



(11) **EP 3 916 906 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
01.12.2021 Bulletin 2021/48

(51) Int Cl.:
H01Q 1/12 ^(2006.01) **H01Q 1/38** ^(2006.01)
H01Q 1/50 ^(2006.01) **H01Q 21/00** ^(2006.01)
H01Q 21/06 ^(2006.01)

(21) Application number: **19912014.8**

(22) Date of filing: **05.11.2019**

(86) International application number:
PCT/CN2019/115523

(87) International publication number:
WO 2020/151297 (30.07.2020 Gazette 2020/31)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(30) Priority: **22.01.2019 CN 201910058017**

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(54) **MICROSTRIP RADIATION UNIT AND ARRAY ANTENNA**

(57) The embodiments of the present disclosure provide a microstrip radiation unit and an array antenna. The microstrip radiation unit comprises a dielectric base material, a radiation circuit and a feed circuit. The dielectric base material is integrally formed by injection molding, and the dielectric base material comprises a top portion, a support portion and a welding portion, the support portion being respectively connected to the top portion and the welding portion; and the radiation circuit is arranged on an upper surface of the top portion, and the feed circuit is arranged on a lower surface of the top portion and extends along the support portion to the welding portion.

The microstrip radiation unit and the array antenna provided in the embodiments of the present disclosure realize the integration of the radiation unit, so that the radiation unit has a simple structure, and does not need to be assembled, improving the reliability and consistency of the radiation unit, and being suitable for large-scale manufacturing. In addition, the microstrip radiation unit has a good low-profile feature, effectively reducing the height of the radiation unit, further reducing the weight of the radiation unit, and achieving a lightweight radiation unit.

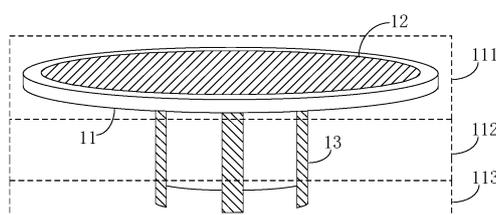


FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

5 [0001] The present application claims priority to Chinese patent application No. 2019100580175 filed on January 22, 2019, entitled "Microstrip Radiation Unit and Array Antenna", which is hereby incorporated by reference in its entirety.

FIELD OF TECHNOLOGY

10 [0002] Embodiments of the present disclosure relate to the technical field of communications, and in particular, to a microstrip radiation unit and an array antenna.

BACKGROUND

15 [0003] With the rapid development of mobile communication technology, the 5th-Generation (5G) mobile communication technology applies large-scale antenna technology, and dozens or even hundreds of antenna arrays are deployed at a base station to increase network capacity. The large-scale antenna technology in the 5G era turns the antenna into an integrated active antenna unit (AAU). AAU integrates the antenna and the radio remote unit (RRU), resulting in the significant increase in the total weight of the AAU, which brings great troubles to the load-bearing and antenna installation of a tower, and thus the lightweight of the antenna becomes the most intuitive and most important goal to be achieved.

20 [0004] The traditional radiation unit is mainly made by the following three solutions. A first solution is to adopt an aluminum alloy integral die-casting structure, in which due to the use of a metal base material with a higher density, a vibrator has a heavier weight, which does not meet a demand for lightweight of large-scale antennas. Moreover, the radiation portion and the feeding portion are separated, and the assembly is complicated, so it is not suitable for large-scale automated production. A second solution is to adopt a PCB structure, in which the radiation portion and the feeding portion are etched on different flat substrate PCBs, and then the various parts are welded together to generate electrical contact. Although this implementation greatly reduces the weight of the radiation unit, due to the large number of parts, complex assembly and low reliability, it is very adverse to large-scale automated production. A third solution is an improvement on the basis of the first solution, in which the radiation portion is made of engineering plastic by injection molding, and then the whole is electroplated. Although the weight of the radiation unit is reduced, the radiation portion and the feeding portion are still separate structures, which leads to complex assembly.

