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(54) **MICROSTRIP ANTENNA AND COMMUNICATION DEVICE**

(57) The present application provides a microstrip antenna and a communication device. A first radiation patch is arranged on the side of a first microwave dielectric substrate furthest from a second microwave dielectric substrate; a second radiation patch is arranged on the side of the second microwave dielectric substrate closest to the first microwave dielectric substrate; a gap layer is disposed on the side of a third microwave dielectric substrate closest to the second microwave dielectric substrate; and a feeding microstrip line is arranged on the side of the third microwave dielectric substrate furthest from the second microwave dielectric substrate. The first radiation patch and the second radiation patch are of a first form or of a second form, so as to construct a spatial filter. The gap layer has etched therein two orthogonal and symmetrical gaps, and a tail end coupling segment of one feeding microstrip line perpendicularly crosses a gap in a gap layer. Constructing a spatial filter from the first radiation patch and second radiation patch in the microstrip antenna results in no longer needing to separately introduce a filtering structure, avoiding loss resulting from the introduction of the filtering structure, and ensuring the gain performance of the antenna.

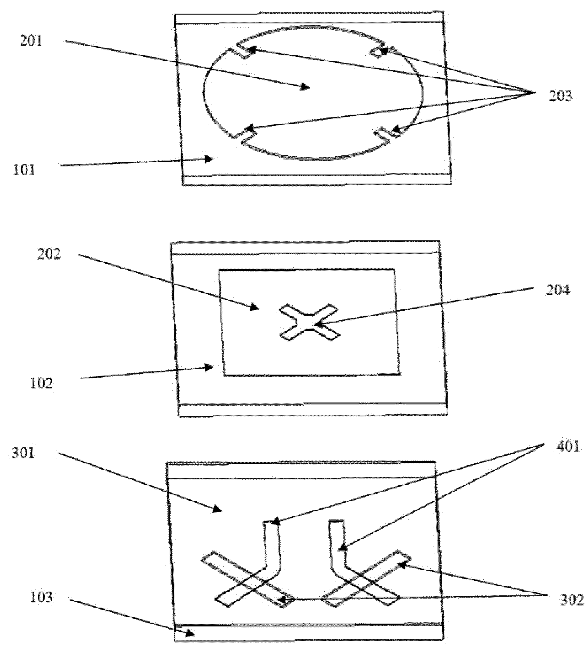

FIG. 1

EP 4 564 599 A1

Description

FIELD OF THE DISCLOSURE

[0001] This application relates to the field of antennas, specifically, it relates to a microstrip antenna and communication device.

BACKGROUND OF THE DISCLOSURE

[0002] Microstrip antennas, with advantages of small size, simple structure, ease of manufacturing and low profile, are widely used in various communication systems. Filtering antennas exhibit excellent out-of-band suppression characteristics and can effectively reduce the mutual coupling effect between heterodyne dipoles in shared-aperture multiband antennas, thereby improving the radiation patterns across different frequency bands. In the fields of mobile communications and satellite communications, filtering technology has attracted increasing attention from both academia and industry. Traditional microstrip filtering antennas typically require the introduction of filtering structures within the feeding network, which can introduce additional losses and degrade the gain performance of the original antenna.

[0003] How to overcome the aforementioned issues is a persistent challenge for persons skilled in this field.

SUMMARY OF THE DISCLOSURE

[0004] The purpose of this application is to provide a microstrip antenna and communication device that at least partially solves the aforementioned issues.

[0005] To achieve the above purposes, the technical solution adopted in the embodiments of this application is as follows:

In a first aspect, an embodiment of this application provides a microstrip antenna comprising: a first radiation patch, a second radiation patch, a gap layer, a first microwave dielectric substrate, a second microwave dielectric substrate, a third microwave dielectric substrate, and two feeding microstrip lines;

> wherein the first microwave dielectric substrate, the second microwave dielectric substrate, and the third microwave dielectric substrate are arranged sequentially; the first radiation patch is disposed on the side of the first microwave dielectric substrate facing away from the second microwave dielectric substrate; the second radiation patch is disposed on the side of the second microwave dielectric substrate facing towards the first microwave dielectric substrate; the gap layer is disposed on the side of the third microwave dielectric substrate facing towards the second microwave dielectric substrate; and the feeding microstrip lines are disposed on the side of the third microwave dielectric substrate facing away from the second microwave dielectric substrate;
>
> wherein the first radiation patch and the second radiation patch are of a first form or a second form to construct a spatial filter;
>
> wherein the first form features four orthogonally and symmetrically etched rectangular hollowed-out gaps along two polarization directions, while the second form features a centrally etched cross-shaped hollowed-out gap along the polarization direction; and
>
> wherein the gap layer has two orthogonally and symmetrically etched gaps, and the end coupling segment of one feeding microstrip line crosses perpendicularly over one of the gaps on the gap layer.

[0006] In one possible implementation, the gaps on the gap layer are perpendicular to the corresponding polarization directions.

