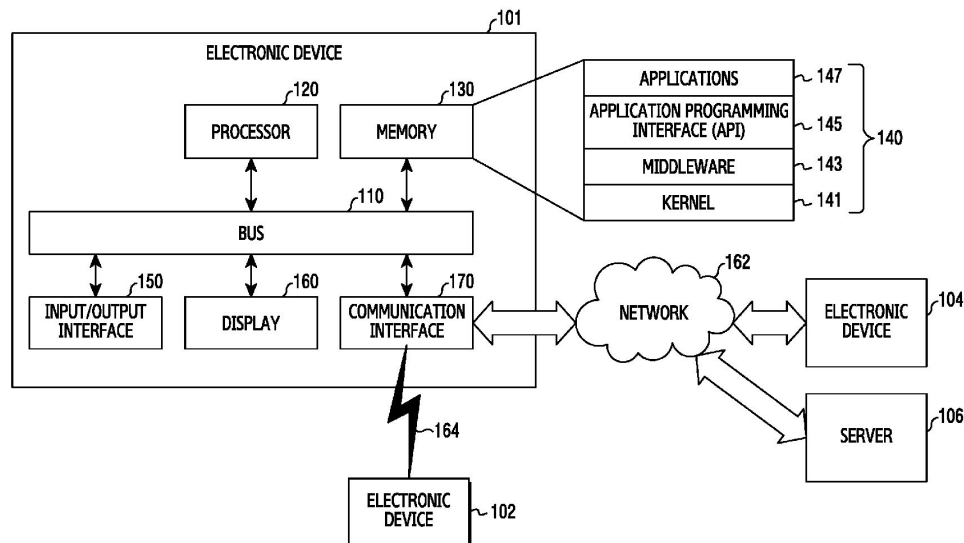
Feb. 27, 2015 (JP) ..... 10-2015-0028340

**Publication Classification**(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H01Q 1/38** (2006.01)(52) **U.S. Cl.**CPC ... **H01Q 1/24** (2013.01); **H01Q 1/38** (2013.01)

(57)

**ABSTRACT**

An electronic device and an antenna device are provided herein. An electronic device includes a conductive sidewall; a conductive structure located within a space formed by the conductive sidewall and extending from the conductive sidewall, wherein the conductive structure includes a first surface directed toward a front of the portable electronic device and a second surface directed toward a back of the portable electronic device; a non-conductive structure located within the space formed by the conductive sidewall and contacting the conductive structure, wherein the non-conductive structure includes a first surface directed toward the front of the portable electronic device and a second surface directed toward the back of the portable electronic device; an antenna pattern electrically connected to the conductive structure; and a flexible conductive connector electrically connected to the conductive structure and the antenna pattern. The antenna pattern extends on a portion of the first surface of the conductive structure and on a portion of the first surface of the non-conductive structure, or extends on a portion of the second surface of the conductive structure and on a portion of the second surface of the non-conductive structure.





US 20160254590A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0254590 A1**

(43) **Pub. Date: Sep. 1, 2016**

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

**Publication Classification**

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

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H04B 1/00** (2006.01)  
**H01Q 1/48** (2006.01)

(72) Inventors: **Jung-Hoon SEO**, Gyeonggi-do (KR);  
**Ui-Chul JEONG**, Gyeonggi-do (KR);  
**Se-Hyun PARK**, Gyeonggi-do (KR);  
**Jae-Ho LIM**, Seoul (KR)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/243** (2013.01); **H01Q 1/48**  
(2013.01); **H04B 1/006** (2013.01)

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

(57) **ABSTRACT**

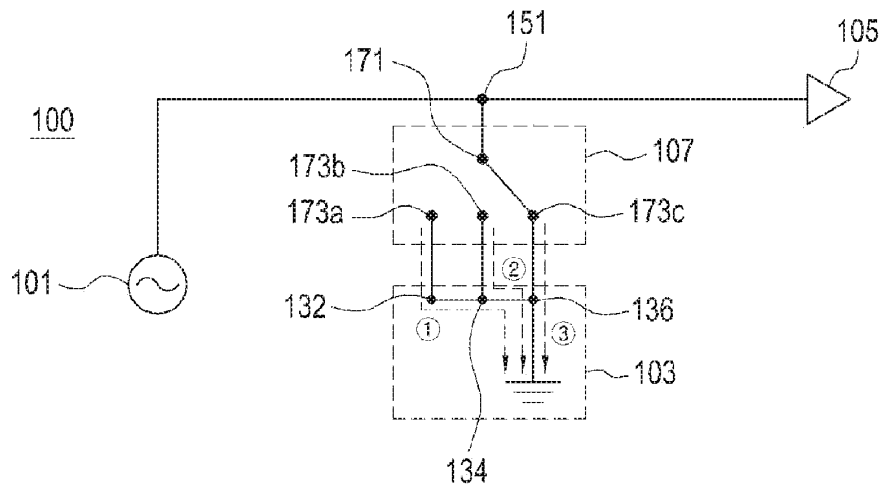
(21) Appl. No.: **15/056,419**

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

(30) **Foreign Application Priority Data**

Feb. 27, 2015 (KR) ..... 10-2015-0028663

Disclosed are an antenna device and an electronic device that includes the antenna device. The antenna device includes a power feeding unit, a ground unit, a radiating unit that is electrically connected to the power feeding unit, and a switching element that selects one or more points from a plurality of different points of the ground unit and connects the radiating unit to the selected one or more points.





