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(54) **RADIATING STRUCTURE AND ARRAY ANTENNA**

STRAHLENDE STRUKTUR UND GRUPPENANTENNE

STRUCTURE RAYONNANTE ET ANTENNE DE RÉSEAU

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Description

Field of the Invention

[0001] This application relates to the field of mobile communication antennas, in particular to a radiating structure, a microstrip antenna unit and an array antenna.

Background

[0002] With the refined and deep coverage of mobile communication networks, the trial commercial use of 5G networks, the deployment of large-scale array antennas in the future, and the development of base station master equipment and antennas toward the gradual integration of antennas, the communication system puts forward higher requirements for the miniaturization and light weight of the antenna.

[0003] In 5G communication technology, the first problem to be solved is how to realize the design of large-scale and lightweight array antennas. In a traditional MIMO system, the distance between the antennas is large and the mutual coupling is weak. Therefore, it is often possible to use metal die-cast dipoles with relatively stable structure and performance, but with a large volume and mass. However, in a 5G massive MIMO system, the base station needs to deploy a large number of array antenna units in a given space, and the total weight of the AAU equipment formed by the integration of the main equipment of the base station and the antenna also poses a greater challenge to the load-bearing capacity of the pillar. At this time, the die-cast dipole of the traditional base station antenna is not suitable for the needs of the communication system due to its large volume and heavy mass. In addition, the traditional die-cast dipoles are used in 5G large-scale dense arrays. Due to their large size and obvious mutual coupling effect, the antenna performance will deteriorate.

[0004] The microstrip antenna itself has the advantages of low profile and light weight, and is more suitable for use in 5G large-scale array antennas. In order to solve the mutual coupling effect, that is, the problem of isolation between antenna ports, or to solve the problem of working bandwidth, the main measure of the microstrip antenna is to adopt a double-layer patch solution. That is, a radiation patch is combined with a parasitic patch, and the patches are interconnected by a plastic holding member and fastened to a reflector plate. Or, these patches are printed on a multi-layer PCB board, so that while the existing microstrip antenna obtains corresponding performance, it will also cause problems such as an increase in the number of parts of the array antenna, a complex assembly, and a higher profile.

[0005] Chinese patent publication No. CN103618149A, entitled "DOUBLE-POLARIZED RADIATION UNIT AND ANTENNA" discloses a double-polarized radiation unit and an antenna. The double-polarized radiation unit comprises two pairs of radiation bodies ar-

ranged in a mutually orthogonal mode, a base installed on lower portions of the radiation bodies and a metal baffle board installed on the lower portion of the base. Each radiation body is sequentially provided with at least three dipoles from the center to an outer circle, each dipole comprises two corresponding half-dipoles, and the half-dipole on the outermost side and an adjacent polarized half-dipole form a closed electromagnetic loop.

[0006] European patent publication No. EP3454414A1, entitled "BROADBAND LOW-PROFILE DUAL-LINEARLY POLARIZED ANTENNA FOR A ONELTE TWO-IN-ONE PLATFORM" discloses a broadband low-profile dual-linearly polarized antenna for a OneLTE two-in-one platform and an antenna array device formed therefrom are provided that can realize low-profile and ultra-broadband and have such advantages as simple structure, neat appearance, easy engineering implementation, and suitability for mass production. The broadband low-profile dual-linearly polarized antenna can include a radiating portion that can include a dielectric substrate, printed folded dipoles spaced apart on an upper surface of the dielectric substrate, first coupled parasitic elements on a lower surface of the dielectric substrate, and second coupled parasitic elements on the upper surface of the dielectric substrate and a feed balun for feeding the radiating portion, wherein each of the printed folded dipoles can include a corresponding one of the first coupled parasitic elements and a corresponding one of the second coupled parasitic elements.

[0007] Chinese patent publication No. CN106329083A, entitled "COMPACT MICROSTRIP ANTENNA" discloses a compact microstrip antenna, which comprises a dielectric layer, a radiation patch, and a grounding part formed on the upper surface and the lower surface of the dielectric layer, wherein gaps are opened in the radiation patch; and the gaps comprise a cross-shaped first gap, and four cross-shaped second gaps symmetrically distributed around the first gap.

SUMMARY OF THE INVENTION

[0008] A primary object of this application is to provide a radiating structure suitable for the development of the 5G era, with simple structure and low-profile characteristics.

[0009] Another object of the present application is to provide an array antenna including the above-mentioned radiating structure.

[0010] In order to achieve the above objects, this application provides the following technical solution:

[0011] As a first aspect, the present application relates to a radiating structure, which includes a radiation sheet, and a radiating slot is defined in a middle portion of the radiation sheet, the radiating slot includes a lateral slot and a longitudinal slot that are communicated with each other and are cross-orthogonal, and the lengths of the lateral slot and the longitudinal slot are both smaller than the lengths of the radiating sheet in corresponding ex-

tending directions of the corresponding radiating slots. At least one groove is provided on an outer edge of the radiating sheet, and the groove is not communicated with the radiating slot, wherein the groove is disposed at a location corresponding to an end portion of the radiating slot.

[0012] Preferably, the lateral slot and the longitudinal slot respectively extend along a direction which is at an angle of $\pm 45^\circ$ with respect to a polarization direction of the radiating structure.

[0013] Preferably, a vector synthesized length of two adjacent slots of the radiating slot in a polarization direction between the two adjacent slots is not less than a length of the radiation sheet in the polarization direction.

[0014] Preferably, the groove includes a notch portion extending inward from the outer edge of the radiating sheet and an elongated portion perpendicular to the notch portion and communicating with the notch portion.

[0015] Preferably, it further comprises a feeding column for connecting the radiating sheet and a feeding network.

[0016] Preferably, corresponding to two polarization directions of the radiating sheet, two groups of the feeding columns are respectively provided, and each group of the feeding columns includes two feeding columns arranged along an axis of a corresponding polarization direction.

[0017] Preferably, the feeding column and the radiating sheet are integrally formed; or the power feeding column and the radiating sheet are welded or snap-connected.