[0007] In one possible implementation, the first radiation patch is of the first form, and the second radiation patch is of the second form.

[0008] In one possible implementation, both the first radiation patch and the second radiation patch are of the second form.

[0009] In one possible implementation, both the first radiation patch and the second radiation patch are of the first form.

[0010] In one possible implementation, the first radiation patch is of the second form, and the second radiation patch is of the first form.

[0011] In one possible implementation, the geometric shapes of the first radiation patch and the second radiation patch are any one of circular, square, or polygonal.

[0012] In one possible implementation, the feeding microstrip lines are used to couple radio frequency signals transmitted by an RF chip to the gaps in the gap layer. The gaps in the gap layer couple the RF signals to the second radiation patch, which then couples the RF signals to the first radiation patch for emission.

[0013] In one possible implementation, the spatial filter is used to filter the RF signals received by the first radiation patch. The filtered RF signals are coupled through the second radiation patch and the gaps in the gap layer to the feeding microstrip lines for transmission to the RF chip.

[0014] In a second aspect, an embodiment of this application provides a communication device comprising the aforementioned microstrip antenna.

[0015] Compared to the prior art, the microstrip antenna and communication device provided in the embodiments of this application include: a first radiation patch, a second radiation patch, a gap layer, a first microwave dielectric substrate, a second microwave dielectric substrate, a third microwave dielectric substrate, and two feeding microstrip lines; wherein the first, second, and third microwave dielectric substrates are arranged sequentially; the first radiation patch is disposed on the side of the first microwave dielectric substrate facing away from the second microwave dielectric substrate; the second radiation patch is disposed on the side of the second microwave dielectric substrate facing towards the first microwave dielectric substrate; the gap layer is disposed on the side of the third microwave dielectric substrate facing towards the second microwave dielectric substrate; and the feeding microstrip lines are disposed on the side of the third microwave dielectric substrate facing away from the second microwave dielectric substrate; the first radiation patch and the second radiation patch are of a first form or a second form to construct a spatial filter; the gap layer has two orthogonally and symmetrically etched gaps, and the end coupling segment of one feeding microstrip line crosses perpendicularly over one of the gaps on the gap layer. By constructing the spatial filter using the first and second radiation patches in the microstrip antenna, there is no need to separately introduce a filtering structure, thereby avoiding the losses associated with the introduction of such a structure and ensuring the gain performance of the antenna.

[0016] To make the purposes, features, and advantages of this application more apparent and understandable, the following provides a detailed description of preferred embodiments, accompanied by the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] To illustrate the technical solutions of the embodiments of the present application more clearly, the following provides a brief introduction to the drawings required for the embodiments. It should be understood that the following drawings only show some embodiments of the present application and therefore should not be regarded as limiting the scope. For those skilled in the art, without exercising creative efforts, other related drawings can also be obtained based on these drawings.

Figure 1 is a structural diagram of a microstrip antenna provided in an embodiment of the present application;

Figure 2 is one of the schematic diagrams of the radiation patch morphology provided in an embodiment of the present application;

Figure 3 is one of the schematic diagrams of the radiation patch morphology provided in an embodiment of the present application;

Figure 4 is one of the schematic diagrams of the radiation patch morphology provided in an embodiment of the present application;

Figure 5 is one of the schematic diagrams of the radiation patch morphology provided in an embodiment of the present application;

Figure 6 is one of the structural diagrams of a microstrip antenna provided in an embodiment of the present application.

[0018] In the drawings: 101-first microwave dielectric substrate; 102-second microwave dielectric substrate; 103-third microwave dielectric substrate; 201-first radiation patch; 202-second radiation patch; 203-first set of hollowed-out gaps; 204-second set of hollowed-out slits; 205-first set of hollowed-out slits; 206-second set of hollowed-out gaps; 301-gap layer; 302-gap; 401-feeding microstrip line.

DETAILED IMPLEMENTATION OF THE DISCLOSURE

[0019] To make the purpose, technical solutions, and advantages of the embodiments of the present application clearer, the technical solutions in the embodiments of the present application will be described below in conjunction with the drawings in the embodiments of the present application in a clear and complete manner. Obviously, the described embodiments are a part of the embodiments of the present application, not all of them. Generally, the components of the embodiments of the present application described and shown in the drawings herein may be arranged and designed in various different configurations.

[0020] Therefore, the following detailed description of the embodiments of the present application provided in the drawings is not intended to limit the scope of the present application that is claimed for protection, but merely represents selected embodiments of the present application. Based on the embodiments in the present application, all other embodiments obtained by those skilled in the art without creative efforts belong to the scope of protection of the present application.

[0021] It should be noted that similar reference numerals and letters indicate similar items in the following drawings. Therefore, once an item is defined in one drawing, it does not require further definition and explanation in subsequent drawings. Meanwhile, in the description of the present application, terms such as "first", "second", etc., are only used to distinguish one entity or operation from another, and cannot be understood as indicating or implying relative importance.

