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(54) **ANTENNA AND TERMINAL**

(57) Disclosed in the present invention are an antenna and a terminal, said antenna comprising: the antenna is formed of a support plate within the terminal, or an extended part of the support plate, and a radiator, the support plate being connected to a main plate of the terminal, and the extended part of the support plate being used for forming, with the radiator, a coupling feed, the extended part of the support plate being a part extending beyond the position at which the support plate engages the terminal housing.

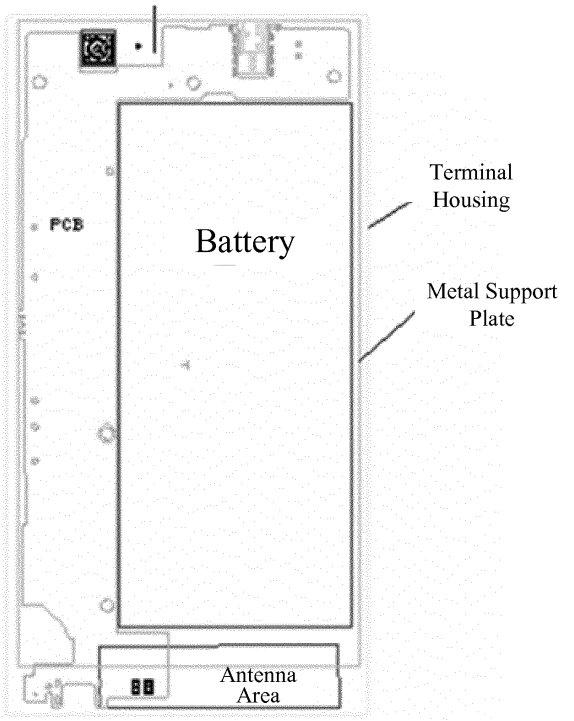

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to the field of mobile communications, and more particularly, to an antenna and a terminal.

BACKGROUND

[0002] Antennas are indispensable components in communications systems, and antenna performance may have a direct bearing on quality in receiving and transmitting signals. Nowadays, sizes of smart terminals trend towards thinner and smaller. Therefore, sizes of antennas built-in the terminals need to be smaller and smaller, and a traditional PIFA (Planar Inverted-F Antenna) needs to have a height of at least 7mm. However, the wider the frequency band needs to be supported by an antenna is, the greater the height and the area of the antenna are. A monopole antenna is required to have a certain clearance area, and the wider the frequency band of the antenna is, the larger the clearance area of the antenna is. Conventional antennas are generally attached to housings in forms of FPC (flexible printed circuit) or steel sheets housingand then are connected with a mainboard via spring plates or pins to form a passage. However, in this manner, it is required that enough areas are kept in housing structures for the antennas. Meanwhile, generally in order that the antenna may have excellent radiation performances, the antenna need to be installed in housing areas as far as possible from the mainboard. In this way, space of the antenna occupying in the terminal is increased, which may cause sizes of the terminal to be increased.

SUMMARY

[0003] A technical problem to be solved by the present disclosure is a problem that a traditional antenna occupies a relatively large space of a terminal.

[0004] To solve the above technical problem, one aspect of embodiments of the present disclosure provides an antenna, including: a support plate inside the terminal or an extended portion of the support plate and a radiator, where the support plate is connected with a mainboard of the terminal, the extended portion of the support plate is configured to form a coupled feeding with the radiator, and the support plate or the extended portion of the support plate exceeds a joint between the support plate and a housing of the terminal.

[0005] In an embodiment, the antenna further includes another antenna arranged on the housing of the terminal.

[0006] In an embodiment, the extended portion of the support plate is provided with an open cavity, one side of open cavity is provided with another cavity, and the radiator is arranged in the open cavity.

[0007] In an embodiment, the open cavity is in shape of a rectangle.

[0008] In an embodiment, the antenna has a radiation frequency of 1,710Mhz~2,200Mhz.

[0009] In an embodiment, the extended portion of the support plate is connected with a ground feed point of the mainboard of the terminal, and the radiator is connected with a signal feed point of the mainboard of the terminal.

[0010] In an embodiment, the support plate is made from aluminum magnesium alloy, zinc alloy or stainless steel.

[0011] In an embodiment, the support plate or the extended portion of the support plate and the radiator are respectively connected with a ground feed point of the mainboard of the terminal and a signal feed point of the mainboard of the terminal via a pin or a spring plate.

[0012] According to another aspect of the embodiments of the present disclosure, there is further provided a terminal, which includes any one of the foregoing antennas.