[0018] Preferably, the radiating sheet is provided with several hollow structures.

[0019] As a second aspect, the present application also relates to an array antenna, including a reflector plate and at least one antenna array provided on the reflector plate, and each antenna array is provided with a plurality of the above-mentioned radiating structures.

[0020] Preferably, a decoupling isolation strip is provided between two adjacent antenna arrays.

[0021] Compared with the prior art, the solution of this application has the following advantages:

1. In the radiating structure of the present application, by defining a radiating slot on the radiation sheet, the radiation sheet not only has the radiation generated between its own outer edge and the antenna reflector plate, but also has the radiation of the radiating slot. When the radiating structure works in the antenna system, it can generate two kinds of radiation simultaneously, achieving the effect of polarization vector superposition and enhancement. By increasing an external radiation window of the radiation sheet, the Q value of the microstrip radiating structure can be reduced, which is helpful to broadening the working frequency band. By opening the radiating slot, the current distribution can be restrained, thereby improving the polarization purity of

the radiation field, thereby achieving the purpose of improving the antenna cross-polarization suppression ratio. That is, only one layer of radiating sheet is required to achieve the same radiation efficiency and radiation gain of the traditional antenna adopting the multilayer patch structure, thereby reducing the use of parts, its structure is simple, and the antenna profile can be reduced, which is beneficial to the realization the miniaturization of the antenna.

2. In the radiating structure of the present application, mutually communicated later slot and longitudinal slot are defined on the radiating sheet, which can reduce the common body in the two polarization directions on the radiating sheet, so as to achieve the purpose of reducing the electromagnetic coupling between the two polarizations. Therefore, the isolation between the two polarization directions of the radiating structure can be improved.

3. In the radiating structure of the present application, the equivalent electrical length of the outer edge of the radiator is extended by arranging grooves on the outer edge of the radiator. Compared with the radiating structure of the traditional microstrip antenna unit, the radiation sheet of the present application has a smaller projected area, which can further reduce the common body between the two polarization directions of the radiation sheet. Therefore, the purpose of improving the isolation between the polarization ports of adjacent radiating structures in the array is achieved.

4. In the radiating structure of the present application, a radiating slot is provided on the radiation sheet, and the radiation generated by the radiating slot and the radiation on the inherent outer edge of the radiation sheet are merged through the feeding column to form a parallel structure, making the microstrip antenna unit have a wider working frequency band. In addition, the connection between the radiating structure and the feeding structure does not require additional components for fastening and interconnection, so the antenna has fewer components to achieve the effect of miniaturization, low profile, and light weight. In addition, the bandwidth required by the microstrip antenna can be realized by only one layer of radiating sheet with a simple structure, and the isolation of the microstrip antenna can be improved, thereby increasing the radiation gain of the antenna.

[0022] The additional aspects and advantages of this application will be partly given in the following description, which will become obvious from the following description, or be understood through the practice of this application.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The above and/or additional aspects and advantages of the present application will become obvious

and easy to understand from the following description of the embodiments in conjunction with the accompanying drawings, in which:

Figure 1 is a schematic structural diagram of an embodiment of a radiating structure of this application; Figures 2a-2c are schematic diagrams of various implementation structures of the radiating structure of this application;

Figure 3 is a schematic structural diagram of an embodiment of a microstrip antenna unit of this application;

Figure 4 is a schematic structural diagram of an antenna sub-module in the array antenna of this application;

Figure 5 is a schematic structural diagram of an embodiment of an array antenna according to this application;

Figure 6 is a simulation curve diagram of the voltage standing wave ratio of the microstrip antenna unit of the application in the working frequency band;

Figure 7 is a graph of isolation of the same polarization ports of the array antenna of the present application; and

Figure 8 is a graph of isolation of different polarization ports of the array antenna of the present application.

[0024] In the figure drawings, 1 represents a radiating structure; 11 represents a radiating sheet; 12 represents a radiation slot; 121 represents a lateral slot; 122 represents a longitudinal slot; 13 represents a groove; 131 represents a notch portion; 132 represents an elongated portion; 14 represents a feeding column; 2 represents a feeding structure; 21 represents a feeding network; 211 represents a feeding line; 212 represents a dielectric substrate plate; 213 represents a ground layer; 100 represents a microstrip antenna unit; 200 represents a decoupling strip; and 300 represents a reflector plate.

DETAILED DESCRIPTION

[0025] The embodiments of the present application are described in detail below. Examples of the embodiments are shown in the accompanying drawings, wherein the same or similar reference numerals indicate the same or similar elements or elements with the same or similar functions. The embodiments described below with reference to the drawings are exemplary, and are only used to explain the present application, and cannot be construed as a limitation to the present application.

[0026] Please refer to figures 1 to 8. This application relates to a radiating structure mainly used in the field of mobile communication antennas. By applying the radiating structure 1 to an antenna structure, the polarization isolation of the antenna can be improved, and the structure is simple, and it has low profile characteristics, which is helpful to miniaturization. It can provide reliable resources for the refined and deep coverage of mobile com-

munication networks and the development of the 5G era.

[0027] Please refer to figure 1, a radiating structure 1 includes a radiating sheet 11 and a feeding column 14 for connecting the radiating sheet 11 and a feeding network (please refer to figure 3). Here, the radiation sheet 11 may be a PCB or a metal sheet formed by etching a circuit, and a radiating slot 12 is defined in the middle portion of the radiation sheet 11.

[0028] Preferably, the radiating slot 12 includes a lateral slot 121 and a longitudinal slot 122 that are communicated with each other and are cross-orthogonal, and the lengths of the lateral slot 121 and the longitudinal slot 122 are both smaller than the lengths of the radiating sheet in corresponding extending directions of the corresponding radiating slots. That is, the radiation slot 12 is of a closed structure.