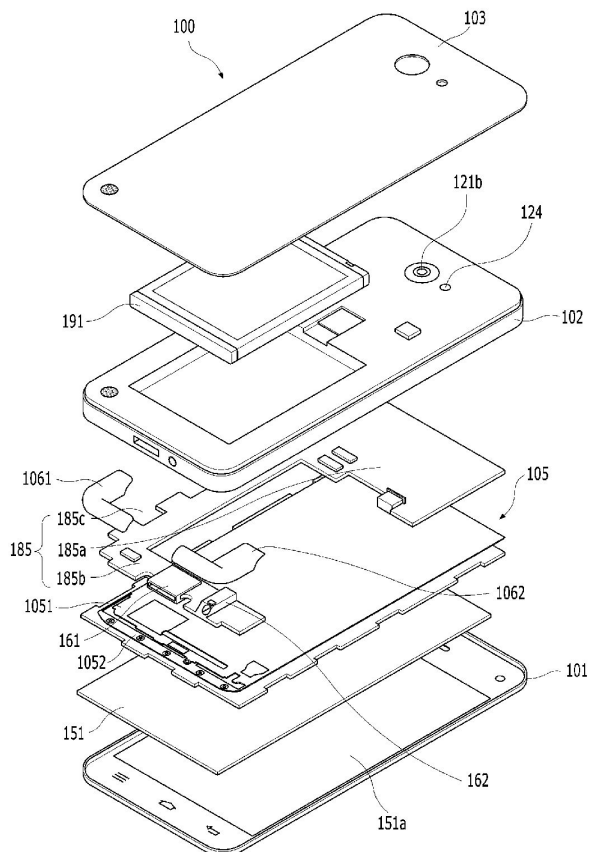
US 20160254591A1

(19) **United States**(12) **Patent Application Publication**  
**JUNG et al.**(10) **Pub. No.: US 2016/0254591 A1**(43) **Pub. Date: Sep. 1, 2016**(54) **MOBILE TERMINAL****Publication Classification**(71) Applicant: **LG ELECTRONICS INC.**, Seoul (KR)(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H01Q 1/52** (2006.01)(72) Inventors: **Byungwoon JUNG**, Seoul (KR);  
**Jaewoo LEE**, Seoul (KR); **Sungjung**  
**RHO**, Seoul (KR); **Changwon YUN**,  
Seoul (KR); **Daeyong KWAK**, Seoul  
(KR); **Sungjoon HONG**, Seoul (KR)(52) **U.S. Cl.**  
CPC . **H01Q 1/243** (2013.01); **H01Q 1/52** (2013.01)(73) Assignee: **LG ELECTRONICS INC.**, Seoul (KR)(21) Appl. No.: **15/150,068**(22) Filed: **May 9, 2016****Related U.S. Application Data**(63) Continuation of application No. 14/693,539, filed on  
Apr. 22, 2015, now Pat. No. 9,363,341.(30) **Foreign Application Priority Data**

Sep. 19, 2014 (KR) ..... 10-2014-0125062

(57) **ABSTRACT**

According to the present invention, a mobile terminal includes a main body including a front side with which a display unit is combined, a first antenna mounted on the main body, extended in a first direction and including a first slot of which one end is closed and another end is opened, a second antenna mounted on the main body, extended in a second direction corresponding to a direction opposite to the direction to which the first slot is extended and including a second slot of which one end is closed and another end is opened, a power supply unit mounted in the inside of the main body, a first feeder configured to supply power to the first antenna from the power supply unit and a second feeder configured to supply power to the second antenna from the power supply unit.





US 20160254592A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0254592 A1**

(43) **Pub. Date: Sep. 1, 2016**

(54) **UTILIZATION OF ANTENNA LOADING FOR IMPEDANCE MATCHING**

**Publication Classification**

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

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

(72) Inventors: **Alireza Mahanfar**, Redmond, WA (US);  
**Javier Rodriguez De Luis**, Kirkland,  
WA (US); **Stanley Yu Tao Ng**, Bellevue,  
WA (US); **Benjamin J. Shewan**,  
Redmond, WA (US); **Kim Willi Schulze**,  
Seattle, WA (US)

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

(73) Assignee: **Microsoft Technology Licensing, LLC**,  
Redmond, WA (US)