[0013] In the embodiments of the present disclosure, a part of the support plate inside the terminal or the extended portion of the support plate and the radiator are employed to form a coupled feeding antenna. In this way, internal space of the terminal may be fully utilized, and a utilization rate of the internal space of the terminal may be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a schematic diagram illustrating a layout of a metal support plate inside a mobile phone according to embodiments of the present disclosure;

FIG. 2 is a schematic diagram illustrating an antenna according to embodiments of the present disclosure;

FIG. 3 is a schematic side view illustrating interior of a terminal provided with the antenna according to embodiments of the present disclosure;

FIG. 4 is a chart of return loss generated when an antenna according to embodiments of the present disclosure is used as an individual antenna;

FIG. 5 is an efficiency curve chart of an antenna according to embodiments of the present disclosure within a frequency range of 1,710MHZ-2,160MHZ;

FIG. 6 is an efficiency curve chart of an antenna according to embodiments of the present disclosure within a frequency range of 710MHZ-890MHZ;

FIG. 7 is an efficiency curve chart depicted, with a combination of an antenna according to embodiments of the present disclosure and an antenna built-in the terminal, within a frequency range of 1,710MHZ-2,160MHZ; and

FIG. 8 is an efficiency curve chart depicted, with a combination of an antenna according to embodiments of the present disclosure and an antenna built-in the terminal, within a frequency range of 710MHZ-

890MHZ.

DETAILED DESCRIPTION

[0015] To solve the problem in the prior art that an antenna occupies a relatively large internal space of a terminal, the present disclosure provides an antenna and a terminal. The following further describes in detail the present disclosure with reference to the accompanying drawings and the embodiments. It should be understood that the embodiments described herein are merely used to explain the present disclosure, and are not intended to limit the present disclosure.

[0016] The terminal as mentioned in this embodiment takes a mobile phone as an example, generally an internal structural layout thereof is as shown in FIG. 1. To a structure whose printed circuit board (PCB) of a mainboard is smaller than a liquid crystal display (LCD) in size, a metal support plate needs to be added to increase stability of the mainboard and the LCD. To provide better radiation performance of the antenna, generally no metal structural part extends below the antenna of the mobile phone, and generally a gap of about 1-2mm is provided between the PCB and the metal support plate. In the antenna provided by the embodiments of the present disclosure, a coupled feeding antenna (hereinafter referred to as antenna) is formed, based on the support plate, with an extended portion of the support plate exceeding a joint between the support plate and a housing of the terminal, or with a part of the support plate itself.

[0017] FIG. 2 is a schematic diagram illustrating an antenna according to embodiments of the present disclosure.

[0018] As shown in FIG. 2, the antenna is composed of extended portions 7 and 8 of a support plate 2 inside the terminal and a radiator 6, where the support plate may be made from aluminum magnesium alloy, zinc alloy or stainless steel. The extended portion of the support plate 2 refers to a portion of the support plate exceeding a joint 3 between the support plate 2 and a housing of the terminal. Dashed areas as shown in FIG. 2 are representative of the support plate 2 inside the terminal and the extended portion of the support plate. In an embodiment, the radiator 6 may be implemented by means of a sheet radiator from the extended portion of the support plate, or also may be implemented by means of other radiators made from materials different from the support plate 2. The support plate 2 is connected with a mainboard 1 of the terminal, and the extended portions of the support plate are used for forming a coupled feeding with the radiator 6 to constitute a coupled feeding antenna. The extended portion 7 and 8 of the support plate are connected with a ground feed point 4 of the mainboard 1 of the terminal, and the radiator 6 is connected with a signal feed point 5 of the mainboard of the terminal. As a high-band radiator combined with the extended portion of the support plate, the radiator 6 may radiate energy within a waveband of 1,710Mhz-2,200Mhz. A resonance generating higher frequency points may also be designed according to the needs. The extended portion 7 and 8 of the support plate are mainly used to couple with the radiator 6 to generate a low-band resonance, where a wire arrangement mode thereof is not limited to what is shown in FIG. 2. Different wire arrangements may be designed and formed for purpose of generating excitation.

[0019] It is to be noted that a structure of the antenna in the embodiments of the present disclosure is not limited to the concrete structure as shown in FIG. 2. The structure of the antenna may be any antenna structure as long as following conditions are satisfied. The extended portion of the support plate inside the terminal is provided with an open cavity, one side of the open cavity is provided with another cavity, and the radiator is arranged in the open cavity. The open cavity as shown in FIG. 2 is in shape of a rectangle, which is merely a specific implementation form of the antenna as mentioned in the embodiments of the present disclosure.