[0029] By defining the radiating slot 12 with a closed structure on the radiating sheet 11, the external radiation window of the radiating structure 1 can be increased, thereby reducing the Q value (Quality factor) of the antenna adopting the radiating structure 1, which is helpful to broaden the working frequency band. In addition, defining a slot on the radiating sheet 11 can also extend the path of the circuit distribution, reduce the resonance frequency of the radiating structure 1, and achieve the purpose of miniaturization. In addition, the lateral slot 121 and the longitudinal slot 122 arranged in a cross orthogonally can restrict the distribution of current, form two current modes with close resonance frequencies, and achieve the design purpose of broadband. At the same time, the current distribution can be restricted by the radiating slot 12 arranged in a cross shape, and the polarization purity of the radiation field can also be improved, so as to achieve the purpose of improving the cross-polarization suppression ratio.

[0030] In a preferred embodiment, the lateral slot 121 and the longitudinal slot 122 of the radiating slot 12 respectively extend along a direction which is at an angle of $\pm 45^\circ$ with respect to a polarization direction of the radiating sheet 11. In addition, the lateral slot 121 and the longitudinal slot 122 communicate with each other, thereby reducing the common body between the two polarization directions on the radiator 11, so as to reduce the electromagnetic coupling between the two polarization directions, and therefore, the isolation between the two polarization directions of the radiating structure 1 can be improved.

[0031] In a further preferred embodiment, the radiation from adjacent slots of the radiating slot 12 can be synthesized into radiation along a polarization direction between adjacent slots through vector synthesis, and its synthesized length is not less than the length of the radiator 11 in the polarization direction. Therefore, the radiation through vector synthesis of the radiating slot 12 having the cross structure can be superimposed on the radiation along the polarization direction, thereby improving the radiation efficiency. Preferably, in this embodiment, the intersection of the lateral slot 121 and the lon-

itudinal slot 122 is located at the geometric center of the radiating sheet 11, and the lengths of the lateral slot 121 and the longitudinal slot 122 are both 0.7λ , and here, λ is related to the working center frequency of the antenna. The radiation length, after vector synthesis, of the lateral slot 121 and the longitudinal slot 122 with a length of 0.7λ in the polarization direction between the two is equal to the length of the radiator 11 in the polarization direction.

[0032] In the radiating structure of the present application, in addition to the radiation generated between the inherent outer edge of the radiation sheet 11 and a reflector plate 300, by defining the radiating slot 12 on the radiation sheet 11, the radiation of the cross structure can be added, so that the radiating structure 1 can generate two kinds of radiation simultaneously, so as to achieve the effect of polarization vector superposition enhancement, improve the radiation efficiency of the antenna unit, and further improve the radiation gain of the antenna. Therefore, only one radiating sheet 11 is required to achieve the same radiation efficiency and radiation gain of the traditional antenna adopting the multi-layer patch structure, which can reduce the use of antenna components, the structure is simple, and the antenna profile can be reduced, which is helpful to realize the miniaturization of the antenna.

[0033] In a preferred embodiment, the length or shape of the lateral slot 121 and the longitudinal slot 122 of the radiating slot 12 can also be changed to reduce errors caused by environmental or processing factors in actual processing and production. This ensures the symmetry of the pattern in the symmetry plane of the antenna, thereby ensuring the radiation efficiency of the antenna and improving the gain of the antenna.

[0034] In addition, referring to figures 2a to 2c, the radiating sheet 11 may have a symmetrical structure such as a square or a circle, or the radiating sheet 11 may be further provided with a hollow structure that is not communicated with the radiating slot 12, thereby reducing the weight of the radiator 11, in order to achieve the purpose of simple structure and light weight of the antenna unit with the radiating structure 1. In addition, in the design of an array antenna with a relatively close unit spacing, this is beneficial to reduce the mutual coupling between the radiating structures 1 and play a role in improving the isolation and improving the pattern.

[0035] According to the invention, an outer edge of the radiating sheet 11 is provided with at least one groove 13, and the groove 13 is not communicated with the radiating slot 12. Preferably, in this embodiment, there are 4 grooves 13 that are respectively disposed at locations corresponding to end portions of the radiating slot 12. That is, the grooves 13 are located in areas defined between the two polarization directions of the radiating sheet 11.

[0036] In a further preferred embodiment, the size of

$$\frac{1}{8}\lambda$$

the grooves is smaller than $\frac{1}{8}\lambda$, where λ is related to the working center frequency of the antenna.

[0037] By arranging the grooves 13 on the outer edge of the radiating sheet 11, the equivalent electrical length of the outer edge of the radiating sheet 11 can be extended. Compared with the radiating structure 1 of a traditional microstrip antenna unit 100, the radiating sheet 11 of the present application has a smaller projected area, reduces the weight of the radiation sheet, can further reduce the common body between the two polarization directions of the radiating sheet 11, thereby achieving the purpose of improving the isolation between the polarization ports of the adjacent radiating structures 1 in the array.

[0038] Preferably, the groove 13 includes a notch portion 131 and an elongated portion 132 communicating with the notch portion 131. The notch portion 131 is formed by extending inwardly from the outer edge of the radiating sheet 11, and the elongated portion 132 is perpendicular to the notch portion 131. By defining the elongated portion 132 communicating with the notch portion 131, the edge length of the groove 13 can be further extended, so as to further extend the equivalent electrical length of the outer edge of the radiating sheet 11. In addition, the purpose of adjusting the radiation of the radiation sheet 11 in different polarization directions can also be achieved by adjusting the location of the elongated portion 132.

[0039] Please refer to figures 1-2. Corresponding to two polarization directions of the radiating sheet 11, two groups of the feeding columns 14 are respectively provided, and each group of the feeding columns 14 includes two feeding columns 14 arranged along an axis of a corresponding polarization direction. Further, the location and length of the feeding column 14 can be adjusted according to actual conditions. The location of the feeding column 14 is adjusted to achieve the purpose of improving the symmetry of the antenna radiation pattern.

[0040] In a preferred embodiment, the feeding column 14 and the radiating sheet 11 are integrally formed. Therefore, the stability of the connection between the feeding structure 2 and the radiating structure 1 is further improved.

[0041] In another preferred embodiment, the feeding column 14 and the radiating sheet 11 can be connected by welding or snapping, which is convenient for production.