(21) Appl. No.: **15/151,312**

(22) Filed: **May 10, 2016**

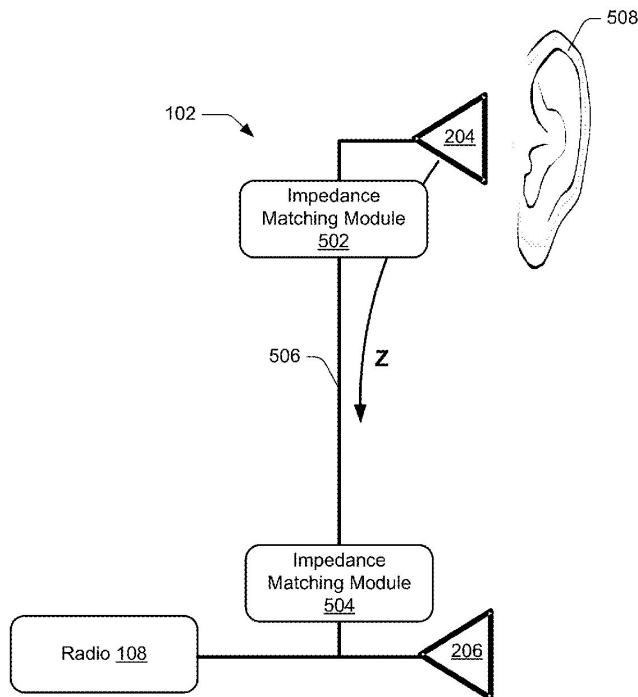
**Related U.S. Application Data**

(63) Continuation of application No. 13/745,609, filed on  
Jan. 18, 2013, now Pat. No. 9,356,343.

(57) **ABSTRACT**

Techniques for utilization of antenna loading for impedance matching are described. In at least some embodiments, a device (e.g., a smart phone) includes multiple antennas that are employed to send and receive wireless signals for the device. The device further includes impedance matching functionality communicatively connected to the antennas, and configured to perform impedance matching for one of the antennas based on loading (e.g., dielectric loading) of another of the antennas.

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US 20160254596A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0254596 A1**

(43) **Pub. Date: Sep. 1, 2016**

(54) **MIMO ANTENNA, TERMINAL AND METHOD  
FOR INCREASING ISOLATION THEREFOR**

**Publication Classification**

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

(72) Inventors: **Hao Ai**, Shenzhen (CN); **Yan Shi**,  
Shenzhen (CN); **Long Li**, Shenzhen  
(CN); **Lu Zhang**, Shenzhen (CN); **Jun  
Xing**, Shenzhen (CN); **Hao Sun**,  
Shenzhen (CN)

(51) **Int. Cl.**  
**H01Q 1/52** (2006.01)  
**H01Q 1/48** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 9/04** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/523** (2013.01); **H01Q 9/0421**  
(2013.01); **H01Q 1/48** (2013.01); **H01Q 1/243**  
(2013.01)

(21) Appl. No.: **14/904,214**

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

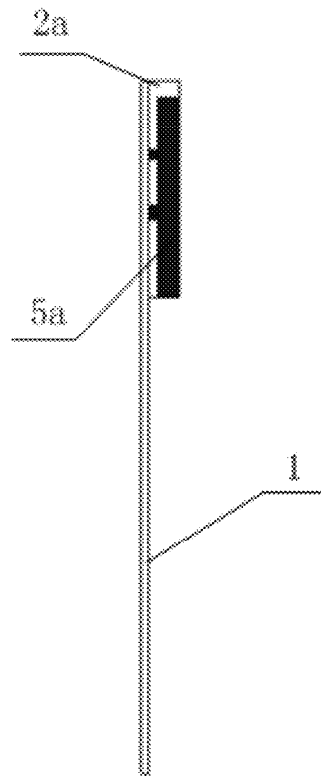
(86) PCT No.: **PCT/CN2013/087850**  
§ 371 (c)(1),  
(2) Date: **Feb. 16, 2016**

(30) **Foreign Application Priority Data**

Jul. 17, 2013 (CN) ..... 201310300672.X

(57) **ABSTRACT**

Disclosed are an MIMO antenna, a terminal and a method for improving MIMO antenna isolation. The MIMO antenna comprises at least two single antennas arranged on a printed circuit board (PCB); the single antenna comprising: an antenna support, a feeding grounding branch node used for shielding low-frequency coupling between the single antennas, a feeding point, a grounding point and an antenna radiation part, wherein the antenna support is arranged on the PCB, and the antenna radiation part is arranged on the antenna support; and the feeding grounding branch node is connected with the antenna radiation part via the feeding point and the grounding point.





US 20160254832A1

(19) **United States**(12) **Patent Application Publication**  
**YOO et al.**(10) **Pub. No.: US 2016/0254832 A1**(43) **Pub. Date: Sep. 1, 2016**(54) **ELECTRONIC DEVICE INCLUDING  
ANTENNA DEVICE**(52) **U.S. Cl.**CPC ..... **H04B 1/3838** (2013.01)(71) Applicant: **Samsung Electronics Co., Ltd.**,  
Gyeonggi-do (KR)

(57)