25 [0005] Therefore, how to meet the requirements of simplified assembly while realizing the lightweight of the radiation unit to facilitate large-scale automated production is still a pressing problem for those skilled in the art.

35 **BRIEF SUMMARY**

[0006] Embodiments of the present disclosure provide a microstrip radiation unit and an array antenna so as to solve the problems of heavy weight and complicated assembly of the traditional radiation unit.

40 [0007] In a first aspect, an embodiment of the present disclosure provides a microstrip radiation unit, including a dielectric substrate, a radiation circuit, and a feed circuit;

[0008] wherein, the dielectric substrate is integrally formed by injection molding, and includes a top portion, a support portion and a welding portion, and the support portion is connected to the top portion and the welding portion respectively;

[0009] the radiation circuit is arranged on an upper surface of the top portion, and the feed circuit is arranged on a lower surface of the top portion and extends along the support portion to the welding portion.

45 [0010] In a second aspect, an embodiment of the present disclosure provides an array antenna, including a plurality of microstrip radiation units as provided in the first aspect, and a feed network configured to install each of the plurality of microstrip radiation units.

50 [0011] In the microstrip radiation unit and the array antenna according to the embodiments of the present disclosure, the weight of the radiation unit is reduced by an integrally injection-molded dielectric substrate, and the radiation circuit and the feed circuit are both arranged on the dielectric substrate to realize the integration of the radiation unit, thus simple structure is provided, no assembly is required, reliability and consistency of the radiation units are improved, and it is more suitable for large-scale manufacture. In addition, the single-layer radiation circuit is adopted to implement the microstrip radiation unit, which has good low profile characteristics, effectively reduces the height of the radiation unit, further reduces the weight of the radiation unit, and provides the lightweight of the radiation unit.

55 **BRIEF DESCRIPTION OF THE DRAWINGS**

[0012] In order to more clearly illustrate the technical solutions in the embodiments of the present disclosure or the

prior art, the drawings needed to be used in the descriptions of the embodiments or the prior art will be briefly introduced below. Obviously, the drawings in the following description show some embodiments of the present application, and other drawings may be obtained according to these drawings without any creative work for those skilled in the art.

5 FIG. 1 is a schematic structural diagram of a microstrip radiation unit according to an embodiment of the present disclosure;

FIG. 2 is a schematic structural diagram of a microstrip radiation unit according to another embodiment of the present disclosure;

10 FIG. 3 is a top view of a microstrip radiation unit according to an embodiment of the present disclosure;

FIG. 4 is a top view of a microstrip radiation unit according to another embodiment of the present disclosure;

15 FIG. 5 is a bottom view of a microstrip radiation unit according to an embodiment of the present disclosure;

FIG. 6 is a schematic structural diagram of an array antenna according to an embodiment of the present disclosure;

20 FIG. 7 is a schematic structural diagram of a feed network according to an embodiment of the present disclosure; and

FIG. 8 is a schematic diagram of differential feeding -for an integrated microstrip radiation unit according to an embodiment of the present disclosure.

25		Reference numerals:		
	1-microstrip radiation unit;	11-dielectric substrate;		12-radiation circuit;
	13- feed circuit;	14-non-conductive area;		15-reinforcing rib;
	111-top portion;	112-support portion;		113-welding portion;
30	114-extension hole;	1131-plug pin;		1132-slot;
	121-top radiation circuit;	122-extension radiation circuit;		
	131-top feed circuit;	132-intermediate connecting portion;		
	133-bottom welding portion;	2-feed network;		21-feed port.

35 **DETAILED DESCRIPTION**

[0013] In order to make the objectives, technical solutions and advantages of the present disclosure clearer, the technical solutions in the embodiments of the present disclosure are clearly and completely described below in conjunction with the accompanying drawings in the present disclosure. Obviously, the described embodiments are a part of the
 40 embodiments of the present disclosure, rather than all of the embodiments. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of the present disclosure without any creative work belong to the scope of the present disclosure.

