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(19) **United States**

(12) **Patent Application Publication**

OGURI et al.

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(43) **Pub. Date: Sep. 28, 2017**

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

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

(72) Inventors: **Shinya OGURI**, Nagaokakyo-shi (JP); **Wataru TAMURA**, Nagaokakyo-shi (JP); **Fumie MATSUDA**, Nagaokakyo-shi (JP); **Takahiro BABA**, Nagaokakyo-shi (JP)

(21) Appl. No.: **15/618,228**

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Related U.S. Application Data

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(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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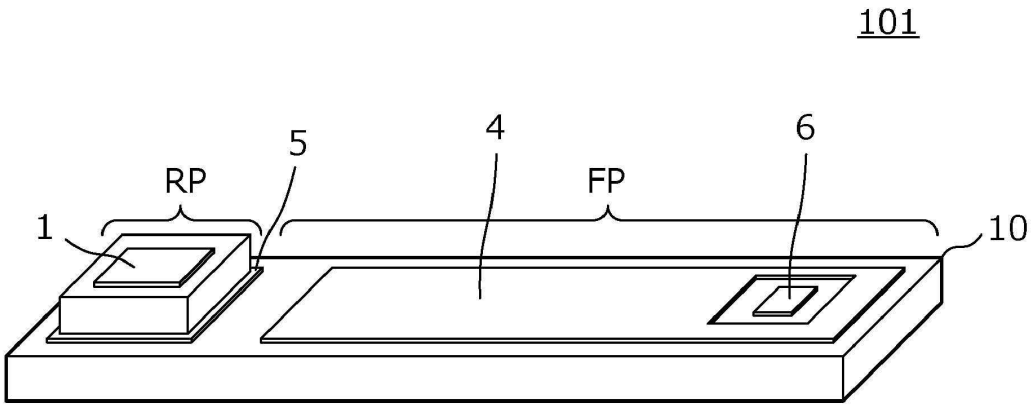
H01Q 1/50	(2006.01)
H05K 1/02	(2006.01)

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

CPC ***H01P 3/08*** (2013.01); ***H05K 1/028*** (2013.01); ***H03H 7/38*** (2013.01); ***H01Q 1/50*** (2013.01)

(57) **ABSTRACT**

An antenna module includes a resin multilayer substrate including a plurality of base materials that are flexible. The resin multilayer substrate includes a rigid portion at which a first number of stacked layers of the base materials is relatively large and a flexible portion at which a second number of stacked layers of the base materials is relatively small. A radiating element including a conductor pattern is provided at the rigid portion. A transmission line including a conductor pattern and electrically connected to the radiating element is provided at the flexible portion. A frame-shaped conductor that surrounds the radiating element when viewed in a direction in which the base materials are stacked is provided at either the rigid portion or the flexible portion, or both the rigid portion and the flexible portion.



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(19) **United States**

(12) **Patent Application Publication**

Hung et al.

(10) **Pub. No.: US 2017/0279185 A1**

(43) **Pub. Date: Sep. 28, 2017**

(54) **ANTENNA WITH SWAPPABLE RADIATION DIRECTION AND COMMUNICATION DEVICE THEREOF**

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

(72) Inventors: **Chung-Yu Hung**, Taipei City (TW); **Chen-Fang Tai**, New Taipei City (TW); **Wun-Jian Lin**, Kaohsiung City (TW); **Shih-Huang Yeh**, Hsinchu City (TW)

