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(19) **United States**

(12) **Patent Application Publication**
NAKAMURA

(10) **Pub. No.:** US 2016/0276737 A1

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

(54) **ANTENNA STRUCTURE AND METHOD FOR MANUFACTURING THE SAME, AND ELECTRONIC DEVICE**

(30) **Foreign Application Priority Data**

Nov. 26, 2014 (JP) 2014-239148

(71) Applicant: **KYOCERA Corporation**, Kyoto-shi (JP)

Publication Classification

(72) Inventor: **Kotaro NAKAMURA**, Osaka (JP)

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

(73) Assignee: **KYOCERA Corporation**

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

(21) Appl. No.: **15/169,533**

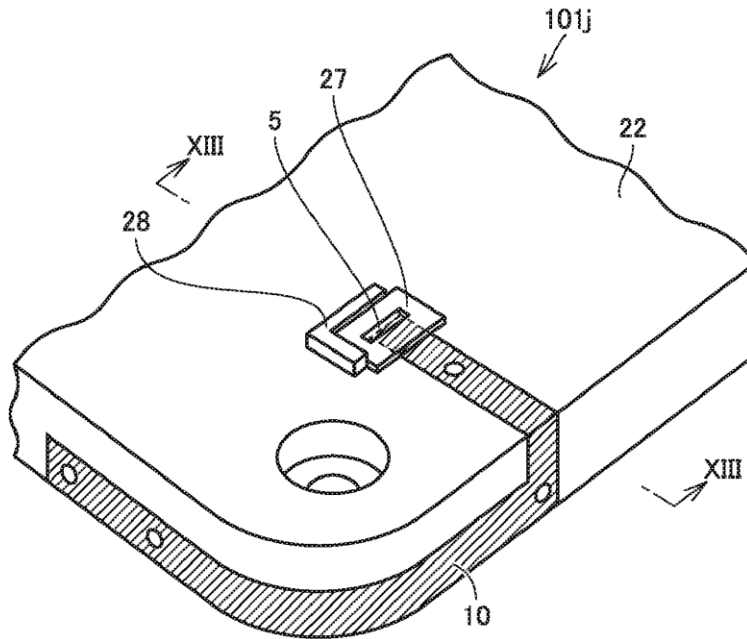
(57) **ABSTRACT**

(22) Filed: **May 31, 2016**

An antenna structure includes a sheet metal antenna, a housing having an outer surface and an inner surface which face opposite to each other and having a through hole for inserting the sheet metal antenna from the outer surface to the inner surface, and a sealing portion which seals the through hole while relative positional relation between the sheet metal antenna and the rear-surface-side housing is fixed with the sheet metal antenna passing through the through hole.

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2015/082406, filed on Nov. 18, 2015.





US 20160276741A1

(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.**,
Tokyo (JP)

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)

(72) Inventors: **Shigeru YAGI**, Tokyo (JP); **Youichi USHIGOME**, Tokyo (JP)

(52) **U.S. Cl.**
CPC *H01Q 1/38* (2013.01); *H01Q 9/0485* (2013.01); *H01Q 1/243* (2013.01)

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

(21) Appl. No.: **15/010,699**

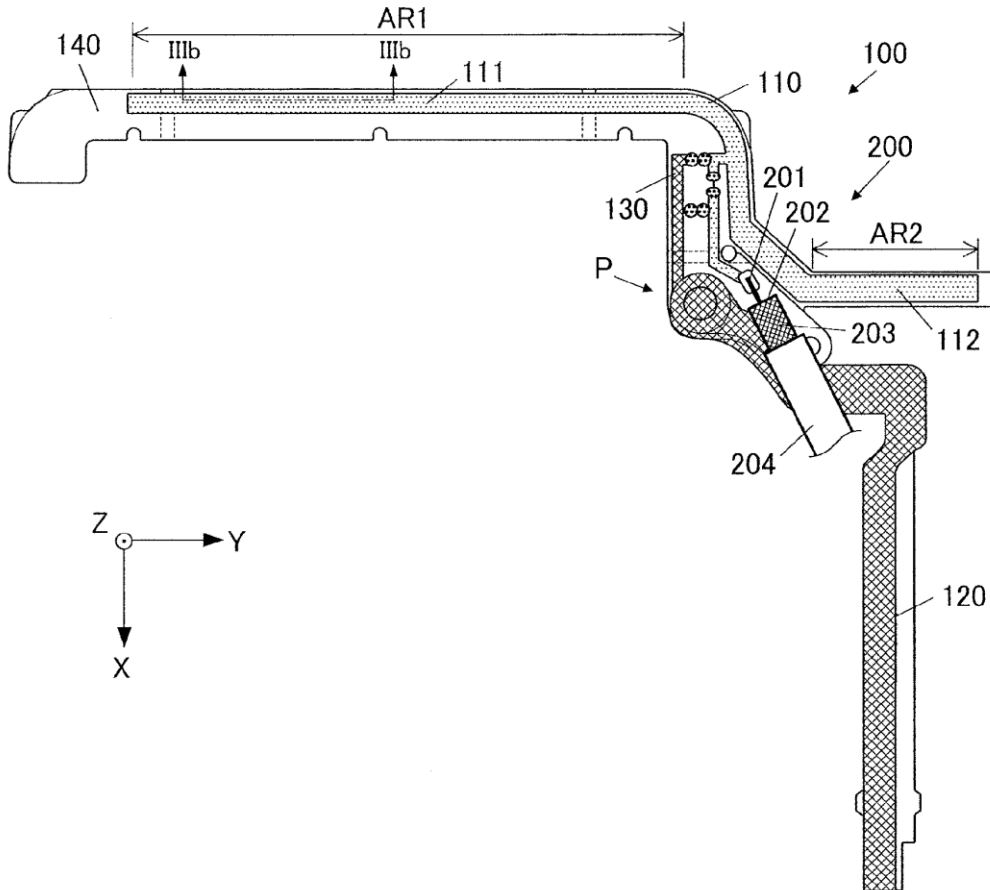
(57) **ABSTRACT**

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

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.

(30) **Foreign Application Priority Data**

Mar. 20, 2015 (JP) 2015-057402





US 20160276742A1

(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

(71) Applicant: **HUAWEI DEVICE CO., LTD.**,
Shenzhen, Guangdong (CN)

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

(72) Inventors: **Dong Yu**, Shanghai (CN); **Liang Xue**,
Shanghai (CN); **Meng Hou**, Shanghai
(CN); **Jiaqing You**, Shanghai (CN); **Lei
Wang**, Shanghai (CN); **Zhaocai Zeng**,
Shanghai (CN)

(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)

(21) Appl. No.: **15/032,392**

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

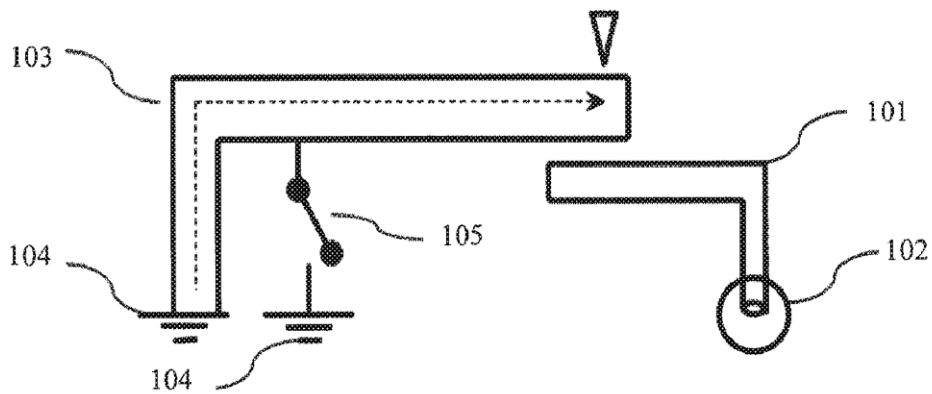
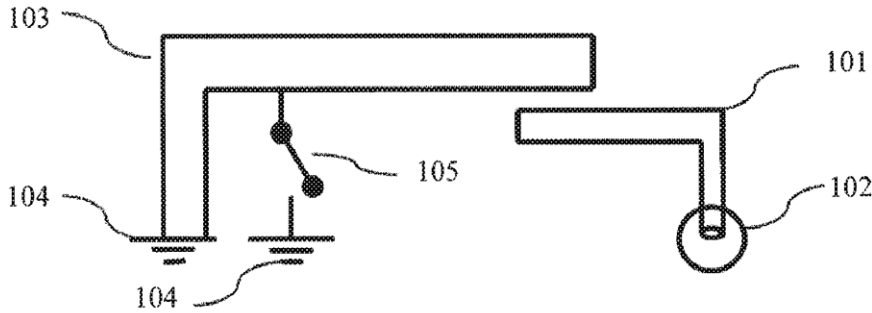
(86) PCT No.: **PCT/CN2013/089277**

§ 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.