[0042] This application also relates to a microstrip antenna unit, and please refer to figure 3, the microstrip antenna unit includes a feeding structure 2 and a radiating structure 1 electrically connected to the feeding structure 2, and the radiating structure is the radiating structure 1 mentioned above. By applying the radiating structure 1 to the microstrip antenna unit 100, its working bandwidth can be broadened, and the radiation efficiency can

be improved. In addition, the radiating structure 1 in this embodiment is only one layer of radiating sheet 11. Therefore, applying the same to the microstrip antenna unit 100 can realize the low-profile design of the microstrip antenna unit 100, with a simple structure and reducing components, and this is helpful for the miniaturization of the antenna.

[0043] The feeding structure 2 includes a feeding network 21 including a dielectric substrate plate 212 and a feeding line 211 provided on the dielectric substrate plate 212 and connected to the feeding column 14. A ground layer 213 is provided on the other side of the dielectric substrate plate 212 facing the side where the feeder line 211 is provided. Specifically, the ground layer 213 in this embodiment is a metal floor.

[0044] In a preferred embodiment, the dielectric substrate plate 212 of the feeding network 21 is a PCB board with a thickness of 1 mm and a dielectric constant of 3.0.

[0045] The radiating structure 1 includes a radiating sheet 11 and a feeding column 14 for connecting the radiating sheet 11 and the feeding network 21. The feeding line 211 is directly electrically connected to the feeding column 14 to realize the feeding of the microstrip antenna unit 100. The structure is simple, no components are required, and the low profile of the antenna can be realized. This contributes to miniaturization of the antenna.

[0046] The radiation generated between the outer edge of the radiating sheet 11 and the reflector plate 300 is in a parallel structure relationship with the radiation generated by the radiating slot 12, and the radiation currents generated by the two can be combined in the feeding column 14 to realize power feeding, to achieve the purpose of parallel resonance, thereby achieving the effect of widening the working bandwidth.

[0047] Based on the above structure, compared with the traditional microstrip antenna, the microstrip antenna unit 100 of the present application is provided with a radiating slot 12 on the radiation sheet 11, and the radiation generated by the radiation slot 12 and the radiation from the inherent outer edge of the radiation sheet 11 are merged through the feeding column 14 to form a parallel structure, and this makes the microstrip antenna unit 100 have a wider working frequency band. In addition, the connection between the radiating structure 1 and the feeding structure 2 does not require additional components for fastening and interconnection, so there are fewer antenna components, thereby achieving the effects of miniaturization, low profile, and light weight. Moreover, the bandwidth required by the microstrip antenna can be realized only by the radiating sheet 11 with a simple structure, and the isolation of the microstrip antenna can be improved, thereby increasing the radiation gain of the antenna.

[0048] The present application also relates to an array antenna. Referring to figures 4 and 5, it includes a reflector plate 300 and at least one antenna array provided on the reflector plate 300, and a plurality of the above-men-

tioned microstrip antenna units are disposed in the antenna array 100.

[0049] As a preferred embodiment, each antenna array has at least one sub-module (not shown in the figure). Each of the sub-modules includes a plurality of microstrip antenna units 100 connected by a plurality of feeding networks 21. In addition, the feeding networks 21 of the microstrip antenna unit 100 in the sub-module are connected by a microstrip line/strip line power dividing network (not shown in the figure) or a coaxial feeding line. Specifically, the sub-module in this embodiment includes three microstrip antenna units 100 arranged in a longitudinal direction, and the three microstrip antenna units 100 are connected by a $\pm 45^\circ$ polarized power dividing network. In addition, the vertical spacing of the three microstrip antenna units DV=0.5-1.0 λ , where λ is related to the working center frequency of the antenna.

[0050] It should be understood that if the number of microstrip antenna units 100 in each sub-module is N ($N \geq 3$), in the same antenna sub-module, input ends of the $+45^\circ$ polarized feeding networks 21 of the microstrip antenna units 100 are electrically connected through a one-to-N power dividing network, and input ends of the -45° polarized feeding networks 21 of the microstrip antenna units 100 are electrically connected through a one-to-N power dividing network.

[0051] As a preferred embodiment, please refer to Figure 5. An array antenna of this embodiment consists of 3 row X 8 column of sub-modules, and each column of sub-modules constitutes an antenna array. In addition, the distance between two adjacent columns of antenna arrays is DH=0.45-0.75 λ , where λ is related to the antenna working center frequency. In addition, a decoupling isolation strip 200 is provided between the antenna arrays of two adjacent columns, which can reduce the mutual coupling between the antenna sub-modules in the antenna working frequency band, thereby improving the isolation of the antenna sub-modules between adjacent columns, and it has little impact on other performance indicators of the antenna.

[0052] The application effects of this application will be described in detail below in conjunction with simulation.

[0053] figure 6 shows a simulation curve diagram of the voltage standing wave ratio of the microstrip antenna unit 100 of the present application in the working frequency band. The figure shows that the microstrip antenna unit 100 has an impedance bandwidth of more than 20% when the standing wave ratio is less than 2, and this indicates that the microstrip antenna unit 100 has a wider impedance bandwidth under the premise of ensuring the radiation efficiency of the antenna.

[0054] Figure 7 is a graph of isolation of the same polarization ports of the array antenna of the present application. That is, in the frequency range of 2.30GHz-3.00GHz, the isolation of the same polarization is greater than 23dB.

[0055] Figure 8 is a graph of isolation of different polarization ports of the array antenna of the present appli-

cation. That is, in the frequency range of 2.30GHz-3.00GHz, the isolation of the same polarization is greater than 35dB.

[0056] The above are only part of the implementation of this application. It should be pointed out that for those of ordinary skill in the art, without departing from the scope of the appended claims, several improvements and modifications can be made, and these improvements and modifications are also regarded as the scope of protection of this application.