(21) Appl. No.: **15/394,713**

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

Related U.S. Application Data

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Publication Classification

(51) **Int. Cl.**

H01Q 1/24	(2006.01)
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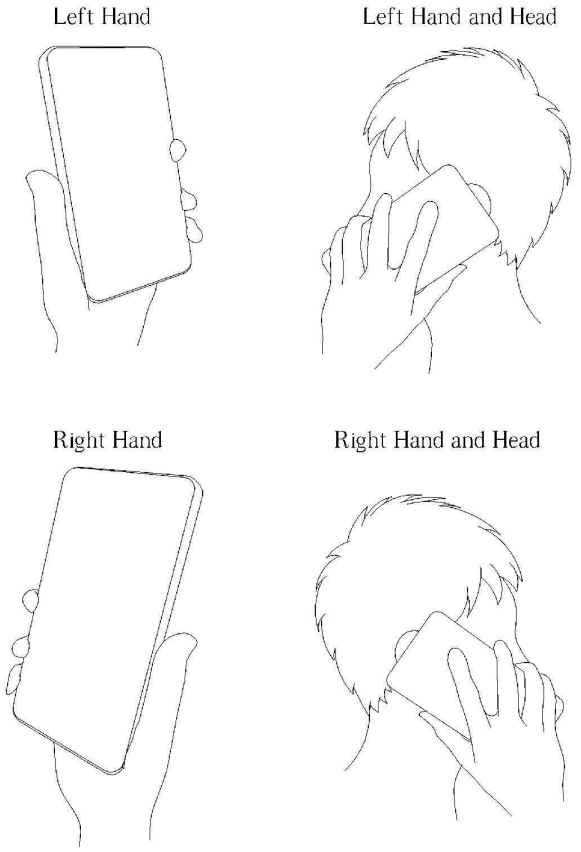
H01Q 7/00	(2006.01)
H01Q 1/22	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 1/245*** (2013.01); ***H01Q 1/2266*** (2013.01); ***H01Q 9/0442*** (2013.01); ***H01Q 7/00*** (2013.01); ***H01Q 3/24*** (2013.01)

(57) **ABSTRACT**

An antenna with swappable and selective radiation direction includes a first arm, a second arm electrically connected to the first arm, a third arm is electrically connected to the first arm, a first impedance tuning circuit coupled to the second arm for connecting the second arm to a ground or a first matching component according to a control signal, and a second impedance tuning circuit coupled to the third arm for connecting the third arm to the ground or a second matching component according to the control signal. By tuning impedance of the antenna, the antenna operates in a first mode corresponding to a first radiation direction or a second mode corresponding to a second radiation direction.



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(43) **Pub. Date: Oct. 5, 2017**

ZHONG et al.

(54) **WIFI ANTENNA DEVICE**

(71) Applicant: **Molex, LLC**, Lisle, IL (US)

(72) Inventors: **Guang-Yong ZHONG**, Shanghai (CN); **Soon-Kuan TAN**, Shanghai (CN)

(73) Assignee: **Molex, LLC**, Lisle, IL (US)

(21) Appl. No.: **15/451,988**

(22) Filed: **Mar. 7, 2017**

(30) **Foreign Application Priority Data**

Mar. 31, 2016 (CN) 201610196020.X

Publication Classification

(51) **Int. Cl.**

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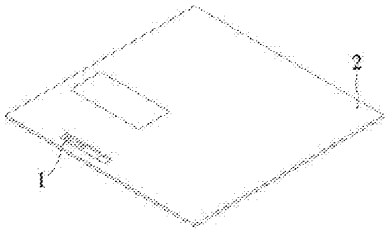
H01Q 1/36	(2006.01)
H01Q 1/48	(2006.01)

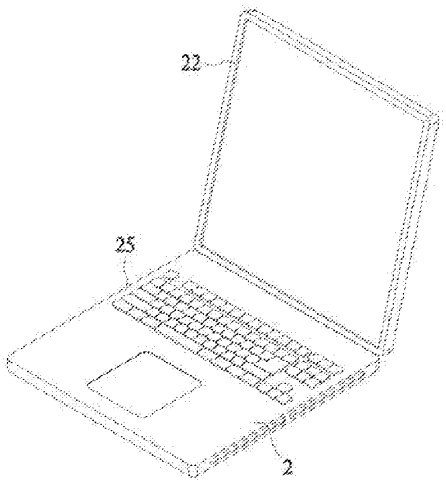
(52) **U.S. Cl.**

CPC ***H01Q 1/2291*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/36*** (2013.01); ***H01Q 1/2258*** (2013.01)

(57) **ABSTRACT**

The present disclosure discloses a WIFI antenna device, the WIFI antenna device includes a carrier, a grounding portion, a first radiation portion, a second radiation portion and a third radiation portion which all are provided on the carrier. The first radiation portion, the second radiation portion and the third radiation portion are coupled to the grounding portion. The coupling portion couples an electrical signal to the first radiation portion, the second radiation portion and the third radiation portion. The first radiation portion, the second radiation portion and the third radiation portion convert the electrical signal into the radiation signal. The first radiation portion determines a low frequency resonance point of a radiation signal emitted by the WIFI antenna device. The second radiation portion determines a first high frequency resonance point of the radiation signal. The third radiation portion determines a second high frequency resonance point of the radiation signal.