US 20160277062A1

(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

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

(51) **Int. Cl.**
H04B 1/525 (2006.01)
H04B 1/48 (2006.01)

(72) Inventors: **Young Min CHEON**, Suwon-si (KR);
Dae Seong JEON, Suwon-si (KR); **Jun
Seung YI**, Suwon-si (KR); **Nam Ki
KIM**, Suwon-si (KR)

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

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

(57) **ABSTRACT**

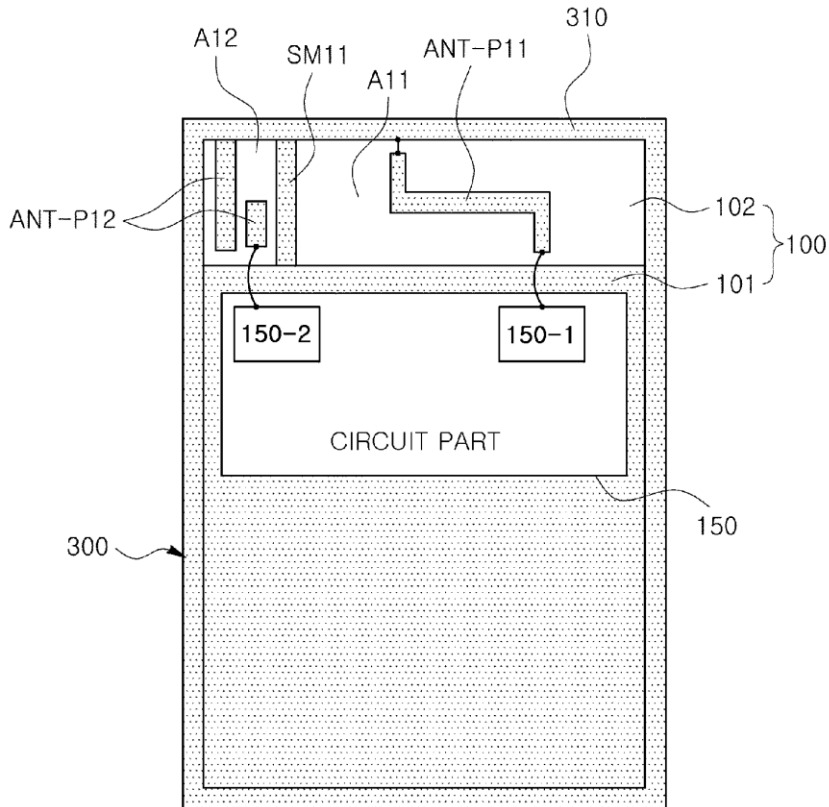
An electronic device includes a board embedded in the electronic device, having a peripheral portion and a conductive region including a ground and a non-conductive region, an external conductor located in the peripheral portion and including a first non-segmented conductor having persistence with respect 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.

(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





(19) **United States**

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

(10) **Pub. No.: US 2016/0277129 A1**

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

(54) **METHOD AND APPARATUS FOR TUNING ANTENNAS IN A COMMUNICATION DEVICE**

H03H 7/40 (2006.01)

H01Q 1/24 (2006.01)

H01Q 1/50 (2006.01)

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

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

CPC *H04B 17/12* (2015.01); *H01Q 1/243* (2013.01); *H01Q 1/50* (2013.01); *H03H 7/40* (2013.01); *H01Q 21/06* (2013.01)

(72) Inventors: **Keith R. Manssen**, Crystal Lake, IL (US); **MATTHEW RUSSELL GREENE**, Crystal Lake, IL (US); **DUANE RABE**, Hawthorn Woods, IL (US)

(57) **ABSTRACT**

A system that incorporates teachings of the present disclosure may include, for example, a process for obtaining a first operational metric for a transmitter of a communication device, determining a range of impedances based on the first operational metric where the range of impedances is associated with an acceptable level of performance for the communication device, obtaining a second operational metric for the transmitter, determining a target impedance within the range of impedances based on the second operational metric, and tuning a first impedance matching network based on the target impedance, where the first impedance matching network is coupled with a first antenna of the communication device, and where the tuning is based on adjusting a first variable component of the first impedance matching network. Additional embodiments are disclosed.

(21) Appl. No.: **15/167,202**

(22) Filed: **May 27, 2016**

Related U.S. Application Data

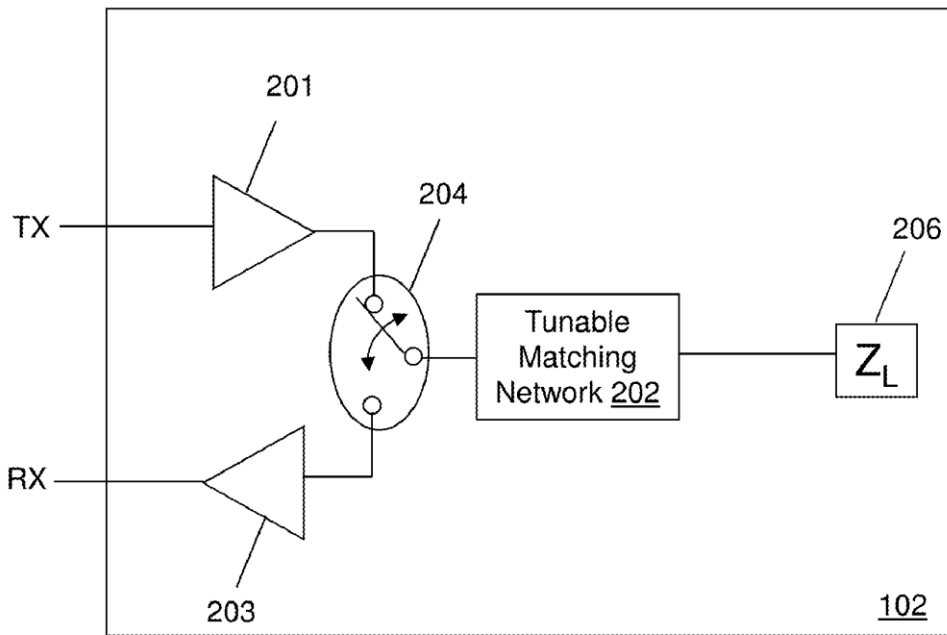
(63) Continuation of application No. 12/941,972, filed on Nov. 8, 2010, now Pat. No. 9,379,454.

Publication Classification

(51) **Int. Cl.**

H04B 17/12 (2006.01)

H01Q 21/06 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2016/0285153 A1**

(43) **Pub. Date: Sep. 29, 2016**

(54) **ANTENNA STRUCTURE AND MOBILE TERMINAL DEVICE**

Publication Classification

(71) Applicant: **HUAWEI DEVICE CO., LTD., SHENZHEN (CN)**

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

(72) Inventors: **YUANPENG LI, BEIJING (CN); YAFANG YU, BEIJING (CN); MENG HOU, SHANGHAI (CN)**

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

(21) Appl. No.: **15/173,086**

(57) **ABSTRACT**

(22) Filed: **Jun. 3, 2016**

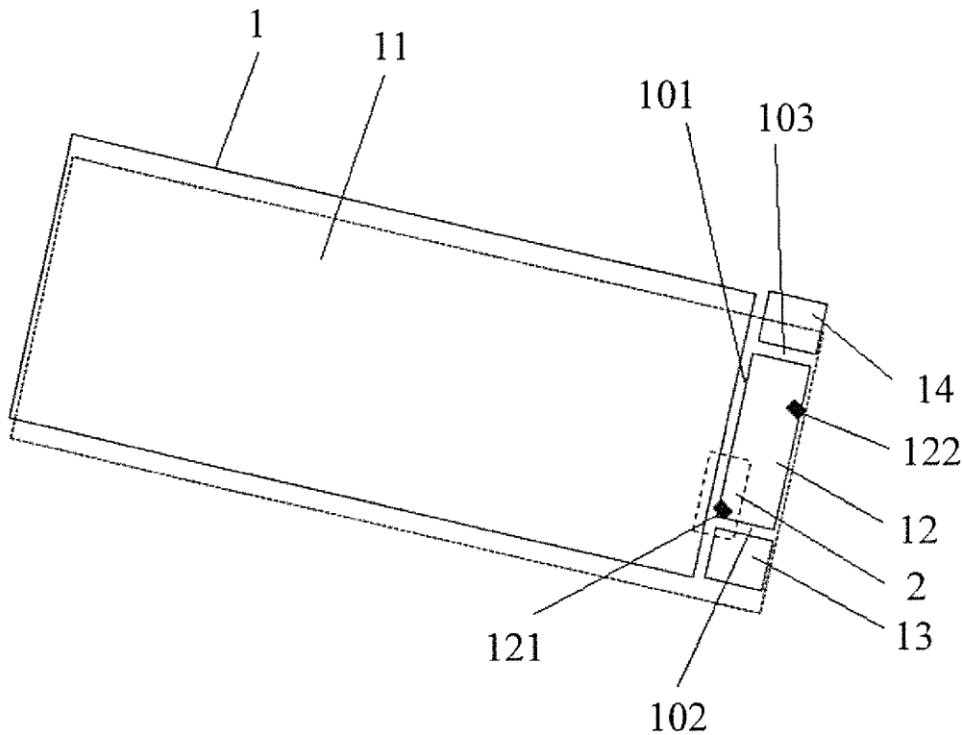
The present invention discloses an antenna structure and ensures an all-metal housing feature of the mobile terminal device. The antenna structure includes a housing and a feed plate, where the housing includes a main housing, a first floating object, a second floating object, and an antenna radiator; and the first floating object, the second floating object, and the antenna radiator are separated from the main housing by a first slot; there is a second slot between the first floating object and one side of the antenna radiator, and a third slot between the second floating object and the other side of the antenna radiator; the main housing, the first floating object, the second floating object, and the antenna radiator are connected as a whole by an insulator; and the feed plate is disposed opposite to the main housing, the first floating object, and the antenna radiator at an interval.