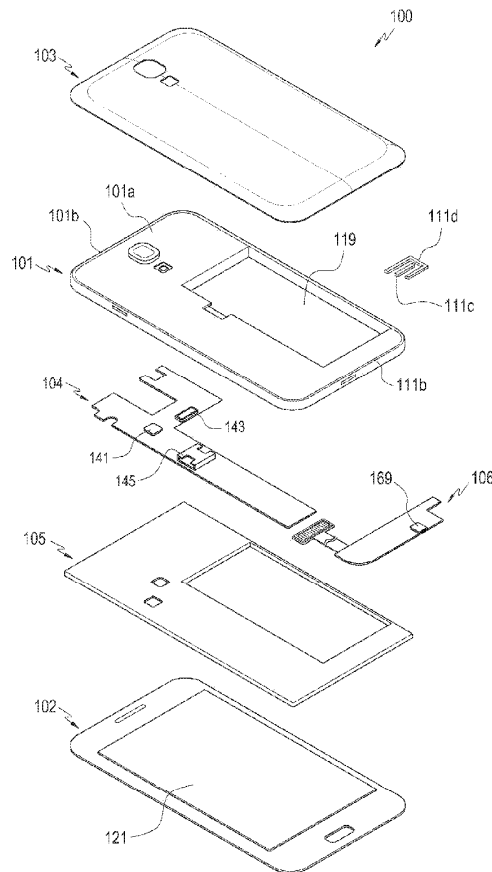
**ABSTRACT**(72) Inventors: **Chae-Up YOO**, Seoul (KR); **Jung-Kyu  
LEE**, Gyeonggi-do (KR); **Byung-Man  
LIM**, Seoul (KR)(73) Assignee: **Samsung Electronics Co., Ltd.**(21) Appl. No.: **15/055,096**(22) Filed: **Feb. 26, 2016**(30) **Foreign Application Priority Data**

Feb. 26, 2015 (KR) ..... 10-2015-0027594

**Publication Classification**(51) **Int. Cl.**  
**H04B 1/3827**

(2006.01)

An electronic device including an antenna device is provided. The electronic device includes a case member, a frame disposed around a periphery of one surface of the case member, forming sidewalls, and an antenna device for transmitting and receiving wireless signals. The antenna device includes a first radiation conductor forming a first part of the frame, a second radiation conductor disposed in a vicinity of the first radiation conductor, forming a second part of the frame, a third radiation conductor provided on the case member and connected to a first power supply of the electronic device, together with the first radiation conductor, and a fourth radiation conductor provided on the case member and connected to a ground of the electronic device. At least a part of the fourth radiation conductor is disposed in a vicinity of the second radiation conductor.



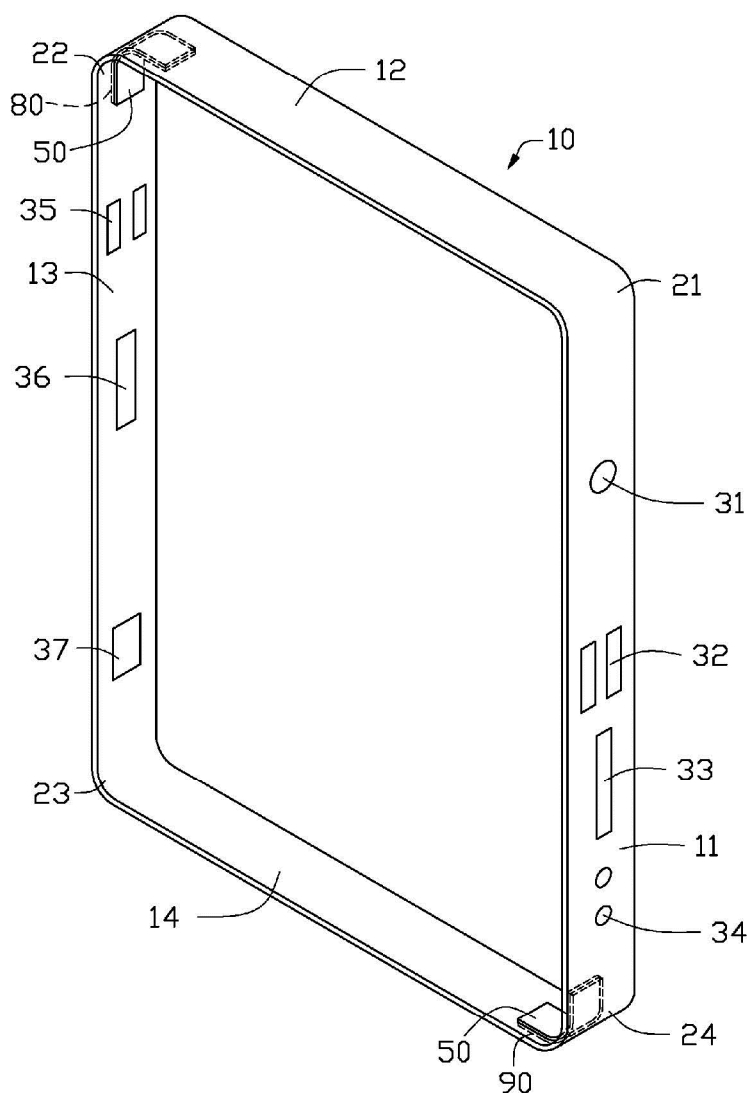


US 20160261025A1

(19) **United States**(12) **Patent Application Publication**  
**LUNG et al.**(10) **Pub. No.: US 2016/0261025 A1**(43) **Pub. Date: Sep. 8, 2016**(54) **ELECTRONIC DEVICE WITH MINIATURE  
MULTIPLE ANTENNAS****Publication Classification**(71) Applicants: **HONG FU JIN PRECISION  
INDUSTRY (ShenZhen) Co., Ltd.**,  
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New Taipei (TW)(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H01Q 21/00** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H01Q 1/243** (2013.01); **H01Q 21/00**  
(2013.01)(72) Inventors: **HSIEN-PEI LUNG**, New Taipei (TW);  
**WU-ZHE YU**, Shenzhen (CN)(57) **ABSTRACT**(21) Appl. No.: **14/737,767**(22) Filed: **Jun. 12, 2015**(30) **Foreign Application Priority Data**