[0014] In order to solve the problems that the traditional radiation unit is generally heavy, does not meet the lightweight requirements of large-scale antennas, is relatively complicated in assembly, and is not suitable for large-scale automated
 45 production, an embodiment of the present disclosure provides a microstrip radiation unit capable of realizing the light weight of the radiation unit while meeting the requirements of simplification in assembly. FIG. 1 is a schematic structural diagram of a microstrip radiation unit according to an embodiment of the present disclosure. As shown in FIG. 1, the microstrip radiation unit includes a dielectric substrate 11, a radiation circuit 12, and a feed circuit 13; wherein the dielectric substrate 11 is integrally formed by injection molding and includes a top portion 111, a support portion 112, and a welding portion 113. The support portion 112 is connected to the top portion 111 and the welding portion 113, respectively; the radiation circuit 12 is arranged on an upper surface of the top portion 111, and the feed circuit 13 is arranged on a lower surface of the top portion 111 and extends along the support portion 112 to the welding portion 113.
 50

[0015] In an embodiment, the dielectric substrate 11 is an integrally injection-molded single part including the top portion 111, the support portion 112, and the welding portion 113 from top to bottom, wherein the support portion 112 is a connecting part between the top portion 111 and the welding portion 113. Although the support portion 112 may be
 55 a single column structure as shown in FIG. 1, it may also be composed of a plurality of support components. Here, a surface of the top portion 111 in contact with the support portion 112 is confirmed as a lower surface of the top portion

111, and accordingly a surface of the top portion 111 not in contact with the support portion 112 is confirmed as an upper surface of the top portion 111. The radiation circuit 12 is arranged on the upper surface of the top portion 111. The radiation circuit 12 may completely cover the upper surface of the top portion 111, or may be arranged on the upper surface of the top portion 111 in a shape consistent with the upper surface of the top portion 111, or may be arranged at a preset position of the upper surface on the top portion 111 based on a preset shape, which is not limited in the embodiment of the present disclosure. Correspondingly, the feed circuit 13 is arranged on the back of a surface for arranging the radiation circuit 12, that is, the lower surface of the top portion 111, and the support portion 112 in contact with the lower surface of the top portion 111 finally extends to the welding portion 113, so as to facilitate the electric connection between the feed circuit 13 and the feed network through the welding portion 113 in the state that the welding portion 113 is connected to the feed network when the microstrip radiation unit is installed. It should be noted that the radiation circuit 12 is arranged on the upper surface of the top portion 111, the feed circuit 13 is arranged on the lower surface of the top portion 111, and a specific arrangement position of the radiation circuit 12 on the upper surface of the top portion 111 corresponds to a specific arrangement position of the feed circuit 13 on the lower surface of the top portion 111 such that the radiation circuit 12 arranged on the upper surface of the top portion 111 and the feed circuit 13 arranged on the lower surface of the top portion 111 form a coupled feeding of the radiation unit.

[0016] In addition, the radiation circuit 12 and the feed circuit 13 may be arranged on the dielectric substrate 11 by 3D-MID (3D molded interconnect device) technology.

[0017] In the microstrip radiation unit according to the embodiment of the present disclosure, the weight of the radiation unit is reduced by an integrally injection-molded dielectric substrate 11, and the radiation circuit 12 and the feed circuit 13 are both arranged on the dielectric substrate 11 to realize the integration of the radiation unit, thus simple structure is provided, no assembly is required, reliability and consistency of the radiation units are improved, and it is more suitable for large-scale manufacturing. In addition, the single-layer radiation circuit is adopted to implement the microstrip radiation unit, which has good low profile characteristics, effectively reduces the height of the radiation unit, further reduces the weight of the radiation unit, and provides the lightweight of the radiation unit.