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2014/092945, filed on Dec. 3, 2014.

(30) **Foreign Application Priority Data**

Dec. 6, 2013 (CN) 201310656510.X





US 20160285156A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0285156 A1**

(43) **Pub. Date: Sep. 29, 2016**

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

Publication Classification

(71) Applicant: **Samsung Electronics Co., Ltd.**

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/50 (2006.01)
H01Q 1/48 (2006.01)

(72) Inventors: **Jae-Hee KIM**, Gyeonggi-do (KR);
Joon-Ho BYUN, Gyeonggi-do (KR);
Se-Hyun PARK, Gyeonggi-do (KR);
Dong-Hyun LEE, Gyeonggi-do (KR);
Austin KIM, Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 1/50** (2013.01)

(21) Appl. No.: **15/180,326**

(57) **ABSTRACT**

(22) Filed: **Jun. 13, 2016**

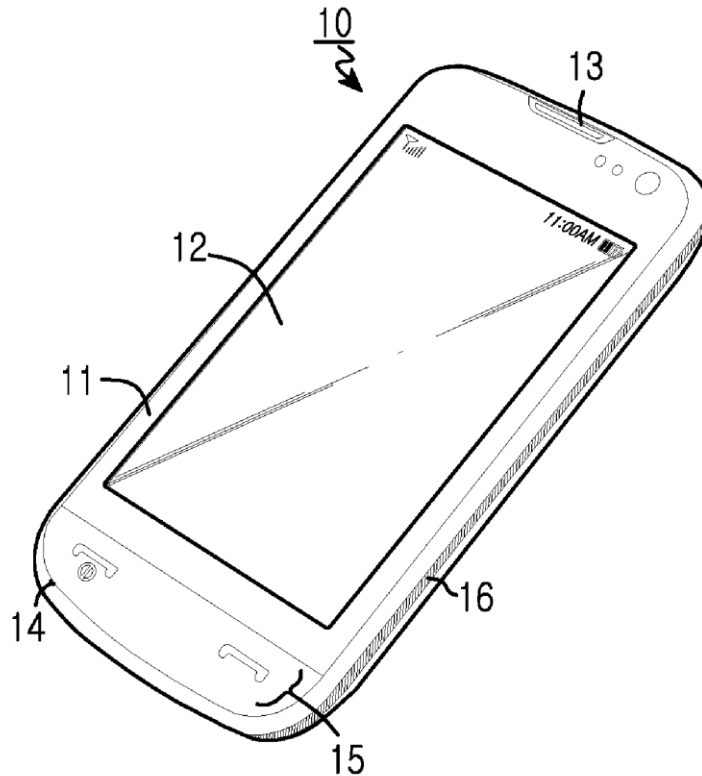
Related U.S. Application Data

(63) Continuation of application No. 14/719,642, filed on May 22, 2015, now Pat. No. 9,385,418, which is a continuation of application No. 14/461,527, filed on Aug. 18, 2014, now Pat. No. 9,059,506, which is a continuation of application No. 13/440,235, filed on Apr. 5, 2012, now Pat. No. 8,842,048.

Foreign Application Priority Data

(30) Apr. 14, 2011 (KR) 10-2011-0034548

An antenna apparatus for a portable terminal having a main board is provided. The antenna apparatus includes a main antenna that electrically connects to a feed line of the main board. A metal frame is constructed as part of a case frame forming an exterior of the portable terminal. The metal frame is divided into first and second parts that are separated. The first part electrically connects to the main antenna or to the main board feed line, and is designed to radiate. The second part electrically connects to a ground surface of the main board. The metal frame enhances overall antenna performance rather than causing degradation through interference.





US 20160285159A1

(19) **United States**

(12) **Patent Application Publication**
Caporal Del Barrio et al.

(10) **Pub. No.: US 2016/0285159 A1**

(43) **Pub. Date: Sep. 29, 2016**

(54) **ANTENNA SYSTEM**

Publication Classification

(71) Applicant: **Intel Corporation**, Santa Clara, CA (US)

(51) **Int. Cl.**
H01Q 1/50 (2006.01)
H01Q 1/38 (2006.01)
H01Q 5/314 (2006.01)

(72) Inventors: **Samantha Caporal Del Barrio**, Aalborg (DK); **Pevand Bahramzy**, Norresundby (DK); **Poul Olesen**, Stoevring (DK); **Peter Bundgaard**, Aalborg (DK); **Alexandru Daniel Tatomiurescu**, Aalborg (DK); **Emil Buskgaard**, Aalborg (DK); **Gert F. Pedersen**, Storvorde (DK); **Simon Svendsen**, Aalborg (DK); **Ole Jagielski**, Frederikshavn (DK); **Boyan Yanakiev**, Aalborg (DK)

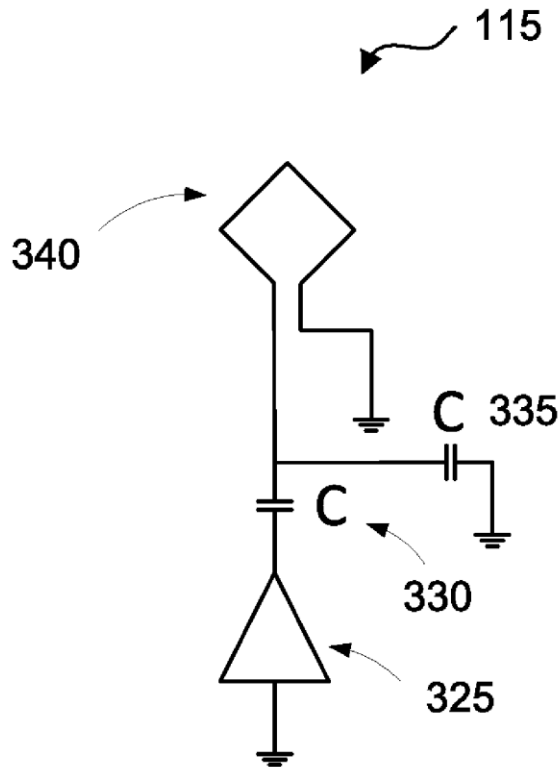
(52) **U.S. Cl.**
CPC **H01Q 1/50** (2013.01); **H01Q 5/314** (2015.01); **H01Q 1/38** (2013.01)

(57) **ABSTRACT**

Antenna systems that can include first and second radiators and an electromagnetic coupler disposed adjacent to the first and the second radiators. The radiators can be tunable to one or more frequencies. The electromagnetic coupler can be, for example, an inductive coupler or a capacitive coupler. One or more of the antenna systems can be configured to use carrier aggregation by tuning the first and/or the second radiators. For example, one or more of the antenna systems can be configured to use inter-band aggregation, intra-band contiguous aggregation, and intra-band non-contiguous aggregation.

(21) Appl. No.: **14/671,470**

(22) Filed: **Mar. 27, 2015**





US 20160285167A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0285167 A1**
(43) **Pub. Date: Sep. 29, 2016**

(54) **MOBILE DEVICE AND MANUFACTURING METHOD THEREOF**

H01Q 5/50 (2006.01)
H01Q 1/48 (2006.01)

(71) Applicant: **HTC Corporation**, Taoyuan City (TW)

(52) **U.S. Cl.**
CPC . *H01Q 5/40* (2015.01); *H01Q 1/48* (2013.01);
H01Q 5/20 (2015.01); *H01Q 5/50* (2015.01)

(72) Inventors: **Tiao-Hsing TSAI**, Taoyuan City (TW);
Chien-Pin CHIU, Taoyuan City (TW);
Hsiao-Wei WU, Taoyuan City (TW);
Yi-Hsiang KUNG, Taoyuan City (TW);
Li-Yuan FANG, Taoyuan City (TW)

(57) **ABSTRACT**

(73) Assignee: **HTC Corporation**, Taoyuan City (TW)

A mobile device includes a ground plane, a ground branch, a supporting element, and a circuit element. The ground branch is coupled to the ground plane. A slot is formed between the ground branch and the ground plane. The supporting element is positioned above the ground branch, and a vertical projection of the supporting element at least partially overlaps the ground branch. The circuit element is coupled between the ground branch and the ground plane. A first antenna structure is formed by the ground branch. The first antenna structure is excited by a first signal source. A second antenna structure is disposed on the supporting element. The second antenna structure is excited by a second signal source.