[0020] FIG. 3 is a schematic side view illustrating interior of a terminal provided with the antenna according to embodiments of the present disclosure. In this figure, the terminal takes a mobile phone as an example to make a further description of the antenna provided by the embodiments of the present disclosure.

[0021] The mobile phone as shown in FIG. 3 internally includes a PCB 1 and a metal support plate 2. The antenna involved in this embodiment may further include another antenna 9, which may be an antenna built-in the mobile phone and may be arranged on the housing of the terminal. The antenna constituted by the extended portions 7 and 8 of the support plate inside the terminal is connected to the mainboard via the ground feed point 4 and the signal feed point 5. Specifically, the extended portion of the support plate and the radiator 6 are respectively connected with the ground feed point and the signal feed point of the mainboard of the terminal via a pin and a spring plate. It is to be noted that the radiator 6 and the extended portions 7 and 8 inside the support plate are in the same plane. Concrete structures of the radiator 6 and the extended portions 7 and 8 of the support plate are not shown in a test chart as shown in FIG. 3. The reference sign 3 as shown in the figure represents a joint between the metal support plate and a plastic part of a front housing of the mobile phone. In a conventional mobile phone, a length of the support plate reaches the position of the reference sign 3 or slightly stretches downward by 1-2mm to increase stability. In this embodiment, the support plate is properly prolonged, and the extended portion thereof are used to form a coupled feeding antenna which is designed by adopting a coupled feeding manner to obtain an antenna having a wider frequency band within a smaller area. However, the antenna is relatively narrow in a low-frequency bandwidth and is not high enough in radiation efficiency. Therefore, in addition to meeting design needs, the extended portion of the grounded metal support plate positioned at the bottom of the mobile phone is as short as possible. Accordingly,

an antenna 9 is additionally designed on the housing of the mobile phone to meet the needs. The design and the performance of the antenna 9 may be adversely affected if the extended portions of the support plate are prolonged downward excessively, and a coupling effect may exist therebetween, which is relatively difficult for debugging. The antenna may be used to generate a part of resonance which may be a high-band resonance. The antenna may be used as an individual high-band antenna and may be connected with the antenna 9 on the housing of the mobile phone to generate a resonance of another frequency band, which may be a low frequency.

[0022] FIG. 4 is a chart of return loss generated when the antenna according to embodiments of the present disclosure is used as an individual antenna. As can be seen, it is somewhat difficult to cover a low frequency range. FIG. 5 is an antenna efficiency curve chart of an antenna according to embodiments of the present disclosure within a frequency range of 1,710MHZ-2,160MHZ. As can be seen from FIG. 5, a high frequency efficiency can basically meet the design needs. FIG. 6 is an efficiency curve chart of an antenna according to embodiments of the present disclosure within a frequency range of 710MHZ-890MHZ. As can be seen from FIG. 6, a low frequency is not high in efficiency, nearby the intermediate 800MHZ is a little better, the antenna efficiency may reach about 14%, and a high frequency part is better in covering 1,710MHZ-2,300MHZ. FIG. 7 is an efficiency curve chart depicted, with a combination of an antenna according to embodiments of the present disclosure and an antenna built-in the terminal, within a frequency range of 1,710MHZ-2,160MHZ, while FIG. 8 is an efficiency curve chart depicted, with a combination of an antenna according to embodiments of the present disclosure and an antenna built-in the terminal, within a frequency range of 710MHZ-890MHZ. As can be seen from FIG. 7 and FIG. 8, the antenna efficiency is greatly improved within a low frequency range.

[0023] The embodiments of the present disclosure further provide a terminal, where the terminal may include any one of following antennas. The antenna is composed of an extended portion of a support plate inside the terminal and a radiator, the support plate is connected with a mainboard of the terminal, the extended portion of the support plate is used for forming a coupled feeding with the radiator, and the extended portion of the support plate refers to a portion of the support plate exceeding a joint between the support plate and a housing of the terminal.

[0024] The antenna further includes another antenna, which is arranged on the housing of the terminal.

[0025] The extended portion of the support plate is provided with an open cavity, one side of which is provided with another cavity, the radiator is arranged in the open cavity, and the antenna is composed of the open cavity and the radiator arranged in the open cavity. The open cavity may also be in shape of a rectangle.

[0026] The antenna built-in the terminal has a radiation frequency of 1,710Mhz~2,200Mhz.

[0027] The extended portion of the support plate may be connected with a ground feed point of the mainboard of the terminal, while the radiator may be connected with a signal feed point of the mainboard of the terminal.