[0022] It should be noted that, in this document, relational terms such as first and second are merely used to distinguish one entity or operation from another, and do not necessarily require or imply any such actual relationship or order between these entities or operations. Moreover, the terms "include", "contain", or any other variants thereof are intended to cover non-exclusive inclusions, such that processes, methods, articles, or devices that include a series of elements not only include those elements, but also include other elements not explicitly listed, or further include elements inherent to such processes, methods, articles, or devices. In the absence of more restrictions, elements limited by the phrase "including a..." do not exclude the presence of additional identical elements in the process, method, article, or device that includes the said elements.

[0023] In the description of the present application, it should be noted that terms such as "upper", "lower", "inner", "outer", etc., indicate orientation or positional relationships based on the orientation or positional relationships shown in the drawings, or the orientation or positional relationships that are customarily placed when the product of the application is in use, merely for the convenience of describing the present application and simplifying the description, rather than indicating or implying that the device or element pointed to must have a specific orientation, be constructed and operated in a specific orientation. Therefore, they cannot be understood as limitations on the present application.

[0024] In the description of the present application, it should also be noted that unless otherwise specified and defined, terms such as "set" and "connect" should be broadly interpreted. For example, they can be fixed connections, detachable connections, or integral connections; they can be mechanical connections, electrical connections; they can be directly connected, or indirectly connected through an intermediate medium; they can be internal connections between two elements. For those skilled in the art, the specific meanings of the above terms in the present application can be understood based on specific situations.

[0025] Below, some embodiments of the present application will be described in detail in conjunction with the drawings. In the case of no conflict, the embodiments and features in the embodiments below can be combined with each other.

[0026] Please refer to Figure 1, which is a structural diagram of a microstrip antenna provided in an embodiment of the present application. As shown in Figure 1, the microstrip antenna provided in the embodiment of the present application includes: a first radiation patch 201, a second radiation patch 202, a gap layer 301, a first microwave dielectric substrate 101, a second microwave dielectric substrate 102, a third microwave dielectric substrate 103, and two feeding microstrip lines 401.

[0027] The first microwave dielectric substrate 101, the second microwave dielectric substrate 102, and the third microwave dielectric substrate 103 are arranged sequentially. The first radiation patch 201 is disposed on the side of the first microwave dielectric substrate 101 away from the second microwave dielectric substrate 102. The second radiation patch 202 is disposed on the side of the second microwave dielectric substrate 102 close to the first microwave dielectric substrate 101. The gap layer 301 is disposed on the side of the third microwave dielectric substrate 103 close to the second microwave dielectric substrate 102. The feeding microstrip lines 401 are disposed on the side of the third microwave dielectric substrate 103 away from the second microwave dielectric substrate 102.

[0028] The first radiation patch 201 and the second radiation patch 202 are in a first morphology or a second morphology to construct a spatial filter.

[0029] Wherein, the first morphology is that four rectangular hollowed-out gaps are etched orthogonally and symmetrically along two polarization directions, and the second morphology is that a cross-shaped hollowed-out slit is etched along the polarization direction at the center.

[0030] For example, as shown in Figure 1, the first radiation patch 201 is etched with a first set of hollowed-out gaps 203, which are four rectangular hollowed-out gaps etched orthogonally and symmetrically along two polarization directions, i.e., the first radiation patch 201 is in the first morphology.

[0031] The second radiation patch 202 is etched with a second set of hollowed-out slits 204, which are a cross-shaped hollowed-out slit etched along the polarization direction at the center, i.e., the second radiation patch 202 is in the second morphology.

[0032] It should be noted that if the four rectangular hollowed-out gaps and the cross-shaped hollowed-out slit are not orthogonal or symmetrical, the suppressed frequencies will differ between the two polarizations.

[0033] It should be noted that the morphological combination shown in Figure 1 is only an example and does not constitute a limitation.

[0034] The spatial filter composed of the first radiation patch 201 and the second radiation patch 202 can play a filtering role.

[0035] The gap layer 301 is etched with two orthogonal and symmetrical gaps 302, and the end coupling segment of one feeding microstrip line 401 crosses perpendicularly over one gap 302 on the gap layer 301.

[0036] In summary, the microstrip antenna provided in an embodiment of the present application includes: a first radiation patch, a second radiation patch, a gap layer, a first microwave dielectric substrate, a second microwave dielectric substrate, a third microwave dielectric substrate, and two feeding microstrip lines; the first microwave dielectric substrate, the second microwave dielectric substrate, and the third microwave dielectric substrate are arranged sequentially; the first radiation patch is disposed on the side of the first microwave dielectric substrate away from the second microwave dielectric substrate; the second radiation patch is disposed on the side of the second microwave dielectric substrate close to the first microwave dielectric substrate; the gap layer is disposed on the side of the third microwave dielectric substrate close to the second microwave dielectric substrate; the feeding microstrip lines are disposed on the side of the third microwave dielectric substrate away from the second microwave dielectric substrate; the first radiation patch and the second radiation patch are in a first morphology or a second morphology to construct a spatial filter; the gap layer is etched with two orthogonal and symmetrical gaps, and the end coupling segment of one feeding microstrip line crosses perpendicularly over one gap on the gap layer. By constructing a spatial filter with the first radiation patch and the second radiation patch in the microstrip antenna, there is no need to separately introduce a filtering structure, which can avoid the loss caused by introducing the filtering structure and ensure the gain performance of the antenna.