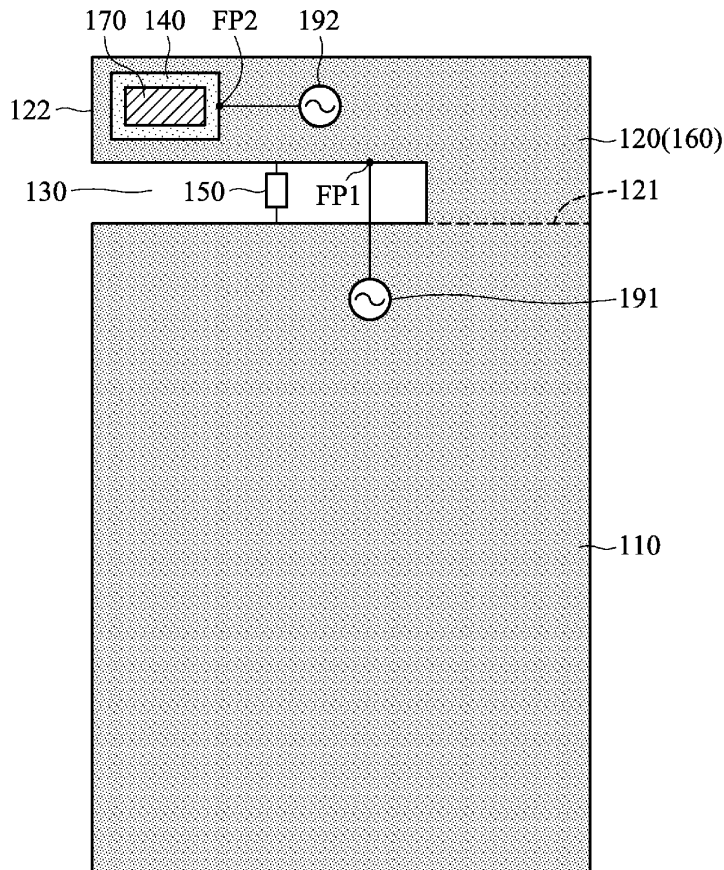
(21) Appl. No.: **14/666,450**

(22) Filed: **Mar. 24, 2015**

Publication Classification

(51) **Int. Cl.**
H01Q 5/40 (2006.01)
H01Q 5/20 (2006.01)

100





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(19) **United States**

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

(10) **Pub. No.: US 2016/0294042 A1**

(43) **Pub. Date: Oct. 6, 2016**

(54) **LOOP-SHAPED ANTENNA AND MOBILE TERMINAL**

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

CPC **H01Q 1/243** (2013.01); **H01Q 7/00** (2013.01); **H01Q 1/48** (2013.01)

(71) Applicant: **HUAWEI DEVICE CO., LTD.**,
Shenzhen, Guangdong (CN)

(57) **ABSTRACT**

(72) Inventors: **Hanyang WANG**, Shenzhen (CN); **Bo MENG**, Shenzhen (CN)

A loop-shaped antenna is disposed in a mobile terminal, where the mobile terminal includes a metal back cover at least partially covers the loop-shaped antenna; the loop-shaped antenna includes a feeding matching circuit, a grounding circuit, and a radiation portion, where the radiation portion is connected between the feeding matching circuit and the grounding circuit, and the radiation portion is of a symmetrical loop-shaped structure; the grounding circuit includes a switch component and an inductor, where the switch component and the inductor are connected in parallel and between ground and the radiation portion; the feeding matching circuit includes a feeding end and a variable capacitor, where the variable capacitor is connected between the feeding end and the radiation portion; and the feeding matching circuit is configured to adjust impedance matching of the loop-shaped antenna, and the grounding circuit is configured to adjust a resonance frequency of the loop-shaped antenna.

(21) Appl. No.: **15/037,290**

(22) PCT Filed: **Dec. 31, 2013**

(86) PCT No.: **PCT/CN2013/091195**

§ 371 (c)(1),

(2) Date: **May 17, 2016**

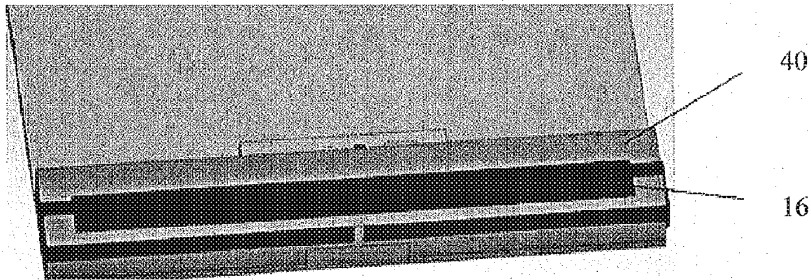
Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/48 (2006.01)

H01Q 7/00 (2006.01)





US 20160294046A1

(19) **United States**

(12) **Patent Application Publication**
Hsieh

(10) **Pub. No.: US 2016/0294046 A1**
(43) **Pub. Date: Oct. 6, 2016**

(54) **RADIO-FREQUENCY DEVICE AND WIRELESS COMMUNICATION DEVICE FOR ENHANCING ANTENNA ISOLATION**

(52) **U.S. CL.**
CPC **H01Q 1/38** (2013.01); **H01Q 9/0407** (2013.01)

(71) Applicant: **Wistron NeWeb Corporation**, Hsinchu (TW)

(57) **ABSTRACT**

(72) Inventor: **Chia-Hsing Hsieh**, Hsinchu (TW)

(21) Appl. No.: **14/934,116**

(22) Filed: **Nov. 5, 2015**

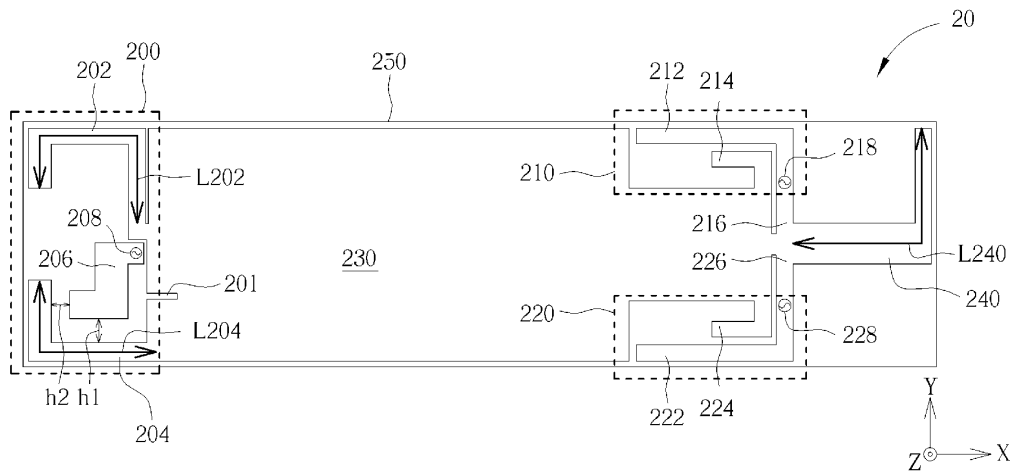
(30) **Foreign Application Priority Data**

Mar. 31, 2015 (TW) 104110483

Publication Classification

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

A radio-frequency device includes a grounding element, a first antenna including a first parasitic element, a second antenna, a third antenna and a second parasitic element, wherein the grounding element is shared by the first, second and third antennas, the second parasitic element is electrically connected to the grounding element for guiding a first reflected signal from the first antenna to the second parasitic element, and the first parasitic element is electrically connected to the grounding element for guiding a second and third reflected signals from the second and third antennas to the first parasitic element, so as to enhance isolations of the first, second and third antennas.





US 20160294048A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0294048 A1**

(43) **Pub. Date: Oct. 6, 2016**

(54) **ANTENNA AND TERMINAL**

H01Q 1/22 (2006.01)

H01Q 1/48 (2006.01)

(71) Applicant: **HUAWEI DEVICE CO., LTD.**,
Shenzhen (CN)

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

CPC *H01Q 1/38* (2013.01); *H01Q 1/48*
(2013.01); *H01Q 1/243* (2013.01); *H01Q*
1/2291 (2013.01)

(72) Inventors: **Huiliang Xu**, Shenzhen (CN);
Hanyang Wang, Shenzhen (CN);
Shuhui Sun, Shenzhen (CN)

(57)

ABSTRACT

An antenna and a terminal, where the antenna includes a first antenna branch, printed on a first surface of a circuit board, where the first antenna branch includes a first sub-branch; a grounding branch, printed on the first surface, where the grounding branch includes a grounding sub-branch, the first sub-branch and the grounding sub-branch are staggered to form a gap, and the first antenna branch and the grounding branch are mutually coupled through the gap; a second antenna branch, printed on a second surface of the circuit board, where the second surface and the first surface are two opposite surfaces of the circuit board; and a first feed, electrically connected to the first antenna branch; where the second antenna branch is electrically connected to a metal via hole on the circuit board, and the metal via hole is electrically connected to the first feed.