[0028] The support plate may be made from aluminum magnesium alloy, zinc alloy or stainless steel.

[0029] The extended portion of the support plate and the radiator may be respectively connected with the ground feed point of the mainboard of the terminal and the signal feed point of the mainboard of the terminal via a pin or a spring plate.

[0030] The antenna provided by the embodiments of the present disclosure not only can fully utilize internal space of the terminal, but also can ensure that the antenna keeps away from a human body when a user is using the terminal, which may reduce a specific absorption rate (SAR) of the antenna and reduce a loss of the antenna efficiency when the terminal is in a usage status. Therefore, when the antenna provided by the embodiments of the present disclosure is combined with the antenna built-in the terminal, the overall efficiency of the antennas may be improved.

[0031] Although preferred embodiments of the present disclosure have been disclosed for illustrative purposes, those skilled in the art will realize that various improvements, increases and substitutions are also possible. Therefore, the scope of the present disclosure shall be not limited to the foregoing embodiments.

Claims

1. An antenna, comprising:

   a support plate inside a terminal or an extended portion of the support plate and a radiator, wherein the support plate is connected with a mainboard of the terminal, the support plate or the extended portion of the support plate is configured to form a coupled feeding with the radiator, and the extended portion of the support plate exceeds a joint between the support plate and a housing of the terminal.

2. The antenna according to claim 1, further comprising another antenna arranged on the housing of the terminal.

3. The antenna according to claim 1, wherein the support plate or the extended portion of the support plate is provided with an open cavity, one side of the open cavity is provided with another cavity, and the radiator is arranged in the open cavity.

4. The antenna according to claim 1, wherein the open cavity is in shape of a rectangle.

5. The antenna according to claim 1, wherein the an-

tenna has a radiation frequency of 1710Mhz~2200Mhz.

6. The antenna according to claim 1, wherein the extended portion of the support plate is connected with a ground feed point of the mainboard of the terminal, and the radiator is connected with a signal feed point of the mainboard of the terminal.

7. The antenna according to claim 1, wherein the support plate is made from aluminum magnesium alloy, zinc alloy or stainless steel.

8. The antenna according to claim 1, wherein the support plate or the extended portion of the support plate and the radiator are respectively connected with a ground feed point of the mainboard of the terminal and a signal feed point of the mainboard of the terminal via a pin or a spring plate.