Claims

1. A radiating structure (1), comprising a radiating sheet (11), wherein a radiating slot (12) is defined in a middle portion of the radiating sheet (11), the radiating slot (12) includes a lateral slot (121) and a longitudinal slot (122) that are communicated with each other and are cross-orthogonal, and the lengths of the lateral slot (121) and the longitudinal slot (122) are both smaller than the lengths of the radiating sheet (11) in corresponding extending directions of the corresponding radiating slots (12);

characterized in that

at least one groove (13) is provided on an outer edge of the radiating sheet (11), and the groove (13) is not communicated with the radiating slot (12), and the groove (13) is disposed at a location corresponding to an end portion of the radiating slot (12).

2. The radiating structure (1) as recited in claim 1, wherein the lateral slot (121) and the longitudinal slot (122) respectively extend along a direction which is at an angle of $\pm 45^\circ$ with respect to a polarization direction of the radiating structure (1).
3. The radiating structure (1) as recited in claim 2, wherein a vector synthesized length of two adjacent slots of the radiating slot (12) in a polarization direction between the two adjacent slots is not less than a length of the radiation sheet (11) in the polarization direction.
4. The radiating structure (1) as recited in claim 1, wherein the groove (13) includes a notch portion (131) extending inward from the outer edge of the radiating sheet (11) and an elongated portion (132) perpendicular to the notch portion (131) and communicating with the notch portion (131).
5. The radiating structure (1) as recited in claim 1, further comprising a feeding column (14) for connecting the radiating sheet (11) and a feeding network.
6. The radiating structure (1) as recited in claim 5, wherein corresponding to two polarization directions of the radiating sheet (11), two groups of the feeding

columns (14) are respectively provided, and each group of the feeding columns (14) includes two feeding columns (14) arranged along an axis of a corresponding polarization direction.

7. The radiating structure (1) as recited in claim 5, wherein the feeding column (14) and the radiating sheet (11) are integrally formed; or the power feeding column (14) and the radiating sheet (11) are welded or snap-connected.
8. The radiating structure (1) as recited in any one of claims 1-7, wherein the radiating sheet (11) is provided with several hollow structures.
9. An array antenna, comprising a reflector plate (300) and at least one antenna array provided on the reflector plate, and each antenna array is provided with a plurality of radiating structures (1) as recited in any one of claims 1-8.
10. The array antenna as recited in claim 9, wherein a decoupling isolation strip (200) is provided between two adjacent antenna arrays.

Patentansprüche

1. Strahlende Struktur (1), umfassend eine strahlende Folie (11), wobei ein strahlender Schlitz (12) in einem mittleren Abschnitt der strahlenden Folie (11) definiert ist, wobei der strahlende Schlitz (12) einen seitlichen Schlitz (121) und einen Längsschlitz (122), die miteinander kommunizieren und kreuzorthogonal zueinander sind, umfasst, wobei die Längen des seitlichen Schlitzes (121) und des Längsschlitzes (122) beide kleiner sind als die Längen der strahlenden Folie (11) in den entsprechenden Erstreckungsrichtungen der entsprechenden strahlenden Schlitze (12);
dadurch gekennzeichnet, dass
mindestens eine Nut (13) an einer Außenkante der strahlenden Folie (11) vorgesehen ist, und die Nut (13) nicht mit dem strahlenden Schlitz (12) kommuniziert, und die Nut (13) an einer Stelle angeordnet ist, die einem Endabschnitt des strahlenden Schlitzes (12) entspricht.
2. Strahlende Struktur (1) nach Anspruch 1, wobei der seitliche Schlitz (121) und der Längsschlitz (122) sich jeweils entlang einer Richtung erstrecken, die in einem Winkel von $\pm 45^\circ$ in Bezug auf eine Polarisationsrichtung der strahlenden Struktur (1) liegt.
3. Strahlende Struktur (1) nach Anspruch 2, wobei eine vektoriell synthetisierte Länge von zwei benachbarten Schlitzen des strahlenden Schlitzes (12) in einer Polarisationsrichtung zwischen den beiden benach-

barten Schlitzen nicht kleiner ist als eine Länge des strahlenden Folie (11) in der Polarisationsrichtung.

4. Strahlende Struktur (1) nach Anspruch 1, wobei die Nut (13) einen Kerbenabschnitt (131) umfasst, der sich von der Außenkante der strahlenden Folie (11) nach innen erstreckt, und ein länglicher Abschnitt (132) senkrecht zu dem Kerbenabschnitt (131) ist und mit dem Kerbenabschnitt (131) kommuniziert.
5. Strahlende Struktur (1) nach Anspruch 1, die ferner eine Speisesäule (14) zum Verbinden der strahlenden Folie (11) und ein Speisenetz umfasst.
6. Strahlende Struktur (1) nach Anspruch 5, wobei entsprechend zwei Polarisationsrichtungen der strahlenden Folie (11) zwei Gruppen von Speisesäulen (14) vorgesehen sind und jede Gruppe der Speisesäulen (14) zwei Speisesäulen (14) umfasst, die entlang einer Achse einer entsprechenden Polarisationsrichtung angeordnet sind.
7. Strahlende Struktur (1) nach Anspruch 5, wobei die Speisesäule (14) und die strahlende Folie (11) einstückig ausgebildet sind; oder die Speisesäule (14) und die strahlende Folie (11) geschweißt oder durch Schnappverbindungen verbunden sind.
8. Strahlende Struktur (1) nach einem der Ansprüche 1-7, wobei die strahlende Folie (11) mit mehreren hohlen Strukturen versehen ist.
9. Gruppenantenne, umfassend eine Reflektorplatte (300) und mindestens eine auf der Reflektorplatte vorgesehene Antennengruppe, wobei jede Antennengruppe mit einer Vielzahl von strahlenden Strukturen (1) nach einem der Ansprüche 1-8 versehen ist.
10. Gruppenantenne nach Anspruch 9, wobei zwischen zwei benachbarten Antennengruppen ein Entkopplungs-Isolationsstreifen (200) vorgesehen ist.