[0018] Based on the above embodiments, FIG. 2 is a schematic structural diagram of a microstrip radiation unit according to another embodiment of the present disclosure. As shown in FIG. 2, in the microstrip radiation unit, an extension hole 114 is opened in the center of the top portion 111, and extends towards the direction of the welding portion in the support portion; and the radiation circuit is extended to and arranged on a wall of the extension hole 114.

[0019] In an embodiment, an extension hole 114 is provided in the center of the top portion 111, and extends towards the direction of the welding portion. Here, the extension hole 114 may be a through hole, that is, both the support portion and the welding portion of the dielectric substrate are designed as hollow structures. Alternatively, the extension hole 114 may also be a blind hole, that is, the extension hole 114 extends in but does not pass through the support portion, which is not specifically limited in the embodiment of the present disclosure. By making the extension hole 114 in the dielectric substrate, the materials used may be further reduced, and thus the weight of the microstrip radiation unit may be decreased.

[0020] On this basis, the radiation circuit arranged on the upper surface of the top portion 111 is extended to and arranged on the wall of the extension hole 114. In FIG. 2, the radiation circuit is divided into two parts, one part is a radiation circuit arranged on the upper surface of the top portion 111, that is, a top radiation circuit 121, and the other is a radiation circuit extending to the wall of the extension hole 114, that is, the extension radiation circuit 122. Since the extension hole 114 is a hole provided in the center of the support portion, the support portion may be regarded as a hollow structure, the wall of the extension hole 114 is regarded as the inner wall of the support portion, and the surface of the support portion on which the feed circuit is arranged is regarded as an outer wall of the support portion. By extending and arranging the radiation circuit on the inner wall of the support portion, the cross-polarization index of the microstrip radiation unit may be greatly improved.

[0021] Based on any of the above embodiments, in the microstrip radiation unit, a non-conductive area is also arranged on the radiation circuit.

[0022] In an embodiment, in order to improve the polarized isolation, a non-conductive area is also arranged on the upper surface of the top portion, and the embodiments of the present disclosure do not limit the shape, number, and specific location of the non-conductive area. FIG. 3 is a top view of a microstrip radiation unit according to an embodiment of the present disclosure. As shown in FIG. 3, the top portion 111 of the dielectric substrate is circular, the top portion 111 is provided with a radiation circuit 12, and the center of the top portion 111 is provided with an extension hole 114. Four groups of demetallized non-conductive areas 14, each of which is a straight-line shape, are evenly distributed on the upper surface with the center of the top portion 111 as a center of symmetry. FIG. 4 is a top view of a microstrip radiation unit according to another embodiment of the present disclosure. As shown in FIG. 4, the top portion 111 of the dielectric substrate is octagonal, the top portion 111 is provided with a radiation circuit 12, and the center of the top portion 111 is provided with an extension hole 114. Four groups of demetallized non-conductive areas 14, each of which is splayed, are evenly distributed on the upper surface with the center of the top portion 111 as a center of symmetry.

[0023] Based on any of the above embodiments, in the microstrip radiation unit, reinforcing ribs are also arranged on

the top portion.

[0024] In an embodiment, by additionally arranging reinforcing ribs on the top portion of the dielectric substrate, the structural strength of the integrated dielectric substrate and the flatness of the top planar structure may be improved. Square-shaped reinforcing ribs with skirt may be disposed at the peripheral edges of the top portion, or cross-shaped reinforcing ribs may be disposed on the surface of the top portion based on the center of the top portion, which is not specifically limited in the embodiments of the present disclosure.

[0025] Based on any of the above embodiments, in the microstrip radiation unit, the radiation circuit and the feed circuit are symmetrically arranged about a central axis of the dielectric substrate. Therefore, when the microstrip radiation unit is subject to the complete machine assembly as a single component, the electrical connection assembly of the radiation unit and the feed network does not require additional identification, which is very suitable for automated production in large-scale array antenna applications.