9. A terminal, comprising the antenna according to any one of claims 1~9.

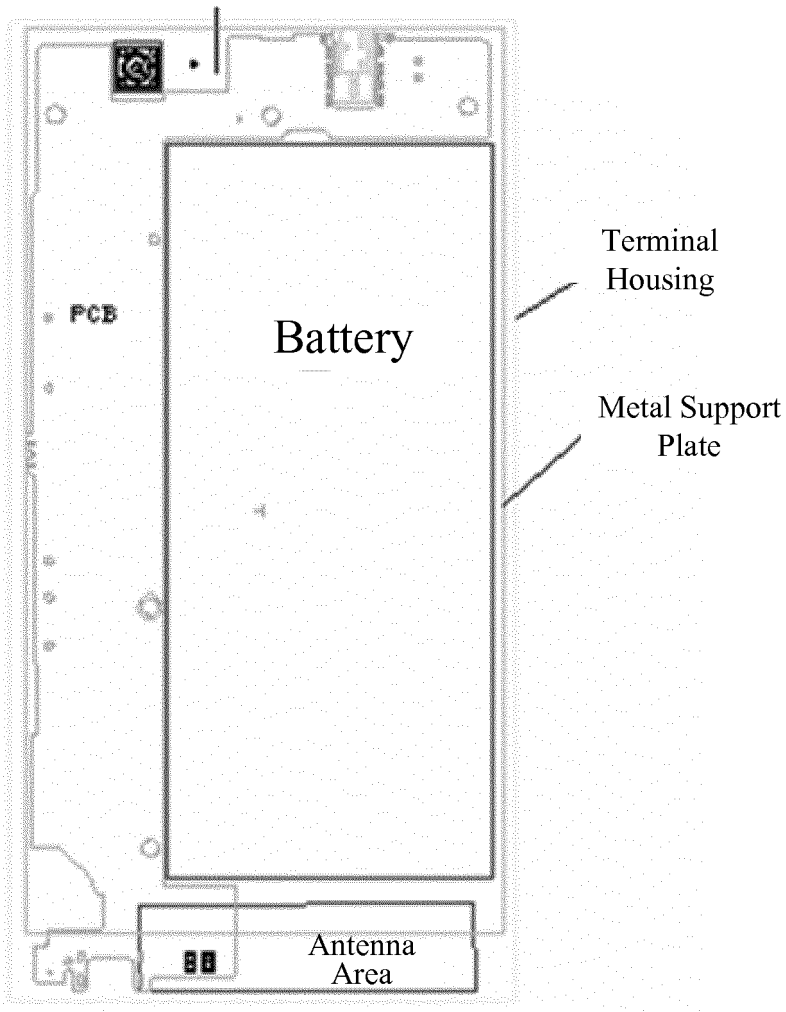

PCB
Battery
Terminal Housing
Metal Support Plate