Revendications

1. Structure rayonnante (1), comprenant une feuille rayonnante (11), dans laquelle une fente rayonnante (12) est définie dans une partie centrale de la feuille rayonnante (11), la fente rayonnante (12) comprend une fente latérale (121) et une fente longitudinale (122) qui communiquent entre elles et sont orthogonales en creux, et les longueurs de la fente latérale (121) et de la fente longitudinale (122) sont toutes deux inférieures aux longueurs de la feuille rayonnante (11) dans les directions d'extension correspondantes des fentes rayonnantes correspondantes (12);

caractérisée en ce que

au moins une rainure (13) est prévue sur un bord extérieur de la feuille rayonnante (11), et la rainure (13) ne communique pas avec la fente rayonnante (12), et la rainure (13) est disposée à un endroit correspondant à une partie terminale de la fente rayonnante (12).

2. Structure rayonnante (1) selon la revendication 1, dans laquelle la fente latérale (121) et la fente longitudinale (122) s'étendent respectivement le long d'une direction formant un angle de $\pm 45^\circ$ par rapport à une direction de polarisation de la structure rayonnante (1).
3. Structure rayonnante (1) selon la revendication 2, dans laquelle une longueur vectorielle synthétisée de deux fentes adjacentes de la fente rayonnante (12) dans une direction de polarisation entre les deux fentes adjacentes n'est pas inférieure à une longueur de la feuille rayonnante (11) dans la direction de polarisation.
4. Structure rayonnante (1) selon la revendication 1, dans laquelle la rainure (13) comprend une partie d'encoche (131) s'étendant vers l'intérieur à partir du bord extérieur de la feuille rayonnante (11) et une partie allongée (132) perpendiculaire à la partie d'encoche (131) et communiquant avec la partie d'encoche (131).
5. Structure rayonnante (1) selon la revendication 1, comprenant en outre une colonne d'alimentation (14) pour relier la feuille rayonnante (11) et un réseau d'alimentation.
6. Structure rayonnante (1) selon la revendication 5, dans laquelle, correspondant à deux directions de polarisation de la feuille rayonnante (11), deux groupes de colonnes d'alimentation (14) sont respectivement prévus, et chaque groupe de colonnes d'alimentation (14) comprend deux colonnes d'alimentation (14) disposées le long d'un axe d'une direction de polarisation correspondante.
7. Structure rayonnante (1) selon la revendication 5, dans laquelle la colonne d'alimentation (14) et la feuille rayonnante (11) sont formées d'un seul tenant; ou la colonne d'alimentation (14) et la feuille rayonnante (11) sont soudées ou assemblées par encliquetage.
8. Structure rayonnante (1) selon l'une quelconque des revendications 1 à 7, dans laquelle la feuille rayonnante (11) est pourvue de plusieurs structures creuses.
9. Antenne de réseau, comprenant une plaque de ré-

fecteur (300) et au moins un réseau d'antennes prévu sur la plaque de réflecteur, et chaque réseau d'antennes est pourvu d'une pluralité de structures rayonnantes (1) selon l'une quelconque des revendications 1 à 8.

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10. Antenne de réseau selon la revendication 9, dans laquelle une bande d'isolation de découplage (200) est prévue entre deux réseaux d'antennes adjacents.

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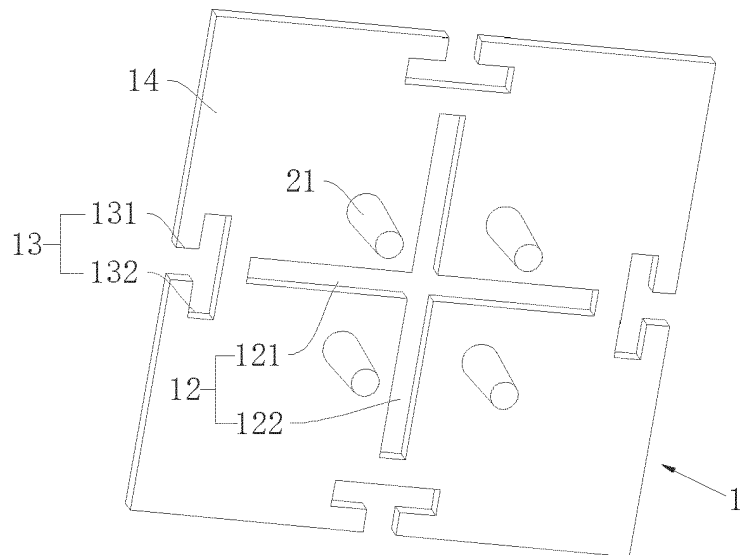