[0026] Based on any of the above embodiments, FIG. 5 is a bottom view of the microstrip radiation unit according to an embodiment of the present disclosure. As shown in FIG. 5, the microstrip radiation unit includes four groups of feed circuits 13 uniformly distributed with a central axis of the dielectric substrate 11 as an axis of symmetry.

[0027] In an embodiment, each group of feed circuits 13 has the same structure, and is distributed along the central axis by a 90° rotation in sequence. Here, the microstrip radiation unit containing four groups of feed circuits 13 is referred to as a dual-polarized radiation unit. Each polarization of the dual-polarized radiation unit is fed differentially (with a 180° phase difference) by two groups of feed circuits 13 arranged oppositely and symmetrically so as to suppress high-order modes, further reduce the coupling between two ports, and improve the pattern consistency and isolation of +45° polarization and -45° polarization of a dual-polarized oscillator.

[0028] Based on any of the above embodiments, in the microstrip radiation unit, the welding portion 113 includes four plug pins 1131 evenly distributed with the central axis of the dielectric substrate 11 as an axis of symmetry, and each feed circuit 13 wraps a plug pin 1131.

[0029] In an embodiment, referring to FIG. 5, each feed circuit 13 includes a top feed circuit 131, an intermediate connecting portion 132 and a bottom welding portion 133. The top feed circuit 131 is a portion of said feed circuit 13 arranged on the top portion 111 of the dielectric substrate, the intermediate connecting portion 132 is a portion of said feed circuit 13 arranged on the support portion 112 of the dielectric substrate for connecting the top feed circuit 131 and the bottom welding portion 133, and the bottom welding portion 133 is a portion of said feed circuit 13 arranged on the welding portion 113 of the dielectric substrate for wrapping one plug pin 1131 corresponding to the welding portion 113. Here, the bottom welding portion 133 for wrapping the plug pin 1131 is configured to electrically connect with a port of the feed network to provide signal excitation.

[0030] Based on any of the foregoing embodiments, referring to FIG. 5, in the microstrip radiation unit, a slot 1132 is provided between any two adjacent plug pins 1131 of the welding portion 113. Through the arrangement of the slot 1132, the weight of the integrated dielectric substrate 11 is further decreased. Here, the slot 1132 may be a slot of various shapes such as U-shaped slot and V-shaped slot.

[0031] Based on any of the above embodiments, the microstrip radiation unit is a three-dimensional molded interconnect device, and the entire microstrip radiation unit is a single component, which simplifies a supply chain, has a simple structure, improves the reliability and consistency of the radiation units, and is suitable for large-scale manufacture.

[0032] Based on any of the above embodiments, FIG. 6 is a schematic structural diagram of an array antenna according to an embodiment of the present disclosure. As shown in FIG. 6, the array antenna includes several microstrip radiation units 1, and a feed network 2 configured to install each microstrip radiation unit 1.

[0033] In an embodiment, each microstrip radiation unit 1 is welded to the feed network 2 through the welding portion of the dielectric substrate to provide the electrical connection between the feed circuit and the feed network 2. The welding portion may be a pin-type welding structure, or may be a patch-type welding structure, and the installation method between the microstrip radiation unit 1 and the feed network 2 is not specifically limited in the embodiments of the present disclosure.

[0034] FIG. 7 is a schematic structural diagram of a feed network according to an embodiment of the present disclosure. Referring to FIG. 7, several feed ports 21 are provided on the feed network 2 for electrical connection with the welding portion of the microstrip radiation unit. In FIG. 7, four feed ports 21 are provided for the microstrip radiation unit whose welding portion includes four plug pins. Each plug pin corresponds to one feed port 21. In the case that four plug pins have rotational center symmetry, the four plug pins only need to be directly connected to the four feed ports 21 without additional identification during assembly, and thus blind mating assembly may be realized, which may significantly shorten the assembly time in antenna production and increase the assembly efficiency. Therefore, it is very suitable for implementing automated production in large-scale array antenna applications.