Antenna Area

FIG. 1

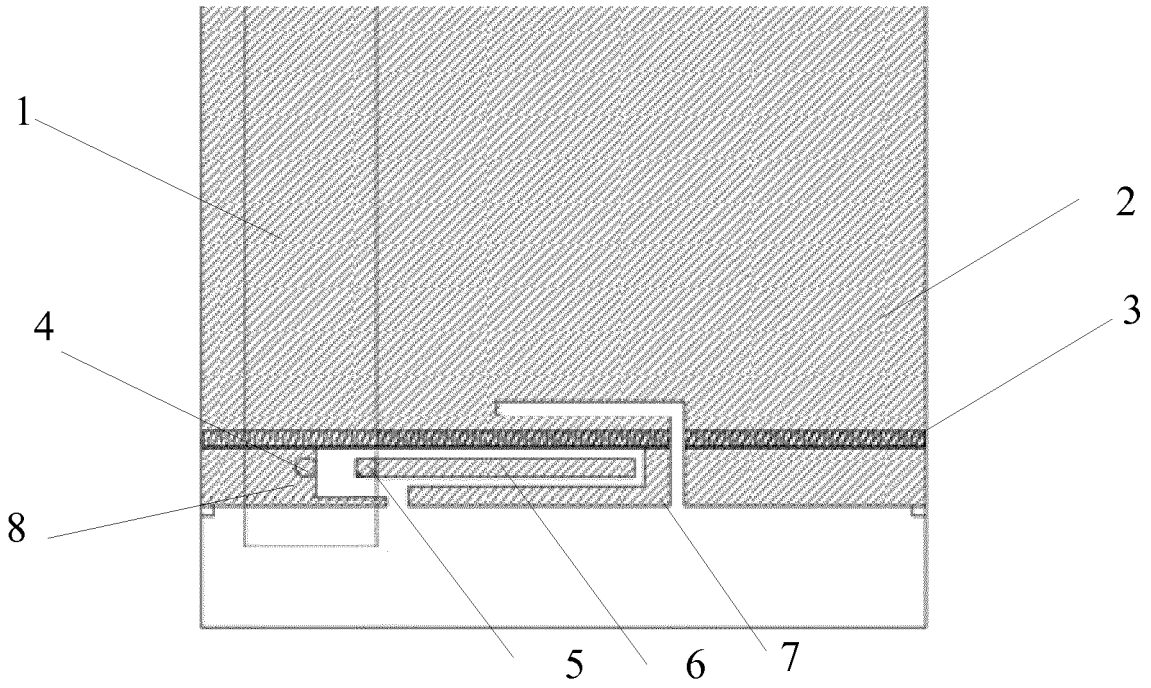


FIG. 2

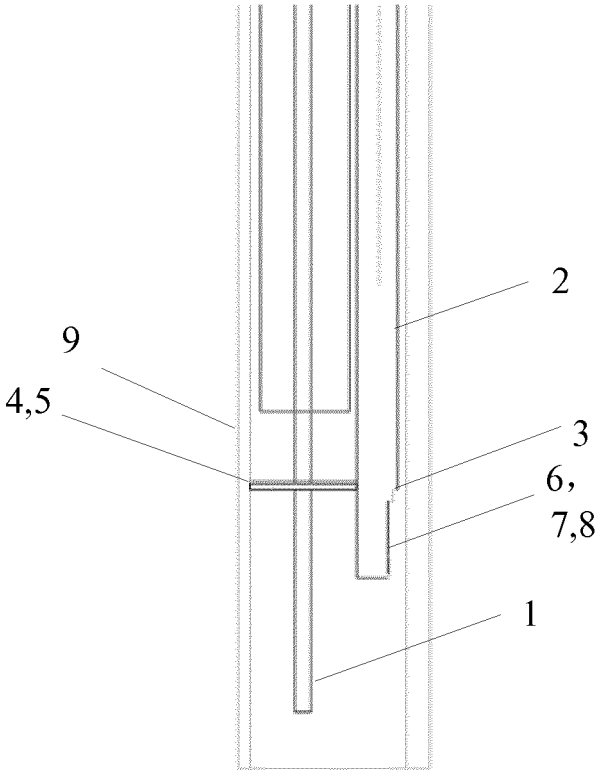
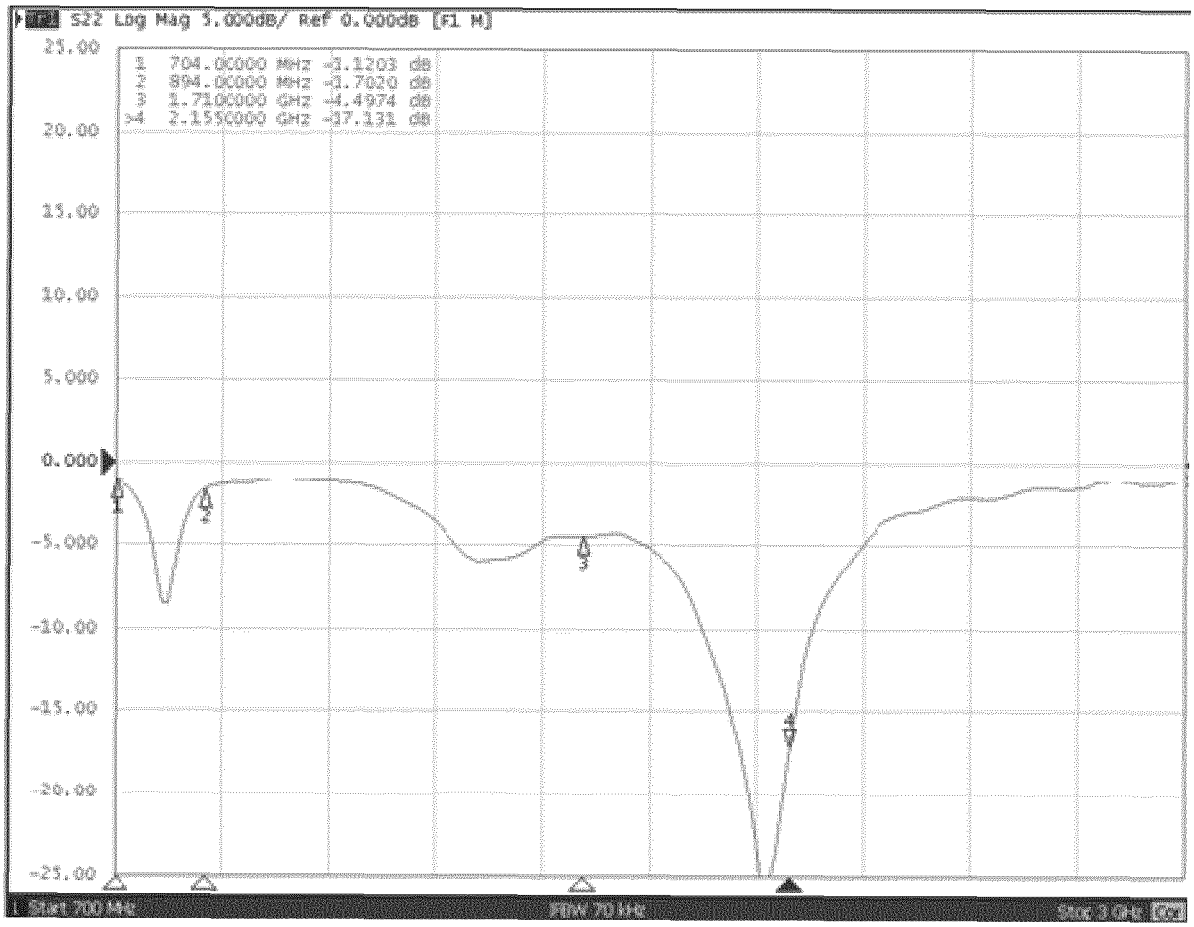