Figure 1

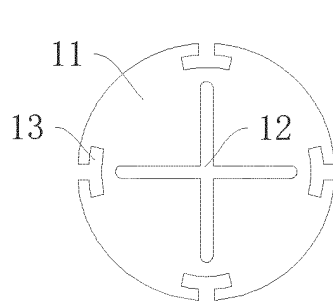


Figure 2a

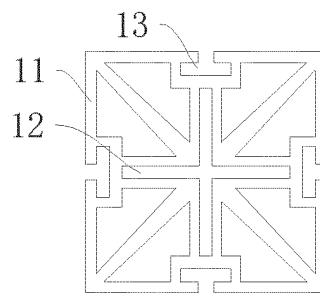


Figure 2b

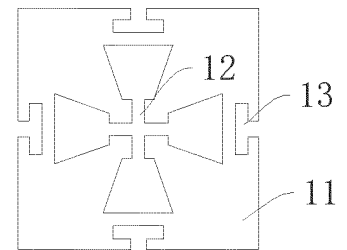


Figure 2c

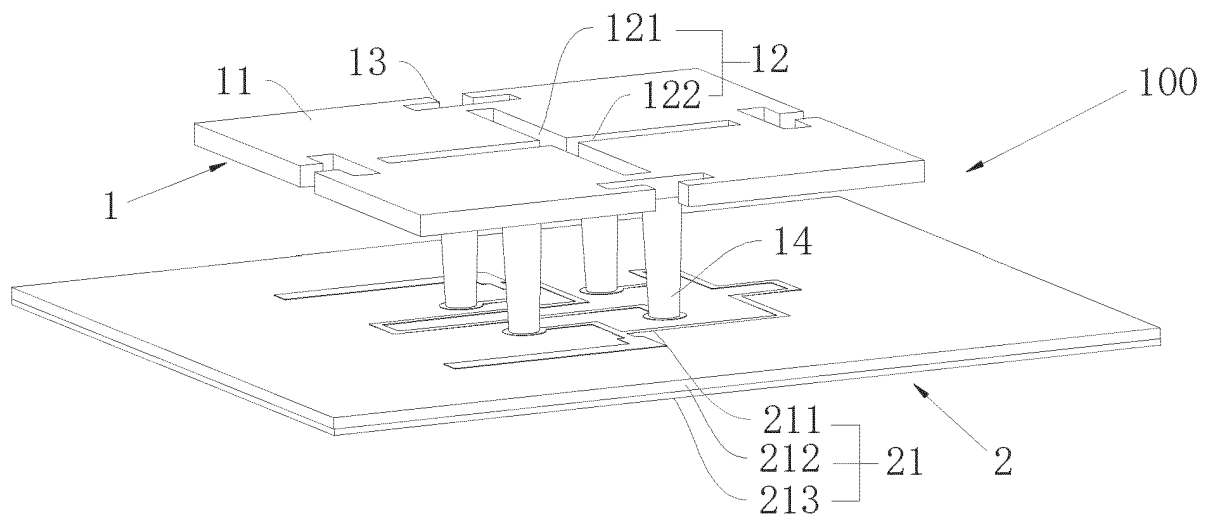


Figure 3

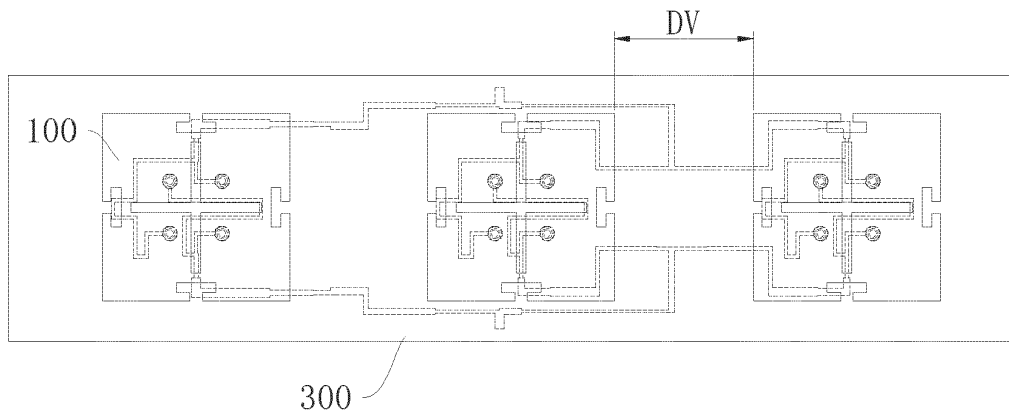


Figure 4