Mar. 4, 2015 (CN) ..... 201510095852.8

An electronic device includes a shell and at least two antennas. Each corner of the shell is formed between two adjacent side walls. The antennas are set in opposing corners, and a shape of each antenna adapts to a shape of the corner. An angle of radiation of the antenna in front or behind the shell can be enlarged to increase the effectiveness of receiving or transmitting signals of the antenna.





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(19) **United States**

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

(10) **Pub. No.: US 2016/0261027 A1**

(43) **Pub. Date: Sep. 8, 2016**

(54) **RADIATOR FRAME, ELECTRONIC DEVICE INCLUDING THE SAME, AND MOLD FOR MANUFACTURING THE SAME**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 1/24* (2006.01)  
*H01Q 9/04* (2006.01)  
*B29C 45/14* (2006.01)  
*H01Q 1/40* (2006.01)  
(52) **U.S. Cl.**  
CPC ..... *H01Q 1/243* (2013.01); *H01Q 1/40* (2013.01); *H01Q 9/04* (2013.01); *B29C 45/14073* (2013.01); *B29C 45/14819* (2013.01); *B29C 2045/14081* (2013.01); *B29C 2045/14163* (2013.01); *B29L 2031/3437* (2013.01)

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

(21) Appl. No.: **14/972,617**

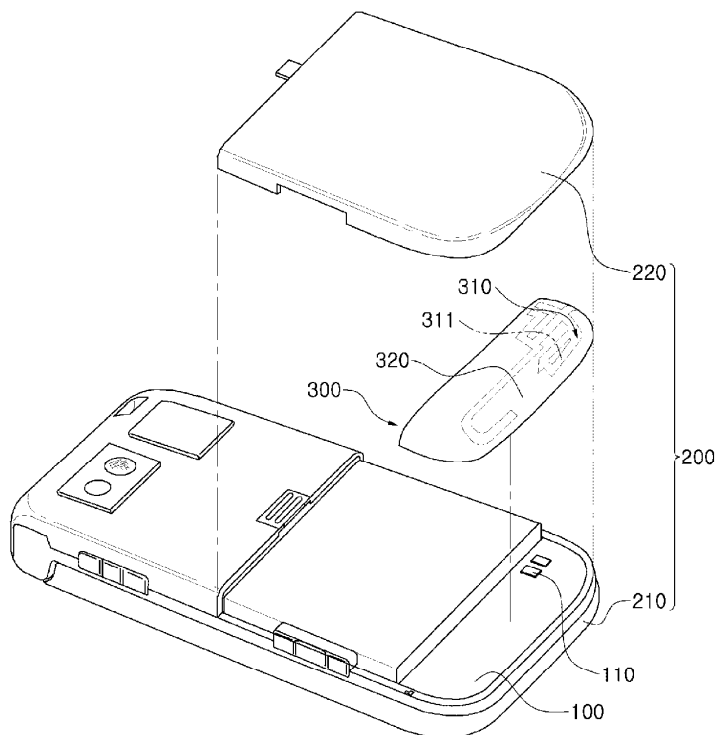
(22) Filed: **Dec. 17, 2015**

(30) **Foreign Application Priority Data**

Mar. 4, 2015 (KR) ..... 10-2015-0030258

(57) **ABSTRACT**

Disclosed is a radiator frame and a method of manufacturing the radiator frame. The radiator frame includes a radiator comprising an antenna pattern configured to transmit or receive a signal and a terminal connection configured to electrically connect the antenna pattern to a circuit board, and a molding frame configured to embed the radiator, wherein the antenna pattern is embedded in a first surface of the molding frame, and the terminal connection is exposed to a second surface of the molding frame.





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(19) **United States**(12) **Patent Application Publication**  
**CHENG et al.**(10) **Pub. No.: US 2016/0261045 A1**(43) **Pub. Date: Sep. 8, 2016**(54) **MULTI-INPUT MULTI-OUTPUT (MIMO)  
ANTENNA**(52) **U.S. Cl.**CPC ..... **H01Q 5/10** (2015.01)(71) Applicant: **Arcadyan Technology Corporation,**  
Hsinchu City (TW)

(57)