(21) Appl. No.: **15/034,825**

(22) PCT Filed: **Mar. 13, 2014**

(86) PCT No.: **PCT/CN2014/073408**

§ 371 (c)(1),

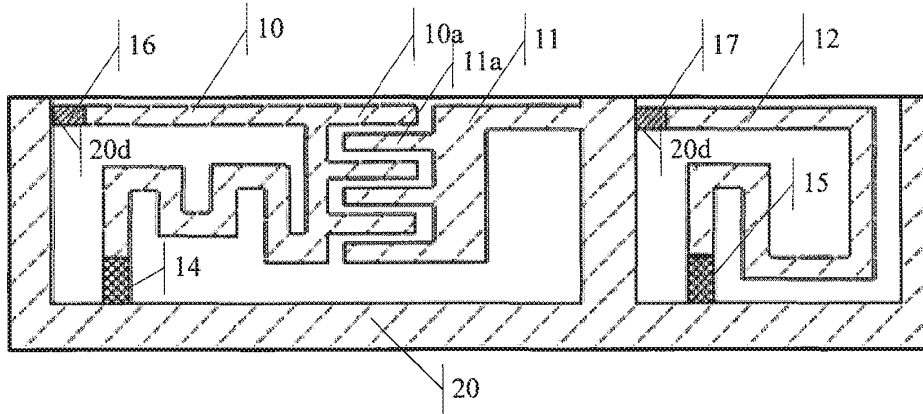
(2) Date: **May 5, 2016**

Publication Classification

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)





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(19) **United States**

(12) **Patent Application Publication**
Chiu

(10) **Pub. No.: US 2016/0294057 A1**

(43) **Pub. Date: Oct. 6, 2016**

(54) **MULTI-ARM TRAP ANTENNA**

(57)

ABSTRACT

(71) Applicant: **Hung-Hsien Chiu**, Hsinchu City (TW)

(72) Inventor: **Hung-Hsien Chiu**, Hsinchu City (TW)

(21) Appl. No.: **14/672,249**

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

A multi-arm trap antenna for use with a wireless communication device includes at least two arms, each of which includes at least one arm segment; at least one wave trapping assembly, which includes an electrical inductor electrically connecting the arm segments of the arms; a signal feeding element, which electrically connects a radio frequency signal positive to at least one of the arms; and a grounding element, which is electrically connected to a radio frequency signal negative for grounding to form a monopole antenna, or electrically connects the radio frequency signal positive to the arms to which the radio frequency signal positive is electrically connected to form an inverted F-shaped antenna, or electrically connects the radio frequency signal negative to at least one of the arms to form an aperture-coupled antenna. The arms are arranged adjacent to the grounding element in a low-profile bent manner to reduce height.

Publication Classification

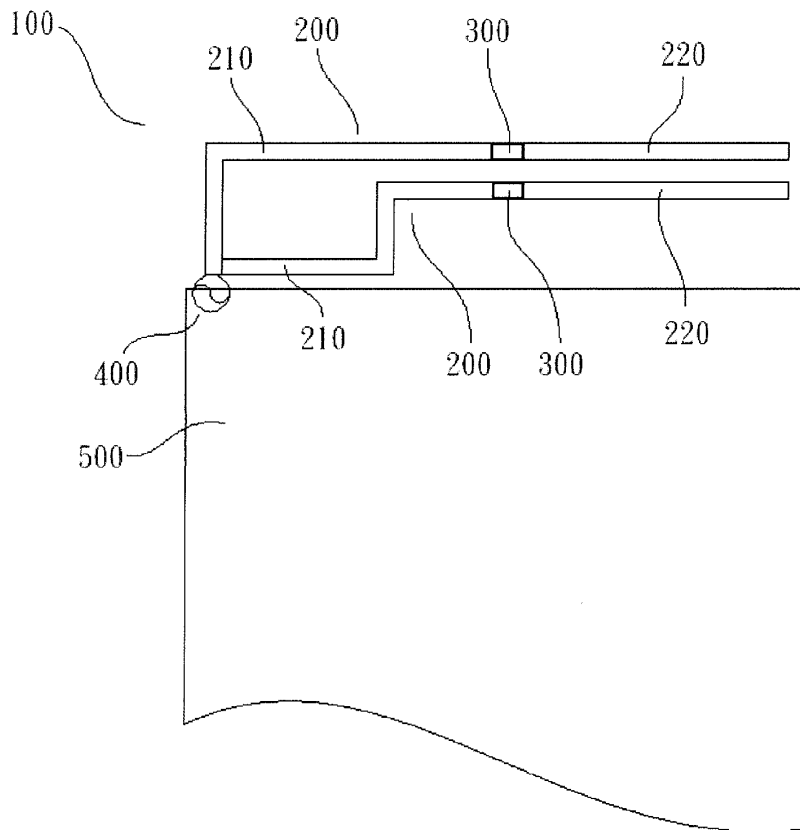
(51) **Int. Cl.**

H01Q 5/10 (2006.01)

H01Q 1/38 (2006.01)

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

CPC ... **H01Q 5/10** (2015.01); **H01Q 1/38** (2013.01)





US 20160294060A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0294060 A1**

(43) **Pub. Date: Oct. 6, 2016**

(54) **TUNABLE ANTENNA AND TERMINAL**

H01Q 1/48 (2006.01)

H01Q 5/364 (2006.01)

(71) Applicant: **HUAWEI DEVICE CO., LTD.**,
Shenzhen (CN)

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

CPC *H01Q 7/005* (2013.01); *H01Q 5/364*

(2015.01); *H01Q 9/42* (2013.01); *H01Q 1/48*
(2013.01)

(72) Inventors: **Bo Meng**, Shenzhen (CN); **Yi Fan**,
Shenzhen (CN); **Wanji An**, Shenzhen
(CN); **Hanyang Wang**, Shenzhen (CN);
Dongxing Tu, Shenzhen (CN); **Shuhui
Sun**, Shenzhen (CN)

(57)

ABSTRACT

The present disclosure discloses a tunable antenna and a terminal. The tunable antenna includes a circuit board, an antenna body configured to transmit and receive a signal of a first frequency band and including a feed end and a ground pin, where the feed end is disposed on the circuit board, and an electrical tuning network, where a ground point disposed on the circuit board is connected to the ground pin of the antenna body by using the electrical tuning network, and the electrical tuning network includes an inductor and a first tunable capacitor with a tunable capacitance value, where a load value of the inductor is changed by tuning a first capacitance value of the first tunable capacitor, so that a first effective electrical length of the antenna body is changed.

(21) Appl. No.: **15/038,132**

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

(86) PCT No.: **PCT/CN2013/087702**

§ 371 (c)(1),

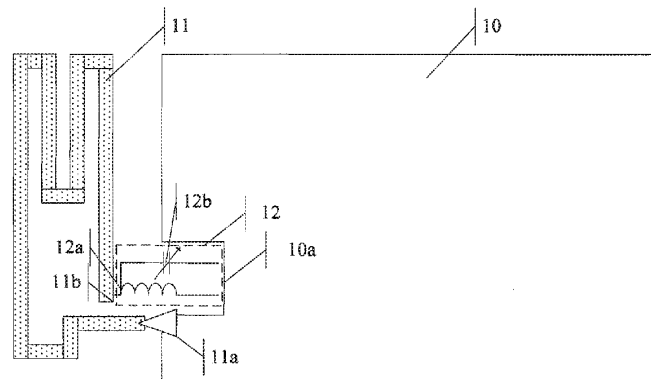
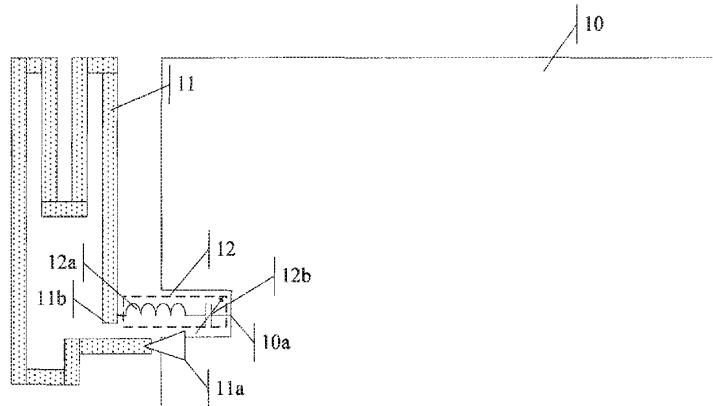
(2) Date: **May 20, 2016**

Publication Classification

(51) **Int. Cl.**

H01Q 7/00 (2006.01)

H01Q 9/42 (2006.01)





US 20160294061A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2016/0294061 A1**
Harper (43) **Pub. Date: Oct. 6, 2016**

(54) **INTEGRATED ANTENNA STRUCTURE**

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

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

CPC **H01Q 9/0414** (2013.01); **H01Q 1/38**
(2013.01)

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

(57) **ABSTRACT**

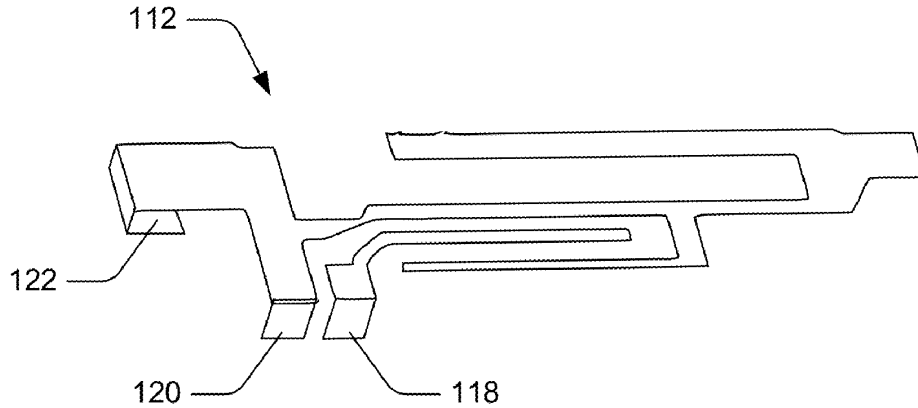
(21) Appl. No.: **14/673,314**

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

Techniques for implementing an integrated antenna structure are described. In at least some implementations, the integrated antenna structure includes an antenna that is folded and/or meandered in design to enable the antenna to be incorporated into a compact area. The integrated antenna structure further includes the antenna electrically attached to a chassis of a device. According to various implementations, the antenna and the chassis combine to form an integrated radiating structure that enables the device to send and/or receive wireless signals.