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(19) **United States**

(12) **Patent Application Publication**

Liu et al.

(10) **Pub. No.: US 2017/0288310 A1**

(43) **Pub. Date: Oct. 5, 2017**

(54) **ANTENNA APPARATUS AND DEVICE**

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

(72) Inventors: **Qing Liu**, Shenzhen (CN); **Yuzhen Zhang**, Wuhan (CN); **Yao Lan**, Shenzhen (CN); **Dingjie Wang**, Shenzhen (CN)

(73) Assignee: **Huawei Technologies Co., Ltd.**, Shenzhen (CN)

(21) Appl. No.: **15/507,313**

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§ 371 (c)(1),
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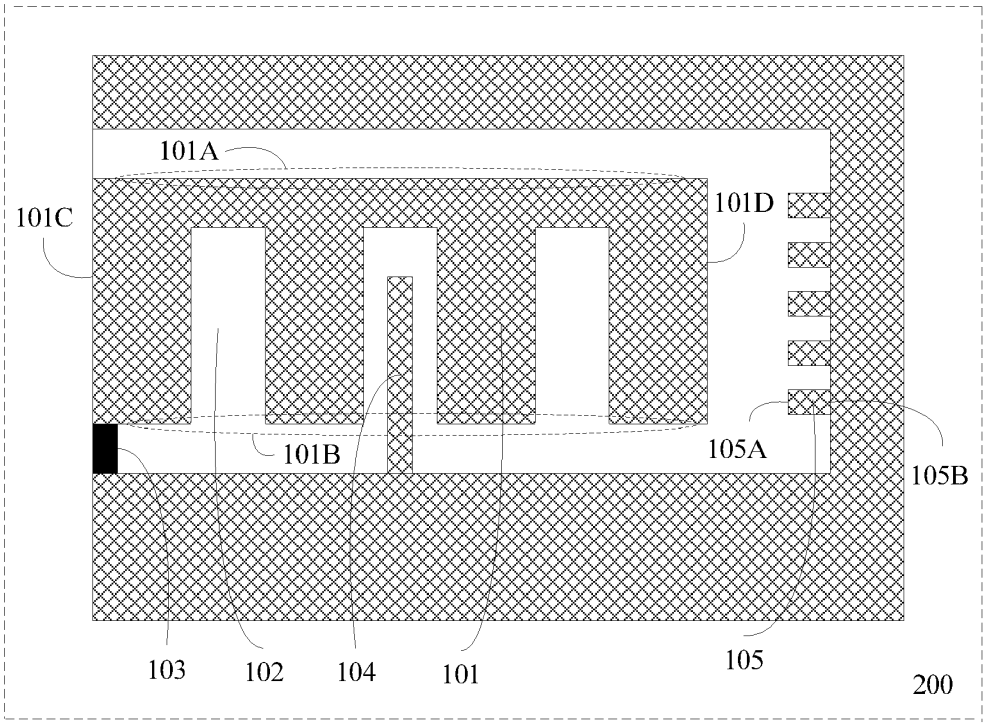
B32B 38/18	(2006.01)
H01Q 5/335	(2006.01)
H01L 21/67	(2006.01)
H01Q 5/342	(2006.01)

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

CPC ***H01Q 9/0421*** (2013.01); ***H01L 21/67144*** (2013.01); ***H01Q 5/342*** (2015.01); ***H01Q 5/335*** (2015.01); ***B32B 38/1841*** (2013.01)

(57) **ABSTRACT**

An antenna apparatus includes: an antenna radiator, at least one antenna cable trough, a feedpoint, and at least one first protruding metal strip; where the at least one antenna cable trough is disposed on the antenna radiator; the at least one antenna cable trough extends along a top edge to a bottom edge of the antenna radiator; the feedpoint is further disposed on the antenna radiator, and the feedpoint is disposed at an end of the bottom edge of the antenna radiator and is near a side edge of the antenna radiator; and the at least one first protruding metal strip is inserted in the antenna cable trough and is separated from the antenna radiator.