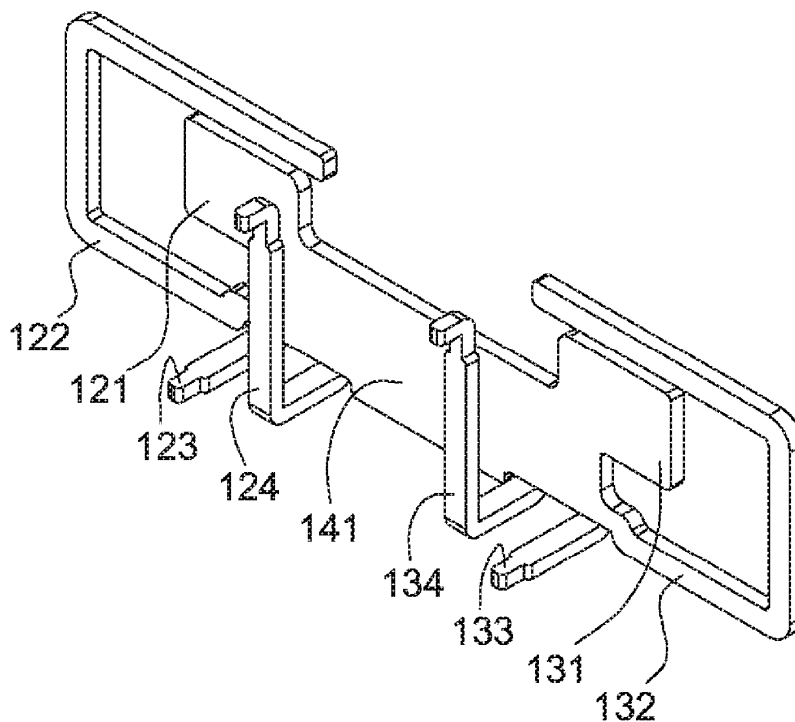
**ABSTRACT**(72) Inventors: **Shih-Chieh CHENG,** Tainan City (TW);  
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Hsinchu City (TW)(21) Appl. No.: **15/060,586**(22) Filed: **Mar. 3, 2016**(30) **Foreign Application Priority Data**

Mar. 5, 2015 (TW) ..... 104107005

**Publication Classification**(51) **Int. Cl.**  
**H01Q 5/10**

(2006.01)

A multi-input multi-output antenna including a substrate, a first multi-band antenna, a second multi-band antenna, and a multi-band filter is provided. The first multi-band antenna includes first and second radiators operated in first and second bands respectively. The second radiator extends from a first terminal of the first radiator and surrounds the first radiator. The operating frequency of the first band is higher than that of the second band. The second multi-band antenna includes third and fourth radiators operated in the first and the second bands respectively. The fourth radiator extends from a second terminal of the third radiator and surrounds the third radiator. The multi-band filter has a first filter part and a second filter part orthogonal to each other. The first filter part and the second filter part filter a first current and a second current respectively.





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(19) **United States**

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

(10) **Pub. No.: US 2016/0261051 A1**

(43) **Pub. Date: Sep. 8, 2016**

(54) **MONOPOLE ANTENNA**

**Publication Classification**

(71) Applicant: **Arcadyan Technology Corporation**,  
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(51) **Int. Cl.**  
**H01Q 21/30** (2006.01)  
**H01Q 1/38** (2006.01)  
**H01Q 5/10** (2006.01)

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(TW)

(52) **U.S. Cl.**  
CPC ..... **H01Q 21/30** (2013.01); **H01Q 5/10**  
(2015.01); **H01Q 1/38** (2013.01)

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

(57) **ABSTRACT**

A monopole antenna including a ground plane and a radiation body is provided. The radiation body includes a feeding connection part, a first radiation part, a second radiation part and a third radiation part. The feeding connection part is adjacent to the ground plane. The first radiation part connects one side of the feeding connection part and extends along a first direction. The first radiation part includes a metal patch whose width reduces towards the first direction. The second radiation part, being closer to the ground plane than the first radiation part, connects the side of the feeding connection part and extends along the first direction. The third radiation part connects the other side of the feeding connection part and extends along a second direction inverse to the first direction.