[0037] Optionally, the first radiation patch 201, the second radiation patch 202, the gap layer 301, and the two feeding microstrip lines 401 are made of a conductive material, which can be a conductive metal, specifically copper.

[0038] The first microwave dielectric substrate 101, the second microwave dielectric substrate 102, and the third microwave dielectric substrate 103 have specific relative permittivities and loss tangents. It should be noted that the first microwave dielectric substrate 101, the second microwave dielectric substrate 102, and the third microwave dielectric substrate 103 can be the same or different, and are not limited herein.

[0039] Please continue to refer to Figure 1. In one possible implementation, the two gaps 302 on the gap layer 301 are respectively perpendicular to the corresponding polarization directions.

[0040] It should be noted that if the two gaps 302 on the gap layer 301 are not perpendicular to the corresponding polarization directions, it will cause the central frequency of the antenna to shift, the gain to decrease, and other performance degradation, as well as affect the subsequent effect of synthesizing circular polarization from linear polarization.

[0041] Based on Figure 1, regarding the morphologies of the first radiating patch 201 and the second radiating patch 202, this embodiment of the present application also provides a possible implementation. Please refer to Figures 2 to 5. Figures 2 to 5 are schematic diagrams of the radiating patch morphologies provided in this embodiment of the present application.

[0042] As shown in Figure 2, the first radiating patch 201 is in the first morphology, and the second radiating patch 202 is in the second morphology.

[0043] Specifically, the first radiating patch 201 is etched with a first set of hollowed-out gaps 203, which are four orthogonally and symmetrically etched long strip hollowed-out gaps along two polarization directions, i.e., the first radiating patch 201 is in the first morphology. The second radiating patch 202 is etched with a second set of hollowed-out slits 204, which are a cruciform hollowed-out slit etched along the polarization direction at the center, i.e., the second radiating patch 202 is in the second morphology.

[0044] As shown in Figure 3, both the first radiating patch 201 and the second radiating patch 202 are in the second morphology.

[0045] Specifically, the first radiating patch 201 is etched with a first set of hollowed-out slits 205, which are a cruciform hollowed-out slit etched along the polarization direction at the center, i.e., the first radiating patch 201 is in the second morphology. The second radiating patch 202 is etched with a second set of hollowed-out slits 204, which are a cruciform hollowed-out slit etched along the polarization direction at the center, i.e., the second radiating patch 202 is in the second morphology.

[0046] As shown in Figure 4, both the first radiating patch 201 and the second radiating patch 202 are in the first morphology.

[0047] Specifically, the first radiating patch 201 is etched with a first set of hollowed-out gaps 203, which are four orthogonally and symmetrically etched long strip hollowed-out gaps along two polarization directions, i.e., the first radiating patch 201 is in the first morphology. The second radiating patch 202 is etched with a second set of hollowed-out gaps 206, which are four orthogonally and symmetrically etched long strip hollowed-out gaps along two polarization directions, i.e., the second radiating patch 202 is in the first morphology.

[0048] As shown in Figure 5, the first radiating patch 201 is in the second morphology, and the second radiating patch 202 is in the first morphology.

[0049] Specifically, the first radiating patch 201 is etched with a first set of hollowed-out slits 205, which are a cruciform hollowed-out slit etched along the polarization direction at the center, i.e., the first radiating patch 201 is in the second morphology. The second radiating patch 202 is etched with a second set of hollowed-out gaps 206, which are four orthogonally and symmetrically etched long strip hollowed-out gaps along two polarization directions, i.e., the second radiating patch 202 is in the first morphology.

[0050] In this embodiment of the present application, the geometric shapes of the first radiating patch 201 and the second radiating patch 202 are any one of circular, square, or polygonal. Optionally, the geometric centers of the first radiating patch 201 and the second radiating patch 202 overlap or align.

[0051] Please refer to Figure 6, which is one of the structural schematic diagrams of the microstrip antenna provided in this embodiment of the present application.

[0052] Optionally, a feeding microstrip line 401 is used to couple a radio frequency signal transmitted by a radio frequency chip to a gap 302 of a gap layer 301. The gap 302 of the gap layer 301 is used to couple the radio frequency signal to the second radiating patch 202, which then couples the radio frequency signal to the first radiating patch 201. The first radiating patch 201 is used to transmit the radio frequency signal.