[0035] FIG. 8 is a schematic diagram of differential feeding of an integrated microstrip radiation unit according to an embodiment of the present disclosure, including an integrated microstrip radiation unit 1 and a differential feed network 2 thereof. Referring to FIGS. 7 and 8, the four plug pins of the integrated radiation unit are blindly plugged into the four feed ports of the differential feed network 2 without additional identification. In the differential feed network 2, two feed

ports of the same polarization are arranged oppositely with a 180° phase difference.

[0036] Referring to FIG. 5, the microstrip radiation unit 1 includes a dielectric substrate 11, a radiation circuit 12 and a feed circuit 13. The dielectric substrate 11 is an integrated structure and is integrally formed by injection molding with high-temperature-resistant engineering plastics. The dielectric substrate 11 includes a top portion 111, a support portion 112, a welding portion 113, and reinforcing ribs 15. An extension hole 114 is provided at the center of the top portion 111 to form a smooth transition structure with the support portion 112, which is unobstructed from the top view. The radiation circuit 12 includes a top radiation circuit 121 arranged on the upper surface of the top portion 111 of the dielectric substrate and an extension radiation circuit 122 arranged on the wall surface of the extension hole 114. In addition, the top radiation circuit 121 is provided with a demetallized gap, that is, a non-conductive area 14. The feed circuit 13 includes a top feed circuit 131 arranged on the bottom surface of the top portion 111 of the dielectric substrate, an intermediate connecting portion 132 arranged on the outer wall surface of the support portion 112 of the dielectric substrate, and a bottom welding portion 113 arranged on the welding portion of the dielectric substrate and wrapping one of the four plug pins of the welding portion 113 of the entire dielectric substrate.

[0037] Here, the top portion 111 of the dielectric substrate has a square planar structure, and may also has a round or other polygonal structure. Through the arrangement of the extension hole 114 at the center of the top portion 111, materials used may be reduced and the weight of the integrated dielectric substrate 11 is also decreased. The top radiation circuit 121 arranged on the top portion 111 of the dielectric substrate has a circuit shape consistent with the planar shape of the top portion 111 of the dielectric substrate 11. On the top radiation circuit 121, four groups of non-conductive regions 14 having the same structures with the central axis of the dielectric substrate 11 as the axis of symmetry are provided, whose shapes are linear or inversed V-shaped or other deformed shapes, so as to improve the polarization isolation. Through the arrangement of the extension radiation circuit 122 extending downwardly from a connection part between the extension hole 114 on the top portion 111 of the dielectric substrate and the support portion 112 of the dielectric substrate toward the inner surface of the support portion 112 of the dielectric substrate, that is, along the wall of the extension hole 114, the cross-polarization ratio index of the microstrip radiation unit 1 may be greatly improved.

[0038] The reinforcing ribs 15 are respectively arranged on the peripheral edges of the top portion 111 of the dielectric substrate, forming a square skirt, and a cross shape on the center of the bottom surface of the top portion 111, so as to improve the structural strength of the integrated dielectric substrate 11 and the flatness of the planar structure of the top portion 111. In addition, the support portion 112 forms a hollow closed structure to enhance the structural strength of the integrated dielectric substrate 11. The support portion 112 may be in a barrel shape or other closed shapes. The welding portion 113 includes four surrounding plug pins 1131 that rotate by 90° . A U-shaped slot 1132 is provided in an area of two adjacent plug pins 1131 to further reduce the weight of the integrated dielectric substrate 11.