Publication Classification

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





US 20160294062A1

(19) **United States**

(12) **Patent Application Publication**
LO HINE TONG et al.

(10) **Pub. No.: US 2016/0294062 A1**

(43) **Pub. Date: Oct. 6, 2016**

(54) **MULTI-BAND ANTENNA**

(71) Applicant: **THOMSON LICENSING**, Issy de
Moulineaux (FR)

(72) Inventors: **Dominique LO HINE TONG**, Rennes
(FR); **Philippe MINARD**, Saint Medard
Sur Ille (FR); **Jean-Luc ROBERT**,
Betton (FR)

(21) Appl. No.: **14/880,710**

(22) PCT Filed: **Apr. 10, 2014**

(86) PCT No.: **PCT/EP2014/057315**

§ 371 (c)(1),

(2) Date: **Oct. 12, 2015**

(30) **Foreign Application Priority Data**

Apr. 12, 2013 (EP) 13305482.5

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/22 (2006.01)

H01Q 9/42 (2006.01)

H01Q 21/30 (2006.01)

H01Q 1/48 (2006.01)

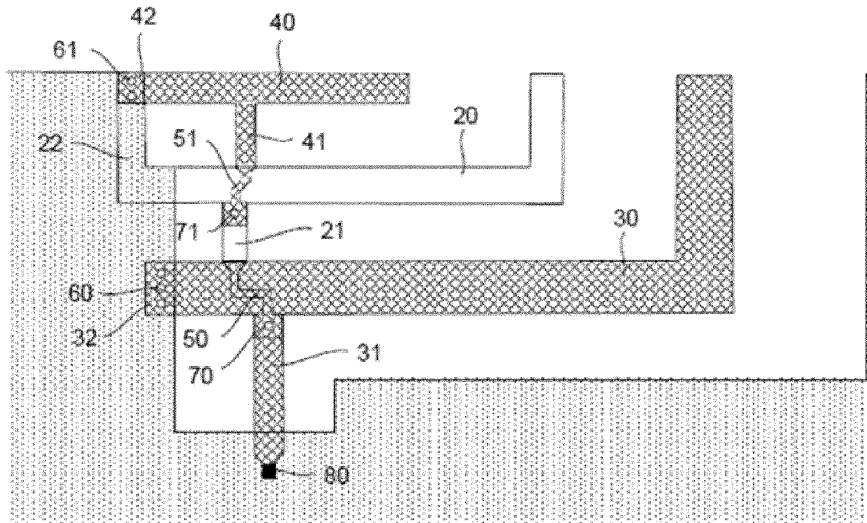
H01Q 5/40 (2006.01)

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

CPC **H01Q 9/0421** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 5/40** (2015.01); **H01Q 9/42**
(2013.01); **H01Q 21/30** (2013.01); **H01Q**
1/2291 (2013.01)

(57) **ABSTRACT**

The present invention relates to multi-band antenna. This antenna comprises a substrate and at least one conductive layer provided with a plurality of antennas, such as PIFAs, resonating in specific frequency bands. The antennas are cascaded in order to achieve a compact antenna. The first antenna comprises a first radiating element, a first feed element connected to said first radiating element and a first ground return element and the second antennas comprises a second radiating element, a second feed element connected to said second radiating element and a second ground return element. The ground plane is printed in the same layer as the first or second antenna.





US 20160301140A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0301140 A1**
(43) **Pub. Date: Oct. 13, 2016**

(54) **PRINTED COUPLED-FED MULTI-BAND ANTENNA AND ELECTRONIC SYSTEM**

(52) **U.S. Cl.**
CPC **H01Q 9/0457** (2013.01); **H01Q 9/065** (2013.01); **H01Q 1/38** (2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **JIAN-JHIH DU**, TAIPEI CITY (TW);
JING-TENG CHANG, HSINCHU COUNTY (TW)

The disclosure is related to a printed coupled-fed multi-band antenna, and a related electronic system. The antenna includes a first antenna member structurally with a mushroom-shaped radiation portion and an antenna connection portion being electrically connected with a ground plane. The mushroom-shaped radiation portion is employed to activate first band electromagnetic wave. The antenna includes a second antenna member, which may be shaped as a U-shaped radiation portion. The second antenna member is floating within a region surrounded by the mushroom-shaped radiation portion, the antenna connection portion and the ground plane. The U-shaped radiation portion is coupled with both the ground plane and the mushroom-shaped radiation portion. The coupling effect allows the second antenna member to activate a second band electromagnetic wave. The multiple band signaling paths are formed over the printed antenna for application of a multi-band antenna.

(21) Appl. No.: **14/846,852**

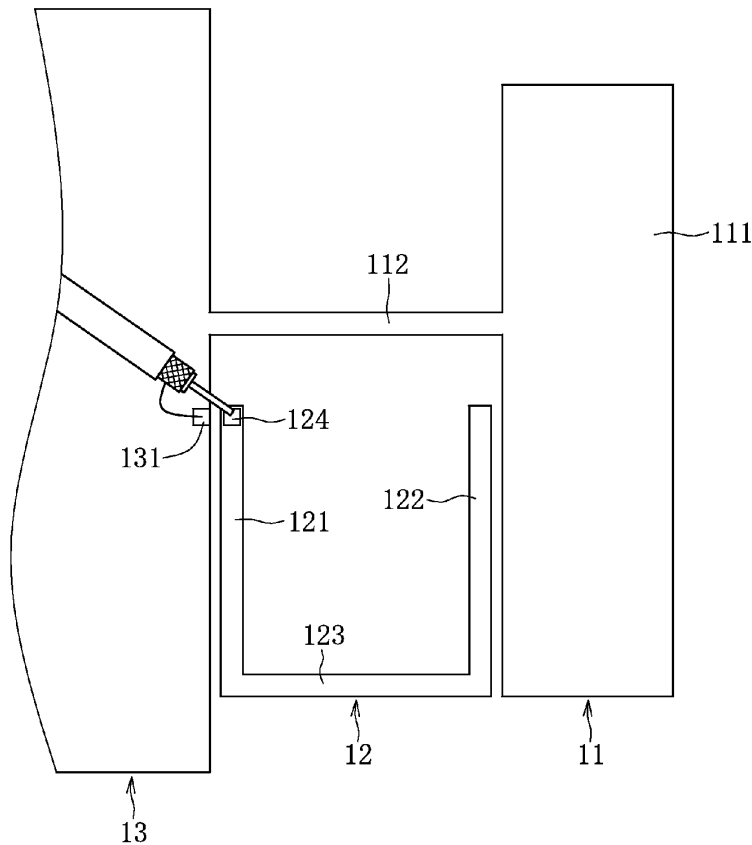
(22) Filed: **Sep. 7, 2015**

(30) **Foreign Application Priority Data**

Apr. 8, 2015 (TW) 104111239

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/38 (2006.01)
H01Q 9/06 (2006.01)





US 20160301145A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0301145 A1**

(43) **Pub. Date: Oct. 13, 2016**

(54) **ANTENNA APPARATUS**

Publication Classification

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

(51) **Int. Cl.**
H01Q 21/28 (2006.01)
H01Q 1/52 (2006.01)
H01Q 1/38 (2006.01)

(72) Inventors: **Ho Jin LEE**, Suwon-si (KR); **Hee Jun PARK**, Suwon-si (KR); **Jong Yun KIM**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 21/28* (2013.01); *H01Q 1/38* (2013.01); *H01Q 1/521* (2013.01)