[0053] Optionally, a spatial filter is used to filter a radio frequency reception signal received by the first radiating patch 201. The filtered radio frequency reception signal is coupled to the feeding microstrip line 401 through the second radiating patch 202 and the gap 302 of the gap layer 301 for transmission to the radio frequency chip.

[0054] In this solution of the present application, by setting the patch shapes of the first radiating patch 201 and the second radiating patch 202, a built-in spatial filter of the microstrip antenna is constructed to achieve filtering effects. The structure is simple and does not require introducing a filtering structure into the feeding network, which avoids additional loss.

[0055] This embodiment of the present application also provides a communication device, which includes the above-mentioned microstrip antenna. The communication device can be applied to a broadcasting vehicle or a communication vehicle and can also serve as a mobile base station. Optionally, the communication device can also be an airborne or shipborne communication device.

[0056] The above description is merely the preferred embodiments of the present application and is not used to limit the present application. For those skilled in the art, the present application can have various modifications and changes. Any modifications, equivalent substitutions, improvements, etc., made within the spirit and principles of the present application should be included within the protection scope of the present application.

[0057] For those skilled in the art, it is apparent that the present application is not limited to the details of the above exemplary embodiments, and can be implemented in other specific forms without departing from the spirit or essential characteristics of the present application. Therefore, from any point of view, the embodiments should be regarded as exemplary rather than restrictive, and the scope of the present application is defined by the appended claims rather than the above description. The reference numerals in the claims should not be regarded as limiting the associated claims.

Claims

1. A microstrip antenna, **characterized by** comprising:

    a first radiation patch, a second radiation patch, a gap layer, a first microwave dielectric substrate, a second microwave dielectric substrate, a third microwave dielectric substrate, and two feeding microstrip lines;
    wherein the first microwave dielectric substrate, the second microwave dielectric substrate, and the third microwave dielectric substrate are arranged in sequence; the first radiation patch is disposed on a side of the first microwave dielectric substrate away from the second microwave dielectric substrate; the second radiation patch is disposed on a side of the second microwave dielectric substrate close to the first microwave dielectric substrate; the gap layer is disposed on a side of the third microwave dielectric substrate close to the second microwave dielectric substrate; and the feeding microstrip lines are disposed on a side of the third microwave dielectric substrate away from the second microwave dielectric substrate;
    wherein the first radiation patch and the second radiation patch are in a first form or a second form so as to construct a spatial filter; wherein, the first form is four rectangular hollowed-out gaps etched along two polarization directions orthogonally and symmetrically, and the second form is a cross-shaped hollowed-out slit etched along the polarization direction at the center; and
    the gap layer is etched with two orthogonal and symmetric gaps, and the end coupling segment of one feeding microstrip line crosses perpendicularly over one gap on the gap layer.

2. The microstrip antenna according to claim 1, **characterized in that** the gaps on the two gap layers are respectively perpendicular to the corresponding polarization directions.

3. The microstrip antenna according to claim 1, **characterized in that** the first radiation patch is in the first form, and the second radiation patch is in the second form.

4. The microstrip antenna according to claim 1, **characterized in that** both the first radiation patch and the second radiation patch are in the second form.

5. The microstrip antenna according to claim 1, **characterized in that** both the first radiation patch and the second radiation patch are in the first form.

6. The microstrip antenna according to claim 1, **characterized in that** the first radiation patch is in the second form, and the second radiation patch is in the first form.

7. The microstrip antenna according to claim 1, **characterized in that** the geometric shapes of the first radiation patch and the second radiation patch can be any one shape of circular, square, or polygonal.

8. The microstrip antenna according to claim 1, **characterized in that** the feeding microstrip lines are used to couple radio frequency signals transmitted by a radio frequency chip to the gaps in the gap layer, the gaps in the gap layer are used to couple the radio frequency signals to the second radiation patch, the second radiation patch is used to couple the radio frequency signals to the first radiation patch, and the first radiation patch is used to transmit the radio frequency signals.

9. The microstrip antenna according to claim 1, **characterized in that** the spatial filter is used to filter radio frequency received signals received by the first radiation patch, and the filtered radio frequency received signals are coupled to the feeding microstrip lines through the second radiation patch and the gaps in the gap layer for transmission to the radio frequency chip.