FIG. 3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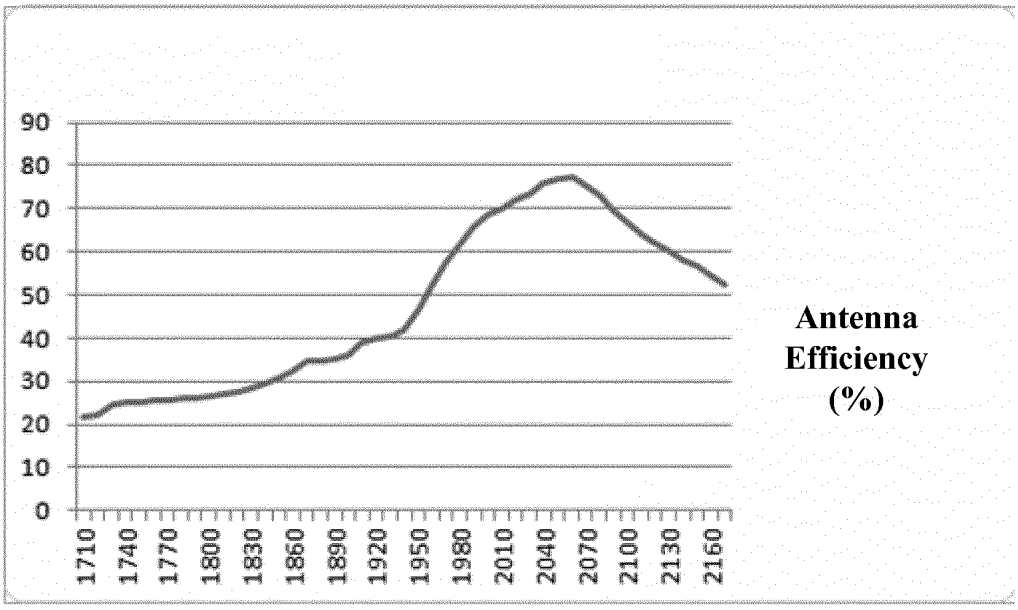
2 894.00000 MHz -1.7020 dB
3 1.7100000 GHz -4.4974 dB
>4 2.1550000 GHz -27.131 dB
25.00
20.00
15.00
10.00
5.000
0.000
-5.000
-10.00
-15.00
-20.00
-25.00
Start 700 MHz
IFBW 70 kHz
Stop 3 GHz

FIG. 4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1740
1770
1800
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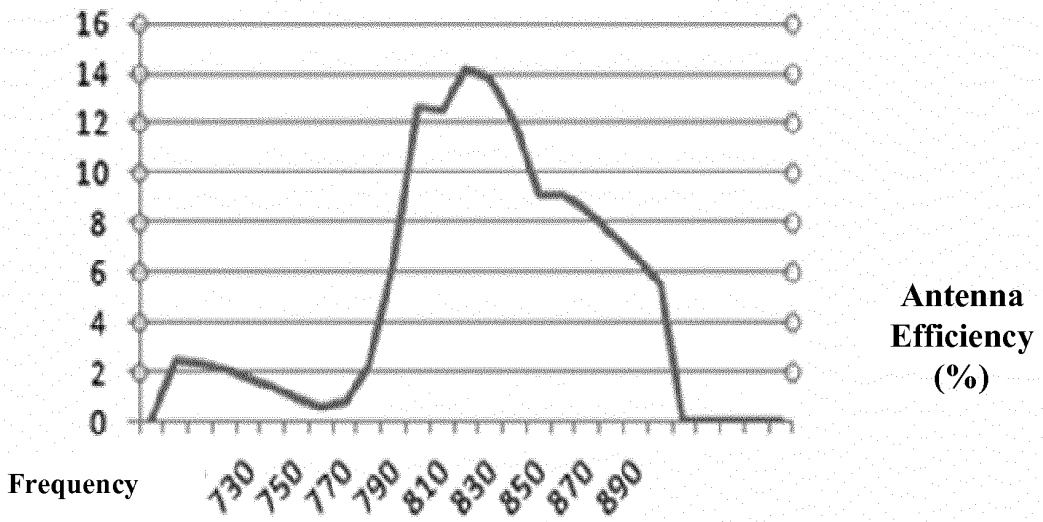
1890
1920
1950
1980
2010
2040
2070
2100
2130
2160
Antenna Efficiency (%)