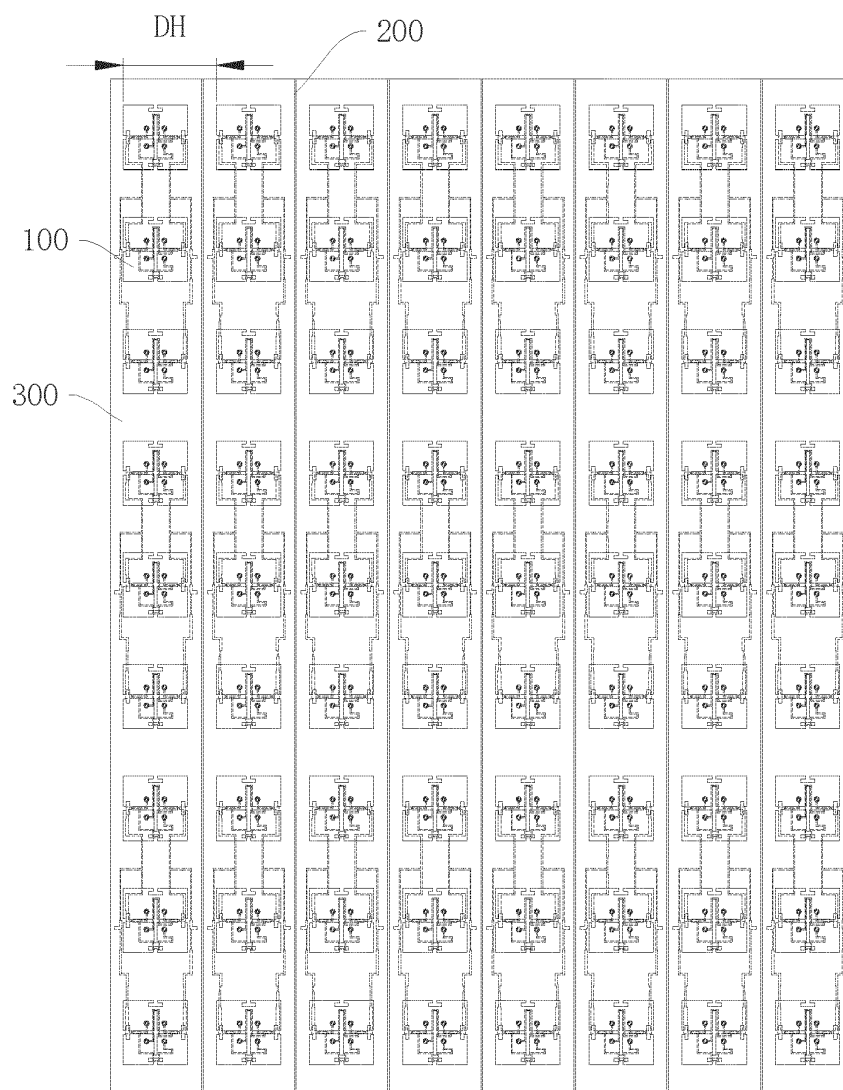


Figure 5

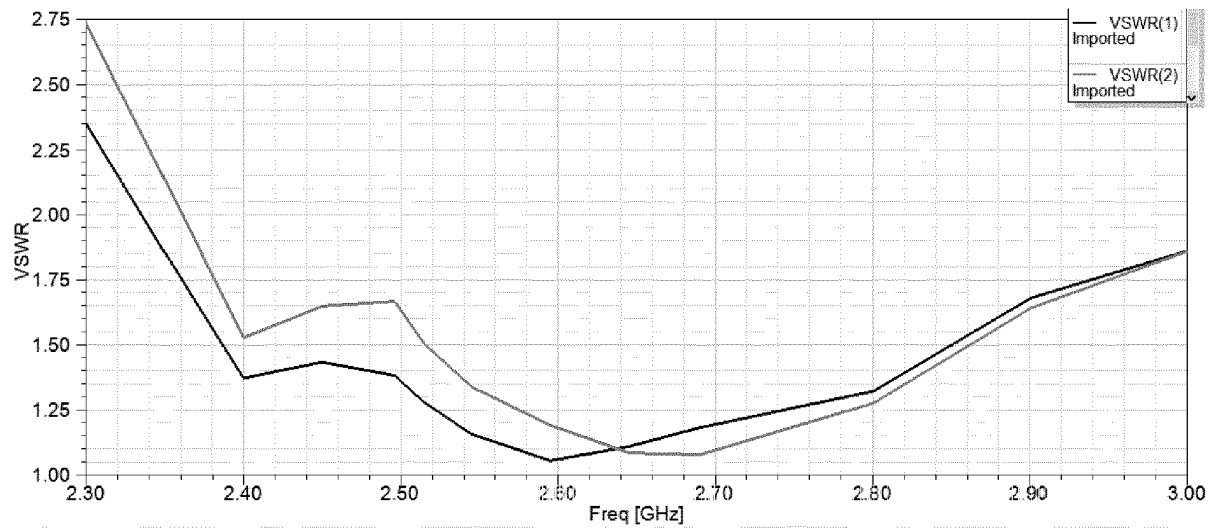


Figure 6

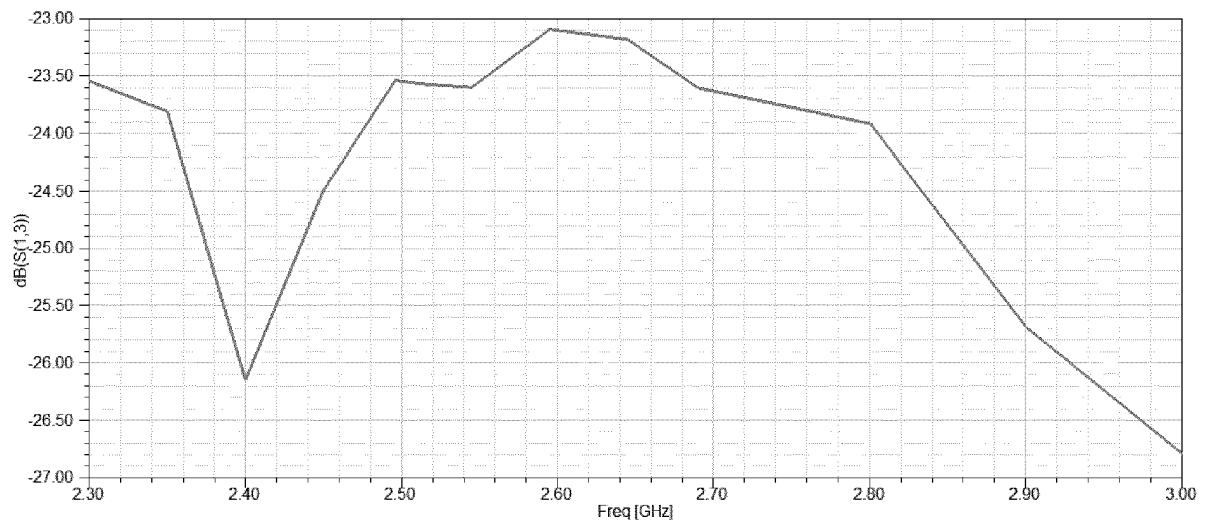


Figure 7

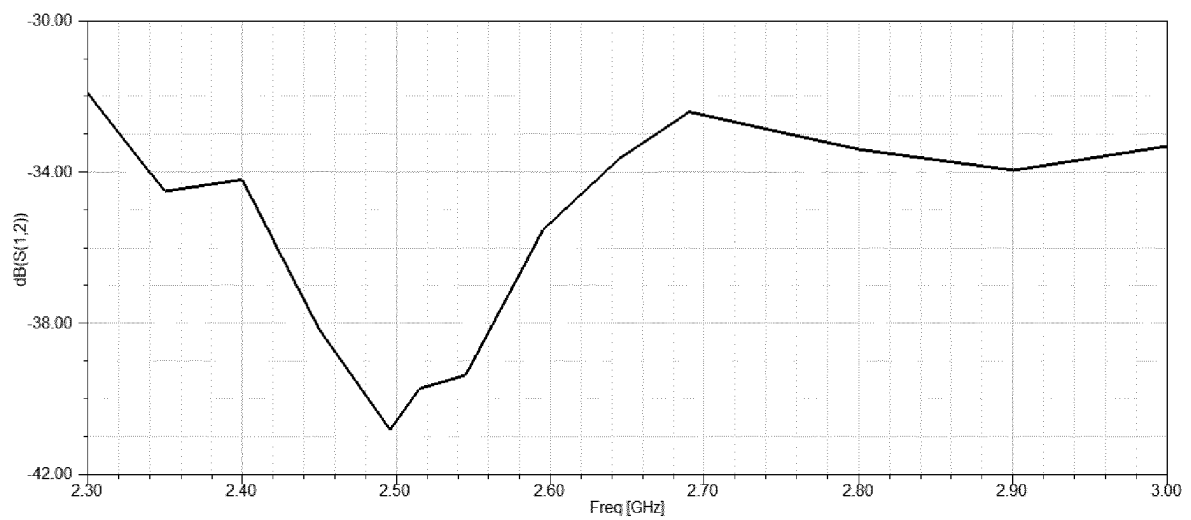


Figure 8

REFERENCES CITED IN THE DESCRIPTION

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