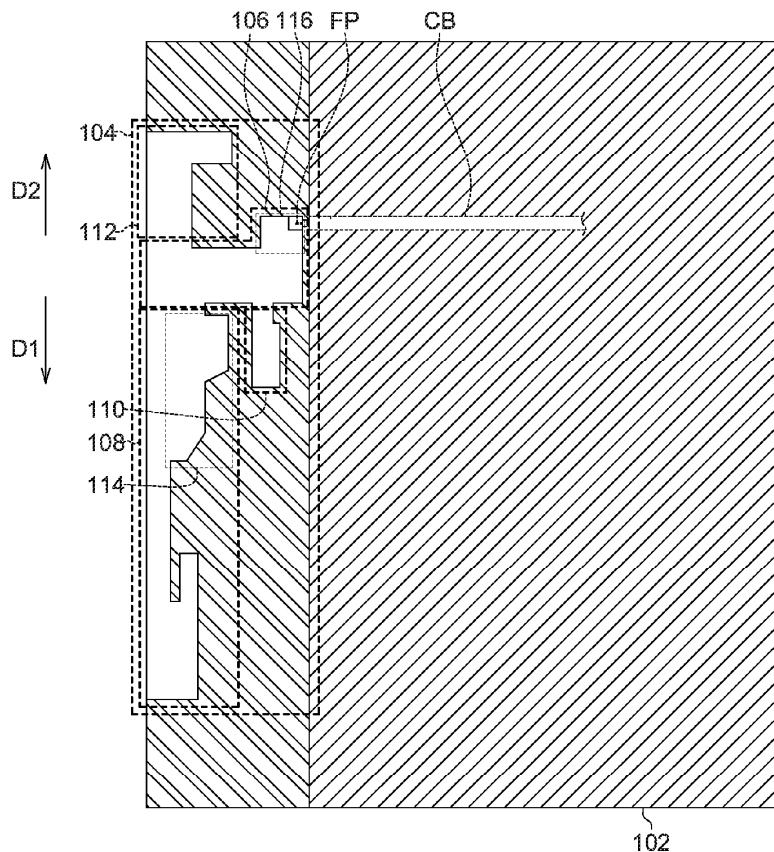
(21) Appl. No.: **15/061,668**

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

(30) **Foreign Application Priority Data**

Mar. 5, 2015 (TW) ..... 104107004

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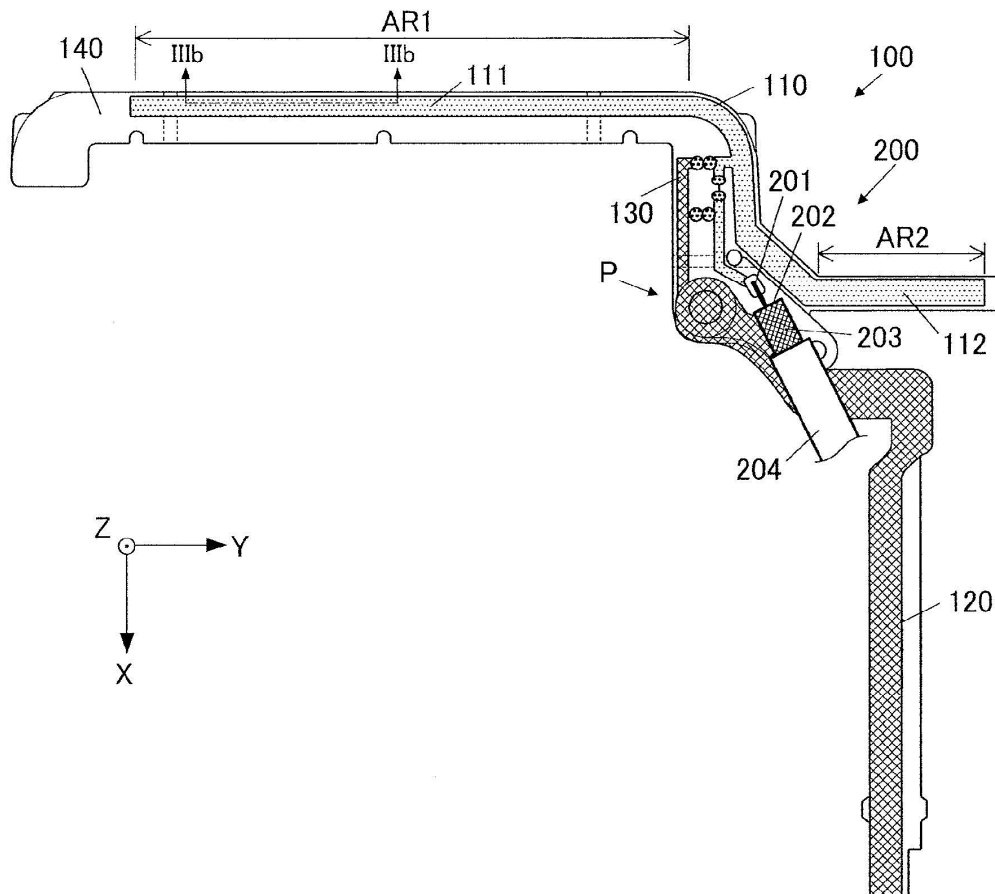
(19) **United States**(12) **Patent Application Publication**  
**YAGI et al.**(10) **Pub. No.: US 2016/0276741 A1**(43) **Pub. Date: Sep. 22, 2016**(54) **ANTENNA DEVICE, ELECTRONIC  
APPARATUS, AND PORTABLE TERMINAL****Publication Classification**(71) Applicant: **CASIO COMPUTER CO., LTD.**,  
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Tokyo (JP)(51) **Int. Cl.****H01Q 1/38** (2006.01)**H01Q 1/24** (2006.01)**H01Q 9/04** (2006.01)(52) **U.S. Cl.**CPC ..... **H01Q 1/38** (2013.01); **H01Q 9/0485**  
(2013.01); **H01Q 1/243** (2013.01)(21) Appl. No.: **15/010,699**(22) Filed: **Jan. 29, 2016**(30) **Foreign Application Priority Data**

Mar. 20, 2015 (JP) ..... 2015-057402

(57)

**ABSTRACT**

An antenna device includes an antenna element including a conductor; and a dielectric component. The antenna element includes a conductor. The dielectric component has a dielectric loss of 0.002 or greater. The dielectric component is attached to the antenna element.