FIG. 5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14
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Frequency
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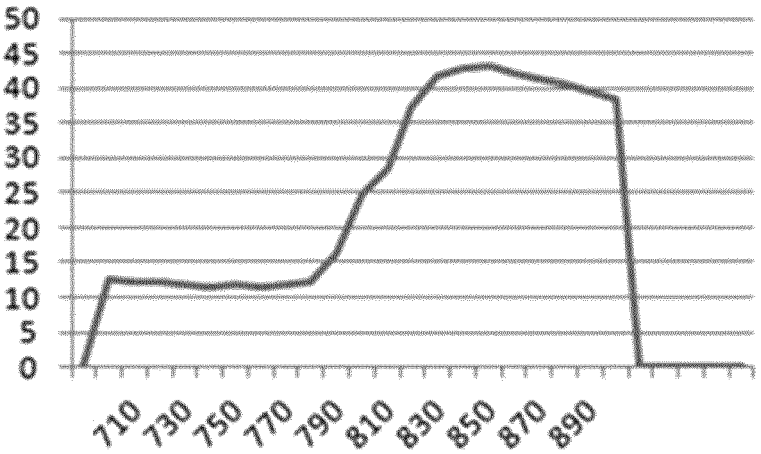
Antenna Efficiency (%)

FIG. 6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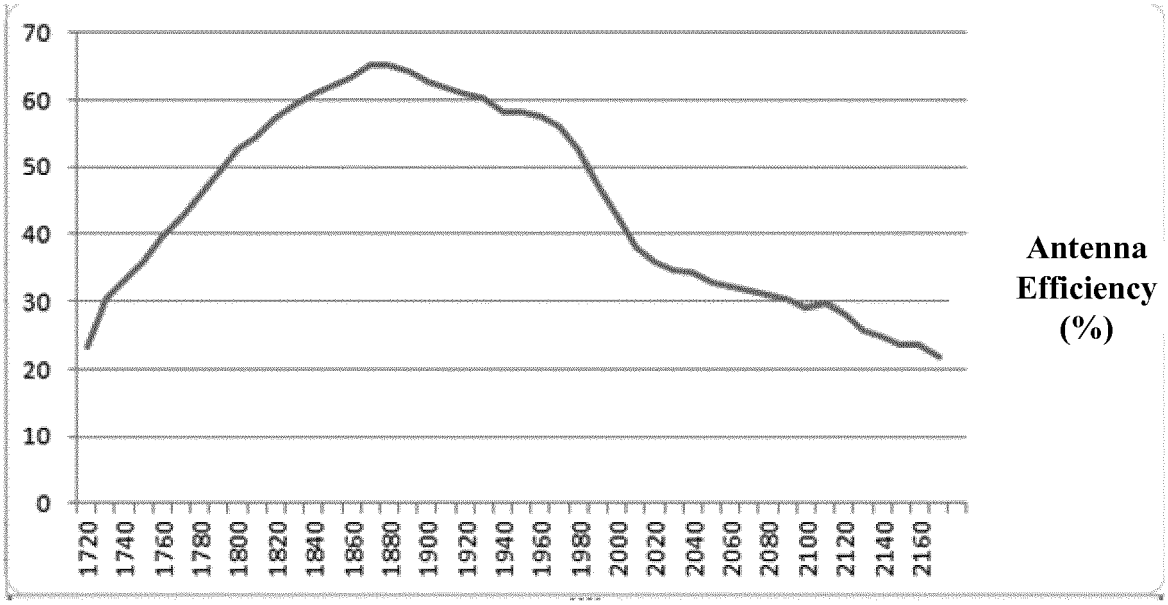
Antenna Efficiency (%)

FIG. 7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1900
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1940
1960
1980
2000
2020
2040
2060
2080
2100
2120
2140
2160
Antenna Efficiency (%)

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/093262

A. CLASSIFICATION OF SUBJECT MATTER

H01Q 1/24 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, CNTXT, CNKI, VEN: support plate, metal plate, PCB, antenna, board, support, plate, mainboard, radiator, couple, feed, opening, housing, cavity, groove

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102299417 A (HARBIN INSTITUTE OF TECHNOLOGY), 28 December 2011 (28.12.2011), description, paragraphs [0010]-[0012], and figures 1 and 2	1-9
A	CN 103036004 A (PEGATRON CORPORATION), 10 April 2013 (10.04.2013), the whole document	1-9
A	CN 103620867 A (SONY ERICSSON MOBILE COMMUNICATION AB), 05 March 2014 (05.03.2014), the whole document	1-9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 March 2015 (12.03.2015)	**01 April 2015 (01.04.2015)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **PAN, Yun** Telephone No.: (86-10) **62089148**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/093262

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 102299417 A	28 December 2011	None	
CN 103036004 A	10 April 2013	TW 201316612 A	16 April 2013
CN 103620867 A	05 March 2014	EP 2735053 A1	28 May 2014
		US 2014132462 A1	15 May 2014
		WO 2013011339 A1	24 January 2013

Form PCT/ISA/210 (patent family annex) (July 2009)