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

(57) **ABSTRACT**

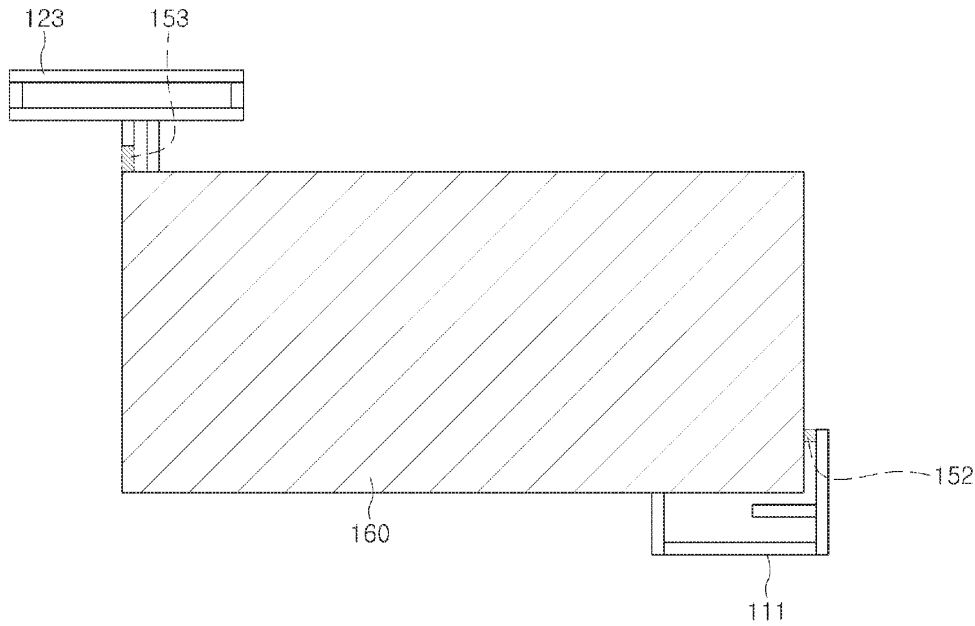
(21) Appl. No.: **15/075,958**

(22) Filed: **Mar. 21, 2016**

(30) **Foreign Application Priority Data**

Apr. 8, 2015 (KR) 10-2015-0049616
Sep. 1, 2015 (KR) 10-2015-0123693

An antenna apparatus includes, a substrate, a first antenna pattern extending from the substrate in a lateral direction and configured to transmit and receive first communications signals, and a second antenna pattern spaced apart from the first antenna pattern, extending from the substrate in another lateral direction, and configured to transmit and receive second communications signals.





US 20160308271A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0308271 A1**
(43) **Pub. Date: Oct. 20, 2016**

(54) **ELECTRONIC DEVICE WITH PERIPHERAL HYBRID ANTENNA**

H04B 1/388 (2006.01)
H01Q 1/48 (2006.01)

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

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 1/48** (2013.01); **H01Q 1/50** (2013.01); **H04B 1/3888** (2013.01)

(72) Inventors: **Nanbo Jin**, Milpitas, CA (US); **Anand Lakshmanan**, San Jose, CA (US); **Enrique Ayala Vazquez**, Watsonville, CA (US); **Erica J. Tong**, Pacifica, CA (US); **Hongfei Hu**, Santa Clara, CA (US); **Matthew A. Mow**, Los Altos, CA (US); **Mattia Pascolini**, San Francisco, CA (US); **Ming-Ju Tsai**, Cupertino, CA (US)

(57) **ABSTRACT**

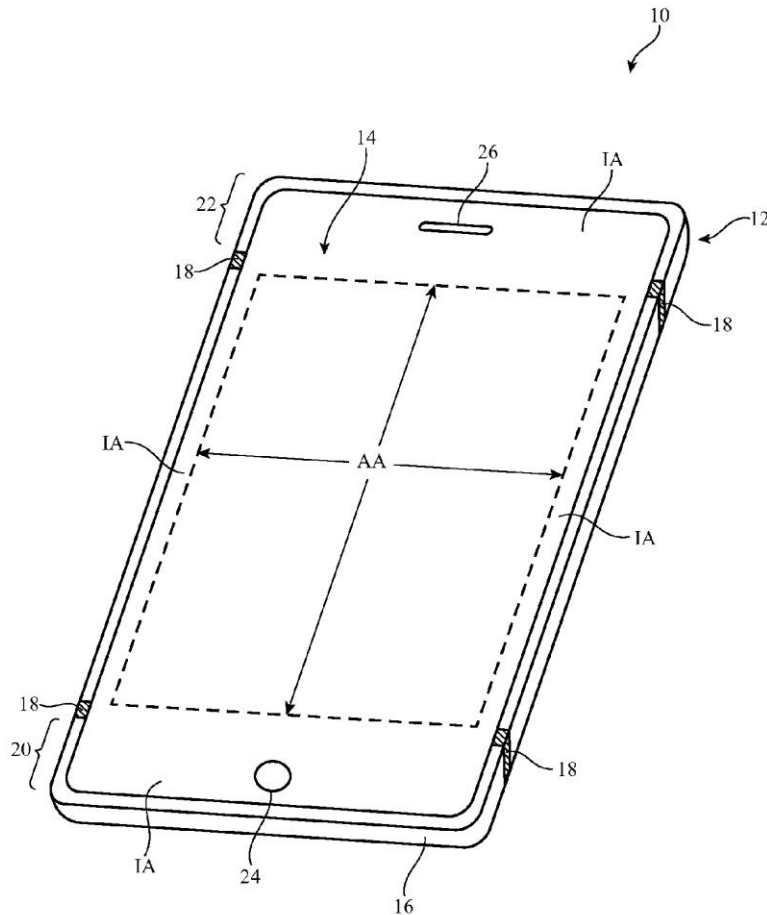
An electronic device may have wireless circuitry with antennas. An antenna resonating element arm for an antenna may be formed from peripheral conductive structures running along the edges of a device housing. Elongated conductive members may longitudinally divide openings between the peripheral conductive housing structures and the ground. The elongated conductive members may extend from an internal ground to outer ends of the elongated conductive members that are located adjacent to the gaps. Transmission lines may extend along the elongated conductive members to antenna feeds at the outer ends. The elongated conductive members may form open slots that serve as slot antenna resonating elements for the antenna.

(21) Appl. No.: **14/691,304**

(22) Filed: **Apr. 20, 2015**

Publication Classification

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





US 20160308274A1

(19) **United States**

(12) **Patent Application Publication**
MATSUMOTO

(10) **Pub. No.: US 2016/0308274 A1**
(43) **Pub. Date: Oct. 20, 2016**

(54) **PORTABLE TERMINAL**

Publication Classification

- (71) Applicant: **KYOCERA Corporation**, Kyoto-shi (JP)
- (72) Inventor: **Takafumi MATSUMOTO**, Osaka (JP)
- (73) Assignee: **KYOCERA Corporation**
- (21) Appl. No.: **15/192,805**
- (22) Filed: **Jun. 24, 2016**

- (51) **Int. Cl.**
H01Q 1/44 (2006.01)
H01Q 1/36 (2006.01)
H01Q 1/40 (2006.01)
H04M 1/02 (2006.01)
H01Q 1/24 (2006.01)
H01Q 9/42 (2006.01)
- (52) **U.S. Cl.**
 CPC *H01Q 1/44* (2013.01); *H01Q 1/243* (2013.01); *H01Q 9/42* (2013.01); *H01Q 1/40* (2013.01); *H04M 1/0283* (2013.01); *H01Q 1/36* (2013.01)

Related U.S. Application Data

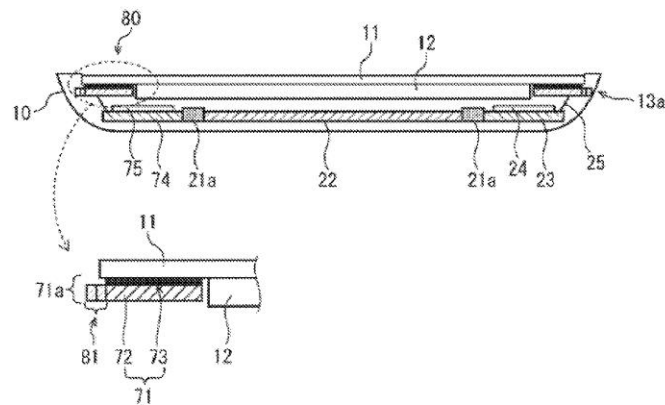
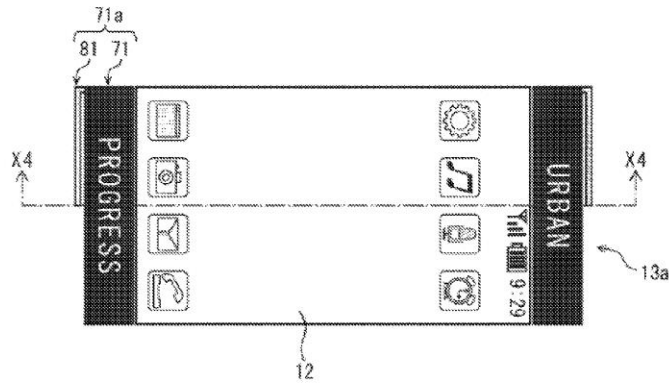
- (63) Continuation of application No. PCT/JP2014/084056, filed on Dec. 24, 2014.

Foreign Application Priority Data

- Dec. 24, 2013 (JP) 2013-265922

(57) **ABSTRACT**

A portable terminal comprises a display and an antenna for wireless communication made of a metal. At least a part of the antenna includes a metallic decoration. The display and the metallic decoration are located in a manner visually recognizable from a specific surface.