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(19) **United States**(12) **Patent Application Publication**  
**Yu et al.**(10) **Pub. No.: US 2016/0276742 A1**(43) **Pub. Date: Sep. 22, 2016**(54) **ANTENNA, ANTENNA APPARATUS,  
TERMINAL, AND METHOD FOR ADJUSTING  
WORKING FREQUENCY BAND OF  
ANTENNA****Publication Classification**

(51) **Int. Cl.**  
*H01Q 1/48* (2006.01)  
*H01Q 1/24* (2006.01)  
*H01Q 9/04* (2006.01)  
*H01Q 5/371* (2006.01)

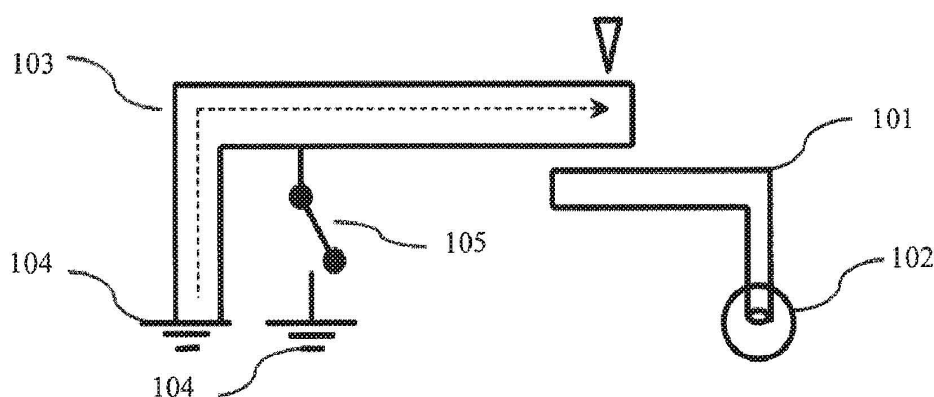
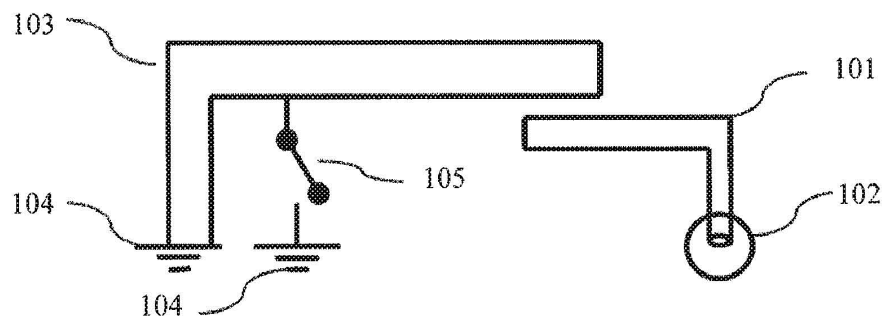
(52) **U.S. Cl.**  
CPC ..... *H01Q 1/48* (2013.01); *H01Q 5/371*  
(2015.01); *H01Q 1/243* (2013.01); *H01Q 9/04*  
(2013.01)

(71) Applicant: **HUAWEI DEVICE CO., LTD.**,  
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(CN); **Jiaqing You**, Shanghai (CN); **Lei**  
**Wang**, Shanghai (CN); **Zhaocai Zeng**,  
Shanghai (CN)(21) Appl. No.: **15/032,392**(22) PCT Filed: **Dec. 12, 2013**(86) PCT No.: **PCT/CN2013/089277**

§ 371 (c)(1),

(2) Date: **Apr. 27, 2016**(57) **ABSTRACT**

An antenna, an antenna apparatus, and a terminal are provided. The antenna includes a feeding point, a feeding stub, and a coupling stub. The feeding stub is electrically connected to the feeding point. The coupling stub is coupled to the feeding stub. The coupling stub includes at least two grounding points. By selecting different grounding combinations of the at least two grounding points of the coupling stub, an antenna clearance area does not need to be increased while multi-frequency coverage of the antenna is implemented.





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(19) **United States**

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

(10) **Pub. No.: US 2016/0277062 A1**

(43) **Pub. Date: Sep. 22, 2016**

(54) **ELECTRONIC DEVICE INCLUDING  
MULTI-FEED, MULTI-BAND ANTENNA  
USING EXTERNAL CONDUCTOR**

**Publication Classification**

(51) **Int. Cl.**  
**H04B 1/525** (2006.01)  
**H04B 1/48** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H04B 1/525** (2013.01); **H04B 1/48**  
(2013.01); **H04B 2001/485** (2013.01)

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

(21) Appl. No.: **15/050,980**

(22) Filed: **Feb. 23, 2016**

(30) **Foreign Application Priority Data**

Mar. 18, 2015 (KR) ..... 10-2015-0037322  
Dec. 28, 2015 (KR) ..... 10-2015-0187603

(57) **ABSTRACT**

An electronic device includes a board embedded in the electronic device, having a peripheral portion and a conductive region including a ground and a non-conductive region, an external conductor located in the peripheral portion and including a first non-segmented conductor having persistence with respect to performing an antenna function and connected to the ground. The device also includes a first antenna pattern configured to receive a first feed signal that contribute to first resonance for a first communications band, a second antenna pattern configured to receive a second feed signal that contributes to second resonance for a second communications band, and a first shield located between the first antenna pattern and the second antenna pattern that is connected to each of the ground and the first non-segmented conductor.