[0039] The microstrip radiation unit 1 includes four groups of feed circuits 13, each of which has the same structure and is distributed along the central axis in a 90° rotation in turn. For a single feed circuit 13, the top feed circuit 131, arranged on the bottom surface of the top portion 111, in the feed circuit 13 and the radiation circuit 12 form a radiation unit coupling feed, and the intermediate connecting portion 132 is configured to connect with the top feed circuit 131 and the bottom welding portion 133, so as to provide the continuous electrical connection of the entire feed circuit 13. The bottom welding portion 133 for wrapping the plug pin 1131 is configured to electrically connect with a feed port of the feed network 2 to provide signal excitation. Here, the bottom welding portion 133 may be configured as a pin-type plug-welding type structure, or may be configured as a disc-shaped patch type welding structure, which is not specifically limited in the embodiments of the present disclosure. The four groups of feed circuits 13 based on the above structure jointly provide the feed excitation of the dual-polarized microstrip radiation unit 1, so as to suppress high-order modes, further reduce the coupling between two ports, and improve the pattern consistency and isolation of $+45^\circ$ polarization and -45° polarization of a dual-polarized oscillator. It should be noted that in the embodiments of the present disclosure, the coupling feed mode may be adopted to effectively increase the matching bandwidth of the oscillator.

[0040] In the microstrip radiation unit 1 according to the embodiments of the present disclosure, a structure of single-layer radiation circuit 12 is adopted, and since the overall height of the microstrip radiation unit 1 is less than 0.15λ (where λ represents the wavelength), it has good low profile characteristics. Secondly, the microstrip radiation unit 1 is specially provided with the extension radiation circuit 122, which greatly improves the cross-polarization index of the microstrip radiation unit 1. Moreover, the microstrip radiation unit 1 is a 3D-MID molded interconnect device, which is very light in weight and suitable for use in large-scale array antenna application, and the entire microstrip radiation unit 1 is a single part, which simplifies the supply chain, has a simple structure, improves the reliability and consistency of the radiation units, and is suitable for large-scale manufacture. In addition, the radiation portion and the feeding portion of the microstrip radiation unit 1 are all centrosymmetric based on a single component of the radiation unit, and the four plug pins may be blindly inserted into the four feed ports of the feed network 2 without additional identification, which significantly shortens the assembly time in antenna production and improves assembly efficiency, being very suitable for realizing automated production in large-scale array antenna applications.

[0041] Finally, it should be noted that the above embodiments are only used to illustrate the technical solutions of the

present disclosure, rather than limiting them; although the present disclosure is described in detail with reference to the foregoing embodiments, it should be understood by those skilled in the art that they can still modify the technical solutions documented in the foregoing embodiments and make equivalent substitutions to a part of the technical features; and these modifications and substitutions do not depart the essence of the corresponding technical solutions from the spirit and scope of the technical solutions of various embodiments of the present disclosure.

Claims

1. A microstrip radiation unit, comprising a dielectric substrate, a radiation circuit and a feed circuit;

wherein, the dielectric substrate is integrally formed by injection molding, and comprises a top portion, a support portion and a welding portion, and the support portion is connected to the top portion and the welding portion respectively; and

the radiation circuit is arranged on an upper surface of the top portion, and the feed circuit is arranged on a lower surface of the top portion and extends along the support portion to the welding portion.
2. The microstrip radiation unit of claim 1, **characterized in that** an extension hole is provided in the center of the top portion, and extends towards the direction of the welding portion in the support portion; and the radiation circuit is extended to and arranged on a wall of the extension hole.
3. The microstrip radiation unit of claim 1, **characterized in that** a non-conductive area is arranged on the radiation circuit.
4. The microstrip radiation unit of claim 1, **characterized in that** the top portion is further provided with reinforcing ribs.
5. The microstrip radiation unit of claim 1, **characterized in that** the radiation circuit and the feed circuit are both symmetrically arranged about a central axis of the dielectric substrate.
6. The microstrip radiation unit of claim 1, **characterized in that** the microstrip radiation unit comprises four groups of the feed circuits, and the four groups of feed circuits are evenly distributed with a central axis of the dielectric substrate as an axis of symmetry.
7. The microstrip radiation unit of claim 6, **characterized in that** the welding portion comprises four plug pins evenly distributed with the central axis of the dielectric substrate as an axis of symmetry, and each of the feed circuits wraps one of the plug pins.
8. The microstrip radiation unit of claim 7, **characterized in that** a slot is provided between any two adjacent plug pins of the welding portion.
9. The microstrip radiation unit of any one of claims 1 to 8, **characterized in that** the microstrip radiation unit is a three-dimensional molded interconnect device.
10. An array antenna, comprising several microstrip radiation units of any one of claims 1 to 9, and a feed network for installing each of the microstrip radiation units.