10. A communication device, **characterized in that** it includes the microstrip antenna in any one of claims 1 to 9.

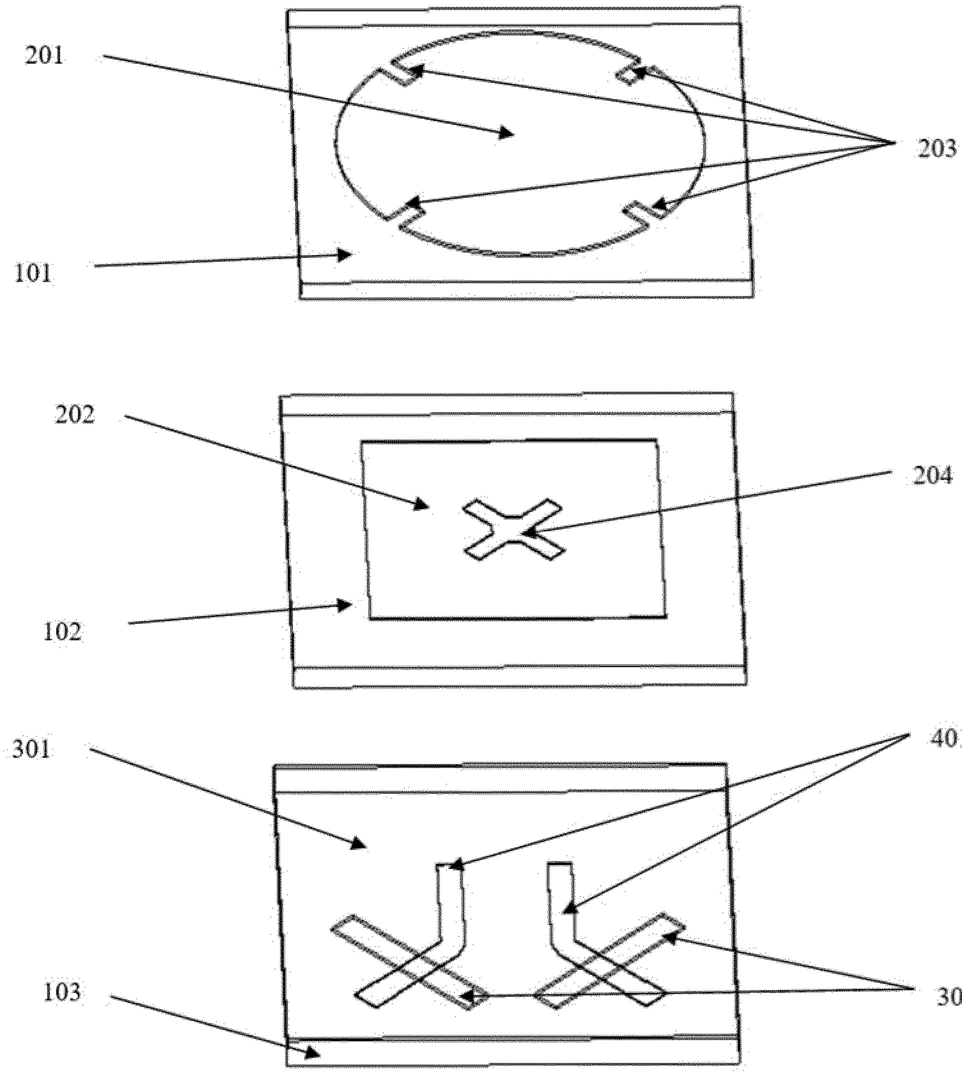

Fig. 1

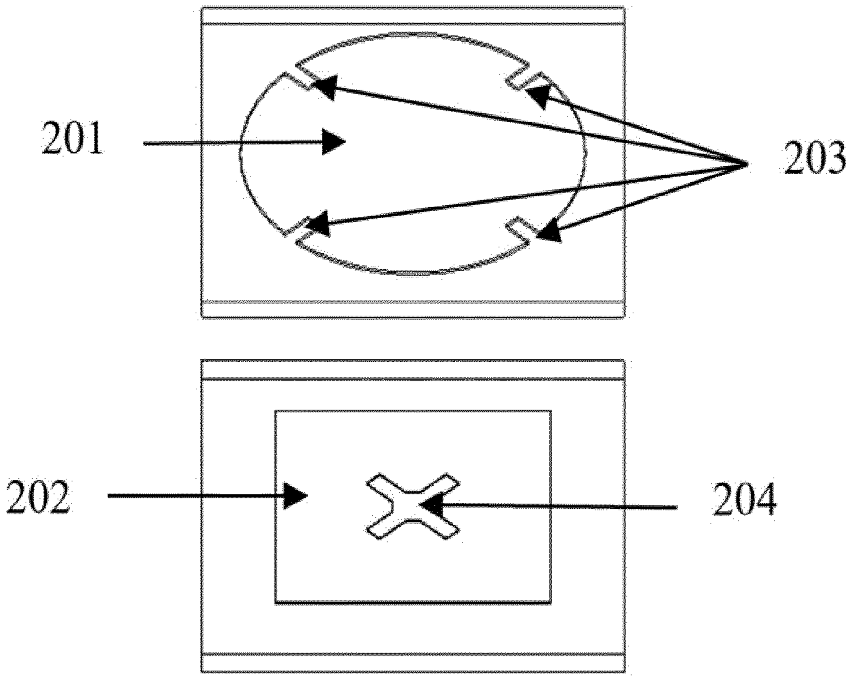

Fig.2

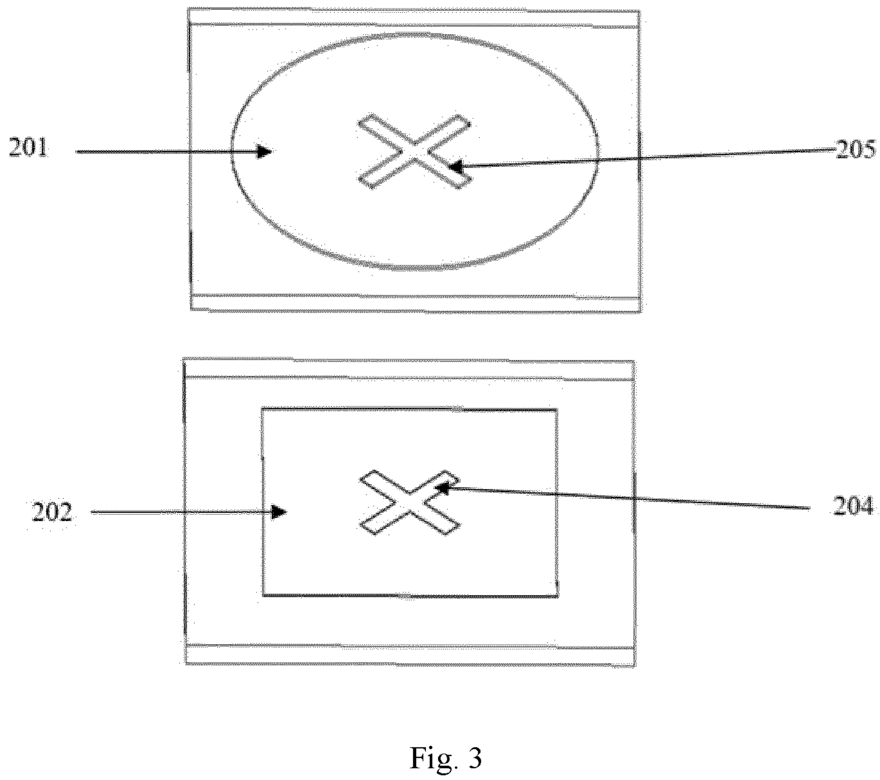

Fig. 3

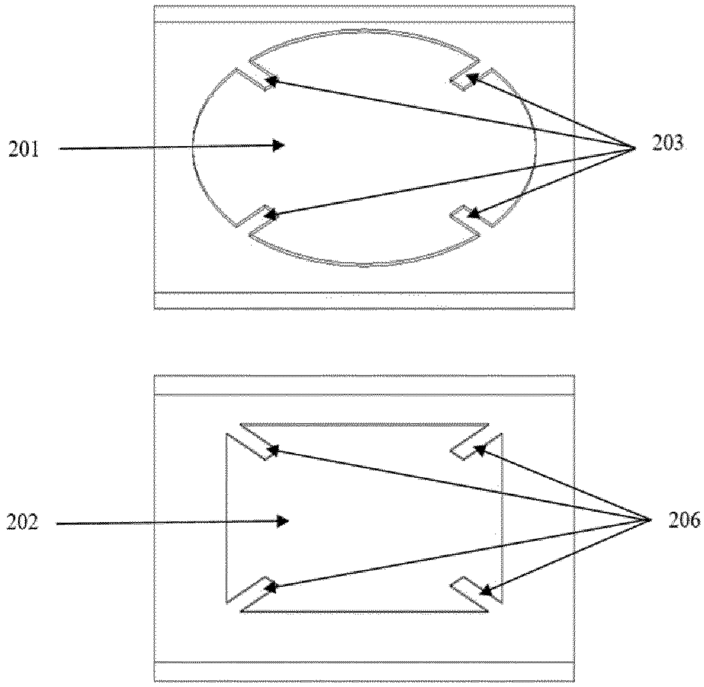

Fig. 4

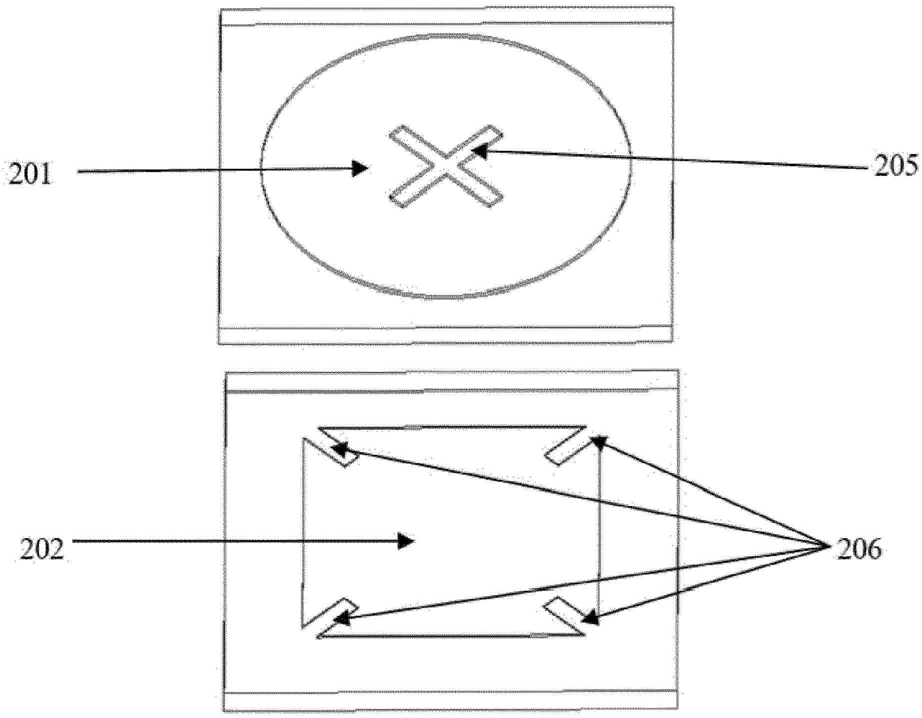

Fig.5

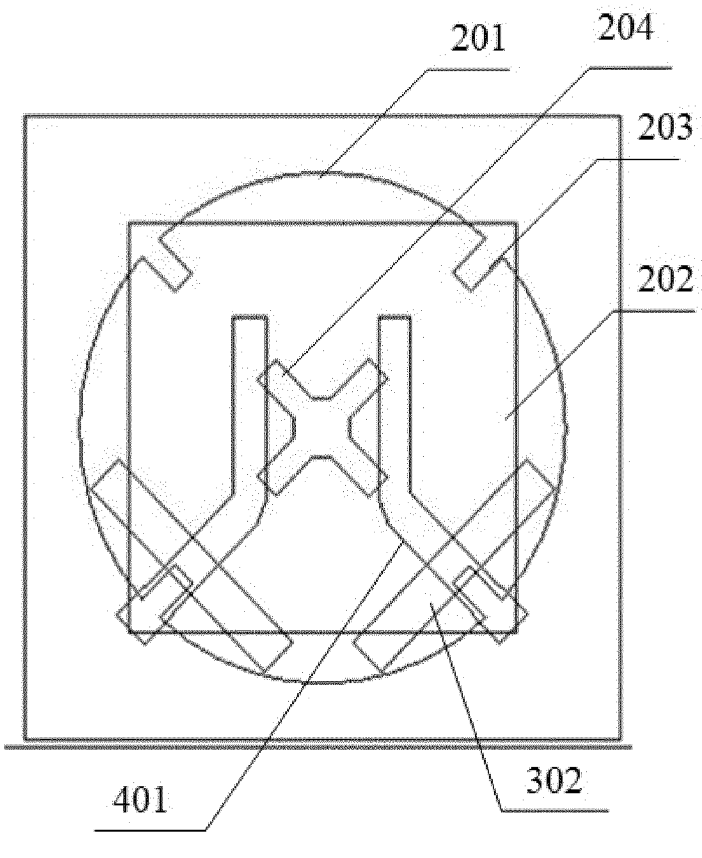

Fig.6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/133130

A. CLASSIFICATION OF SUBJECT MATTER

H01Q1/36(2006.01)i;H01Q1/38(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)

IPC: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, VEN, USTXT, EPTXT, WOTXT, CNKI, IEEE: 天线, 滤波, 微带, 贴片, 馈电, 十字形, 缝隙, antenna, filter, microstrip, patch, feed, cross, slot