US 20160308281A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0308281 A1**

(43) **Pub. Date: Oct. 20, 2016**

(54) **ANTENNA STRUCTURE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 5/371 (2006.01)

(72) Inventors: **Kun-Sheng CHANG**, New Taipei City (TW); **Ching-Chi LIN**, New Taipei City (TW); **Chung-Wen YANG**, New Taipei City (TW); **Chuan-Chun WANG**, New Taipei City (TW); **Kuan-Jen CHUNG**, New Taipei City (TW)

(52) **U.S. Cl.**
CPC **H01Q 5/371** (2015.01)

(57) **ABSTRACT**

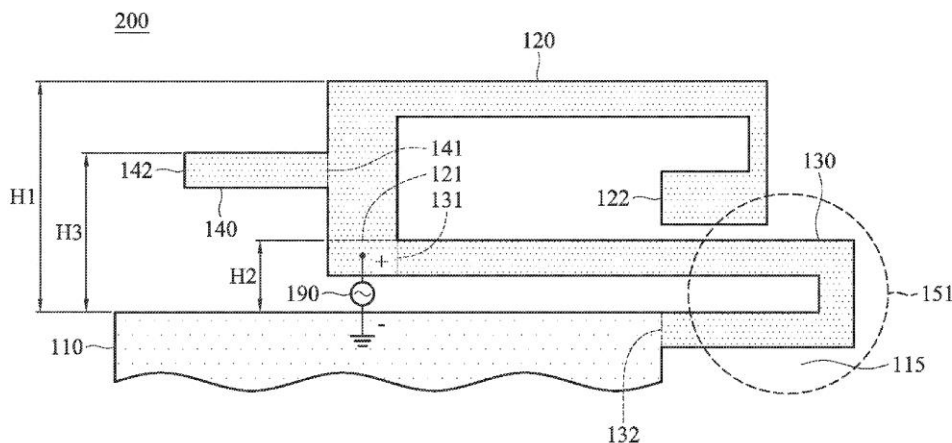
An antenna structure includes a ground element, a first radiation branch, and a second radiation branch. The first radiation branch has a first end and a second end. The first end of the first radiation branch is coupled to a signal source. The second end of the first radiation branch is open. The second radiation branch has a first end and a second end. The first end of the second radiation branch is coupled to the signal source. The second end of the second radiation branch is coupled to the ground element. The length of the second radiation branch is substantially equal to that of the first radiation branch.

(21) Appl. No.: **14/755,240**

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

(30) **Foreign Application Priority Data**

Apr. 16, 2015 (TW) 104112169





US 20160308282A1

(19) **United States**

(12) **Patent Application Publication**
CHANG

(10) **Pub. No.: US 2016/0308282 A1**

(43) **Pub. Date: Oct. 20, 2016**

(54) **ANTENNA STRUCTURE**

Publication Classification

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

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

(72) Inventor: **Kun-Sheng CHANG**, New Taipei City (TW)

(52) **U.S. Cl.**
CPC **H01Q 9/0421** (2013.01)

(21) Appl. No.: **14/799,871**

(57) **ABSTRACT**

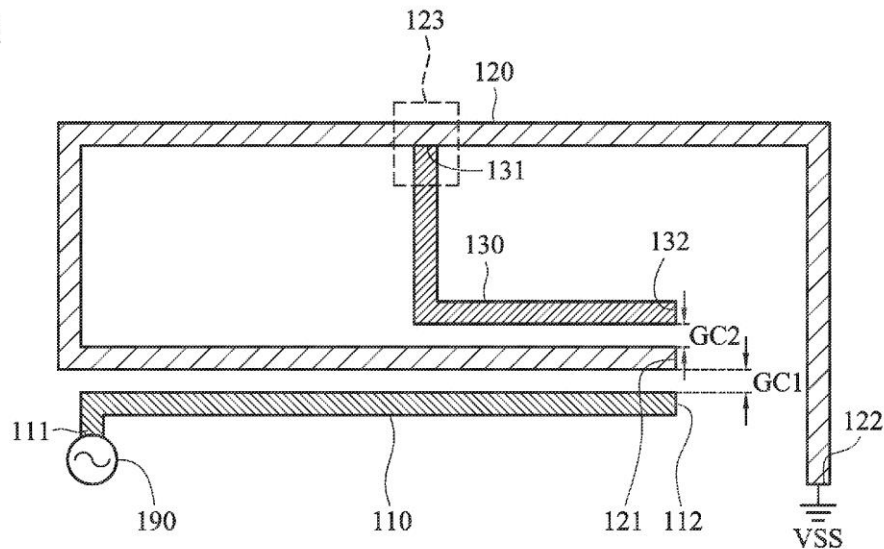
(22) Filed: **Jul. 15, 2015**

An antenna structure includes a feeding element, a first radiation element, and a second radiation element. The feeding element is coupled to a signal source. The first radiation element is coupled to a ground voltage. The first radiation element is disposed adjacent to the feeding element. The second radiation element is coupled to the first radiation element. The second radiation element is substantially surrounded by the first radiation element.

(30) **Foreign Application Priority Data**

Apr. 17, 2015 (TW) 104112324

100





US 20160308576A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0308576 A1**

(43) **Pub. Date: Oct. 20, 2016**

(54) **HIGH BAND TDD ANTENNA SWAPPING METHOD WITH IMPROVED RECEIVER SENSITIVITY**

(52) **U.S. Cl.**
CPC **H04B 1/48** (2013.01); **H04B 1/3833** (2013.01); **H04L 5/1469** (2013.01)

(71) Applicant: **RF Micro Devices, Inc.**, Greensboro, NC (US)

(57) **ABSTRACT**

(72) Inventors: **Nadim Khlat**, Cugnaux (FR); **Marcus Granger-Jones**, Scotts Valley, CA (US)

(21) Appl. No.: **15/062,693**

(22) Filed: **Mar. 7, 2016**

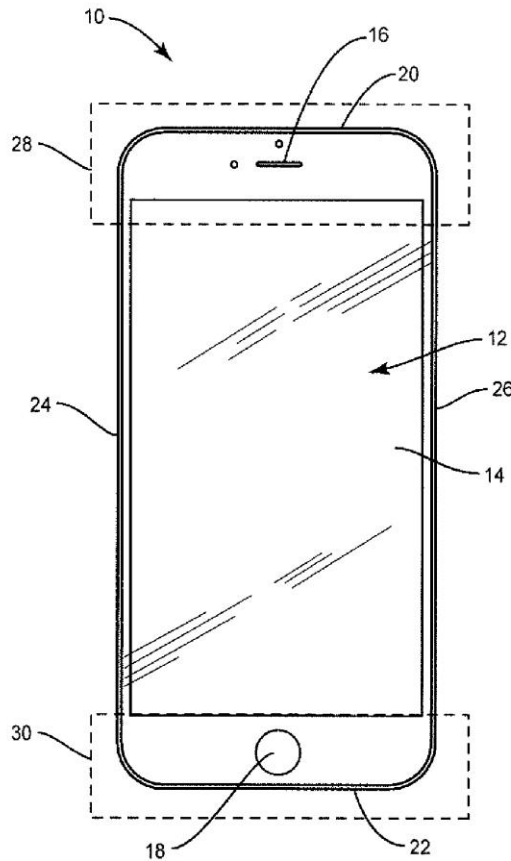
Related U.S. Application Data

(60) Provisional application No. 62/148,838, filed on Apr. 17, 2015.

Publication Classification

(51) **Int. Cl.**
H04B 1/48 (2006.01)
H04L 5/14 (2006.01)
H04B 1/3827 (2006.01)

This disclosure relates to radio frequency (RF) front end circuitry for portable communication devices. In one embodiment, the RF front end circuitry includes an antenna, a switchable receive path configured to be opened and to be closed, a coaxial cable, and a low noise amplifier (LNA). The LNA is coupled so as to drive the coaxial cable. Thus, when the switchable receive path is closed, an RF receive signal received by the antenna can propagate through the switchable receive path to the LNA. Since the LNA is driving the coaxial cable, the RF receive signal can propagate through the coaxial cable without being excessively degraded. In this manner, embodiments of the RF front end circuitry can be utilized to provide antenna swapping and RF transceiver circuitry coupled to the coaxial cable can receive the RF receive signal from the coaxial cable without excessive degradation.





US 20160309007A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0309007 A1**

(43) **Pub. Date: Oct. 20, 2016**

(54) **REMOVABLE ELECTRONIC DEVICE CASE WITH SUPPLEMENTAL WIRELESS CIRCUITRY**

(52) **U.S. Cl.**
CPC **H04M 1/026** (2013.01); **H04B 1/3888** (2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **Erdinc Irci**, Santa Clara, CA (US); **Enrique Ayala Vazquez**, Watsonville, CA (US); **Hongfei Hu**, Santa Clara, CA (US); **Mattia Pascolini**, San Francisco, CA (US); **Ruben Caballero**, San Jose, CA (US)

A removable case may receive an electronic device. A male connector in the case may mate with a female connector in the device. A battery in the case may supply power to the device through the male connector. The electronic device may have an antenna formed from peripheral conductive housing structures and an antenna ground. The antenna may include a slot antenna resonating element. The case may have supplemental antenna structures such as a metal patch that overlaps an end of the slot antenna resonating element to retune the slot antenna resonating element to a desired operating frequency after being detuned by dielectric loading from the case. The supplemental antenna structures may overlap antennas of other types and may include tunable circuitry that is adjusted based on information received from the electronic device.

(21) Appl. No.: **14/685,904**

(22) Filed: **Apr. 14, 2015**

Publication Classification

(51) **Int. Cl.**
H04M 1/02 (2006.01)
H04B 1/3888 (2006.01)