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(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2017/0288311 A1**

(43) **Pub. Date: Oct. 5, 2017**

ZHONG et al.

(54) **ANTENNA DEVICE**

(71) Applicant: **Molex, LLC**, Lisle, IL (US)

(72) Inventors: **Guang-Yong ZHONG**, Shanghai (CN); **Qiang LIU**, Shanghai (CN)

(73) Assignee: **Molex, LLC**, Lisle, IL (US)

(21) Appl. No.: **15/456,738**

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(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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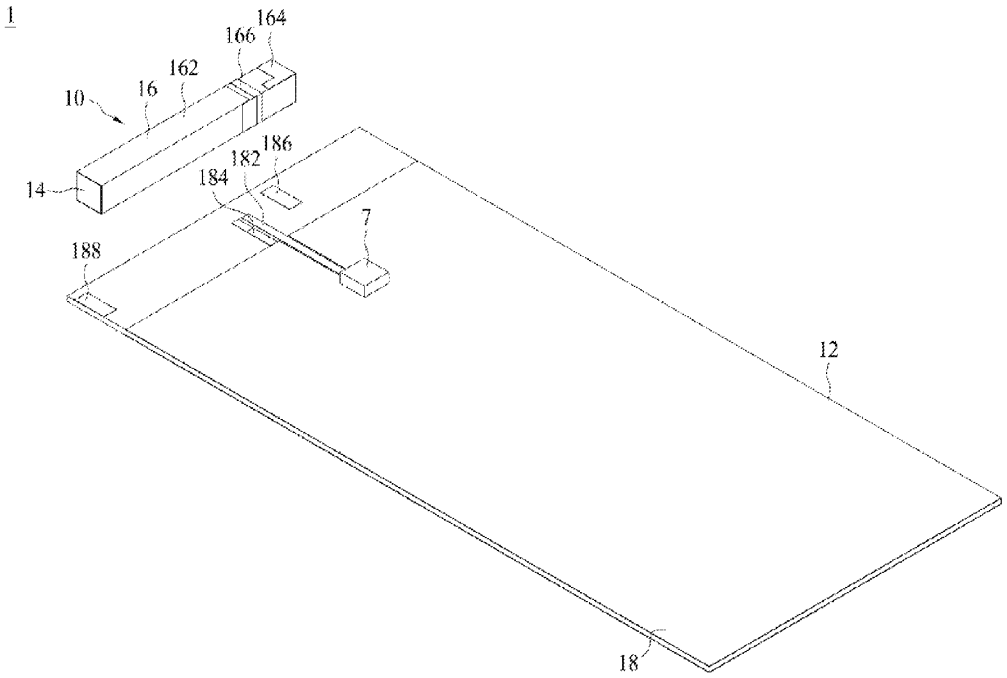
H01Q 5/22	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 9/0442*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 9/0421*** (2013.01); ***H01Q 5/22*** (2015.01)

(57) **ABSTRACT**

An antenna device comprises a carrier, a first radiation portion, a second radiation portion and a coupling portion. The first radiation portion, the second radiation portion and the coupling portion are provided on the carrier. The second radiation portion electrically connects with the first radiation portion. The first radiation portion and the second radiation portion share a shared part, the shared part is directly connected to a reference grounding. The coupling portion capacitively couples an electrical signal to the first radiation portion and the second radiation portion. The first radiation portion and the second radiation portion convert the electrical signal into a radiation signal emitted by the antenna device.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0294706 A1**

KOGA (43) **Pub. Date: Oct. 12, 2017**

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

(71) Applicant: **FUJITSU LIMITED**, Kawasaki-shi (JP)