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 115173042 A (CHENGDU T-RAY TECHNOLOGY CO., LTD.) 11 October 2022 (2022-10-11) description, paragraphs [0037]-[0066], and figures 1-6	1-10
Y	JP H07321548 A (ATR KOUDENPA TSUSHIN KENKYUSHO) 08 December 1995 (1995-12-08) description, paragraphs [0002]-[0052], and figures 1-14	1-10
Y	CN 110137672 A (HUAWEI TECHNOLOGIES CO., LTD.) 16 August 2019 (2019-08-16) description, paragraphs [0054]-[0120], and figures 1-8	1-10
Y	CN 112510339 A (SOUTH CHINA UNIVERSITY OF TECHNOLOGY et al.) 16 March 2021 (2021-03-16) description, paragraphs [0007]-[0038], and figures 1-6	1-10
A	CN 103337696 A (AIR FORCE ENGINEERING UNIVERSITY OF PLA) 02 October 2013 (2013-10-02) entire document	1-10

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

* Special categories of cited documents:
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- "&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 March 2023	**10 March 2023**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/133130

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 212517535 U (NANJING UNIVERSITY OF INFORMATION SCIENCE & TECHNOLOGY) 09 February 2021 (2021-02-09) entire document	1-10
A	WO 2022082959 A1 (TCL COMMUNICATION (NINGBO) CO., LTD.) 28 April 2022 (2022-04-28) entire document	1-10

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/133130

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