(72) Inventor: **Yohei KOGA**, Kawasaki (JP)

(21) Appl. No.: **15/456,305**

(22) Filed: **Mar. 10, 2017**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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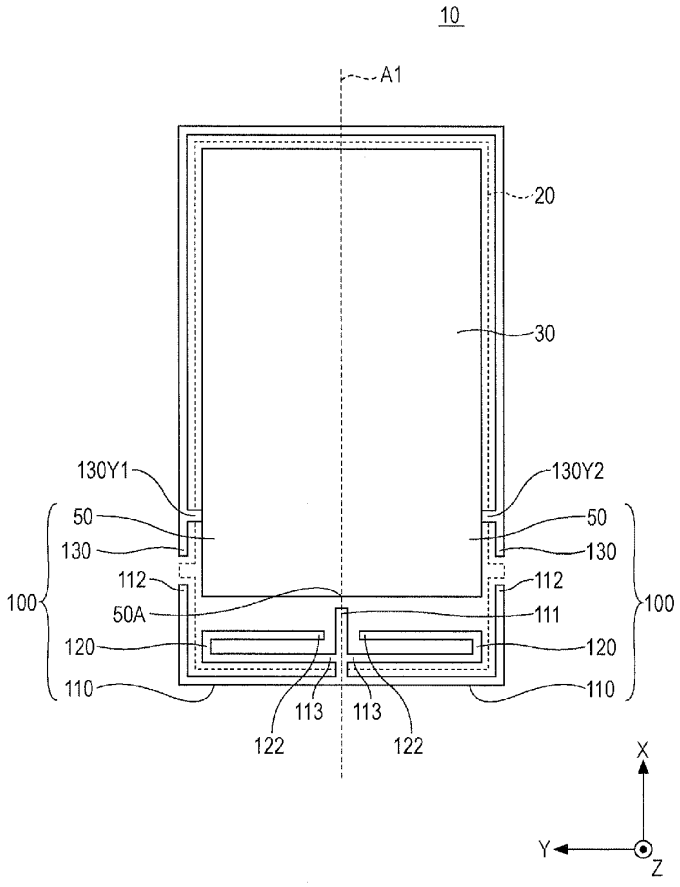
H01Q 1/38	(2006.01)
H01Q 21/30	(2006.01)
H04B 1/3805	(2006.01)
H01Q 21/24	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H04B 1/3805*** (2013.01); ***H01Q 21/245*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 21/30*** (2013.01); ***H01Q 1/24*** (2013.01); ***H04M 1/02*** (2013.01)

(57) **ABSTRACT**

An antenna system includes a ground which is disposed in a housing and has an end side; a first antenna element which includes a first open-end and a feeding point, and is exposed to an outside of the housing on the side of the first open-end; a second antenna element which includes the feeding point and a second open-end, is disposed between the end side and the first antenna element, and is branched from the first antenna element at a branching point, a section between the branching point and the second open-end being disposed in the housing or being covered with the housing and the first antenna element; and a metal plate which includes a portion connected to the ground and an end portion disposed near the first open-end, a portion of the metal plate near to the end portion being exposed to an outside of the housing.



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(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2017/0294709 A1**

(43) **Pub. Date: Oct. 12, 2017**

XUE et al.

(54) **ANTENNA FOR TERMINAL**

(71) Applicant: **Beijing Xiaomi Mobile Software Co., Ltd.**, Beijing (CN)

(72) Inventors: **Zonglin XUE**, Beijing (CN); **Linchuan WANG**, Beijing (CN); **Xiaofeng XIONG**, Beijing (CN)

(73) Assignee: **Beijing Xiaomi Mobile Software Co., Ltd.**, Beijing (CN)

(21) Appl. No.: **15/473,211**

(22) Filed: **Mar. 29, 2017**

(30) **Foreign Application Priority Data**

Apr. 8, 2016 (CN) 201610214832.2

Publication Classification

(51) **Int. Cl.**

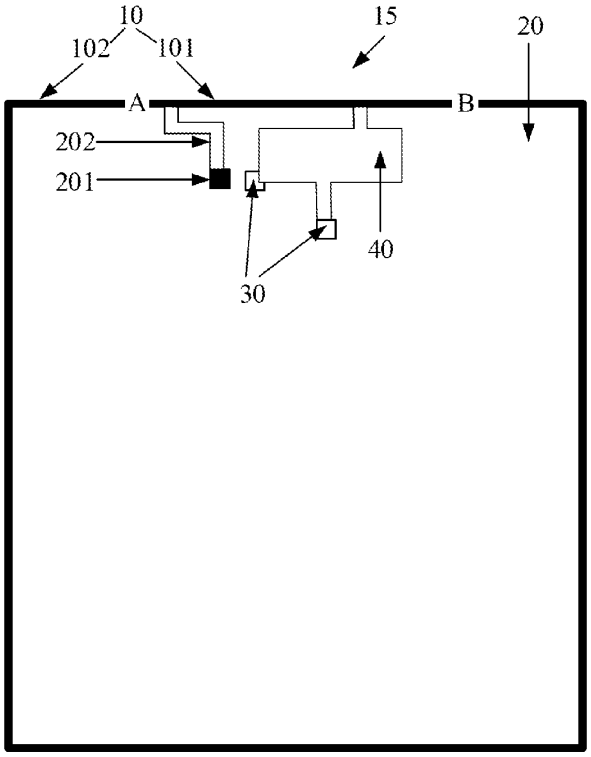
H01Q 1/48	(2006.01)
H01Q 5/385	(2006.01)
H01Q 1/38	(2006.01)

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

CPC ***H01Q 1/48*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 5/385*** (2015.01)

(57) **ABSTRACT**

An antenna for a terminal includes: a metal frame surrounding four sides of the terminal, a circuit board positioned within the metal frame and at least two radiation units arranged on the circuit board. The metal frame includes a bottom frame and a side frame defined by two breaking joints disposed on a side of the metal frame. A signal feed point is arranged on the circuit board, the signal feed point is connected with the bottom frame through a first radiation unit. At least two first grounding points are also arranged on the circuit board, the at least two first grounding points are positioned on one side of the signal feed point, the at least two first grounding points are connected with the bottom frame through a second radiation unit, and the bottom frame is configured to generate low-frequency resonance.



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(19) **United States**

(12) **Patent Application Publication**

KIM et al.

(10) **Pub. No.: US 2017/0302771 A1**

(43) **Pub. Date: Oct. 19, 2017**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

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

(72) Inventors: **Ho Saeng KIM**, Gyeonggi-do (KR); **Sang Youn LEE**, Gyeonggi-do (KR); **Young Sik CHOI**, Gyeonggi-do (KR); **Seung Min CHOI**, Gyeonggi-do (KR); **Seung Jun HYUN**, Seoul (KR); **Seung Nyun KIM**, Incheon (KR); **Dong Il SON**, Gyeonggi-do (KR)

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

(21) Appl. No.: **15/491,657**

(22) Filed: **Apr. 19, 2017**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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H01Q 1/24	(2006.01)
H04B 1/40	(2006.01)
H01Q 1/38	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H04M 1/0266*** (2013.01); ***H04B 1/40*** (2013.01); ***H01Q 1/38*** (2013.01); ***H04M 1/0277*** (2013.01); ***H01Q 1/243*** (2013.01); *H01Q 1/245* (2013.01); *H04M 2250/22* (2013.01)

(57) **ABSTRACT**

Disclosed is an electronic device including a housing having a first surface, a second surface and a side surface, a touch screen display including a conductive plane substantially parallel with the first surface, a printed circuit board positioned between the touch screen display and the second surface substantially parallel with the conductive plane; a wireless communication circuit, and a side member forming at least a portion of the side surface, which includes a first elongated part surrounding at least a portion of the conductive plane and formed of a non-conductive material, and a second elongated part surrounding at least a portion of the printed circuit board, but no portion of the conductive plane, and extending in parallel with the first elongated part. The second elongated part is formed of a conductive material, and is electrically coupled to the wireless communication circuit.