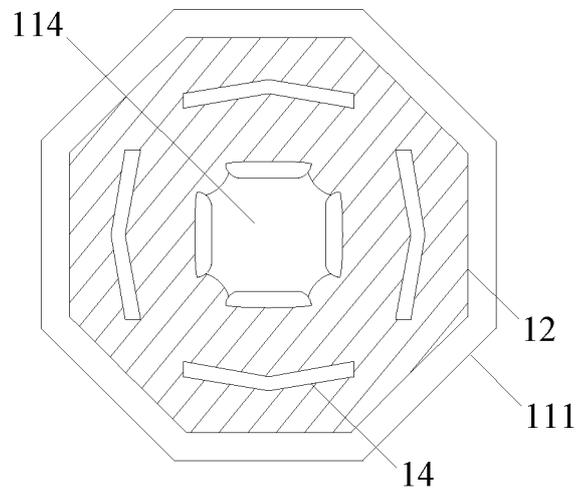


FIG. 4

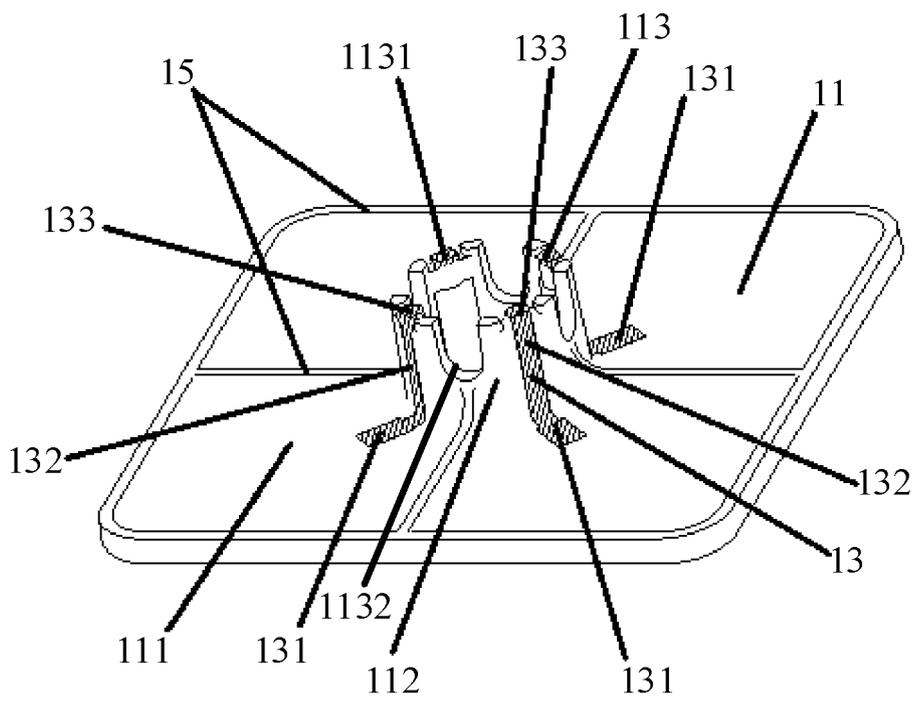


FIG. 5

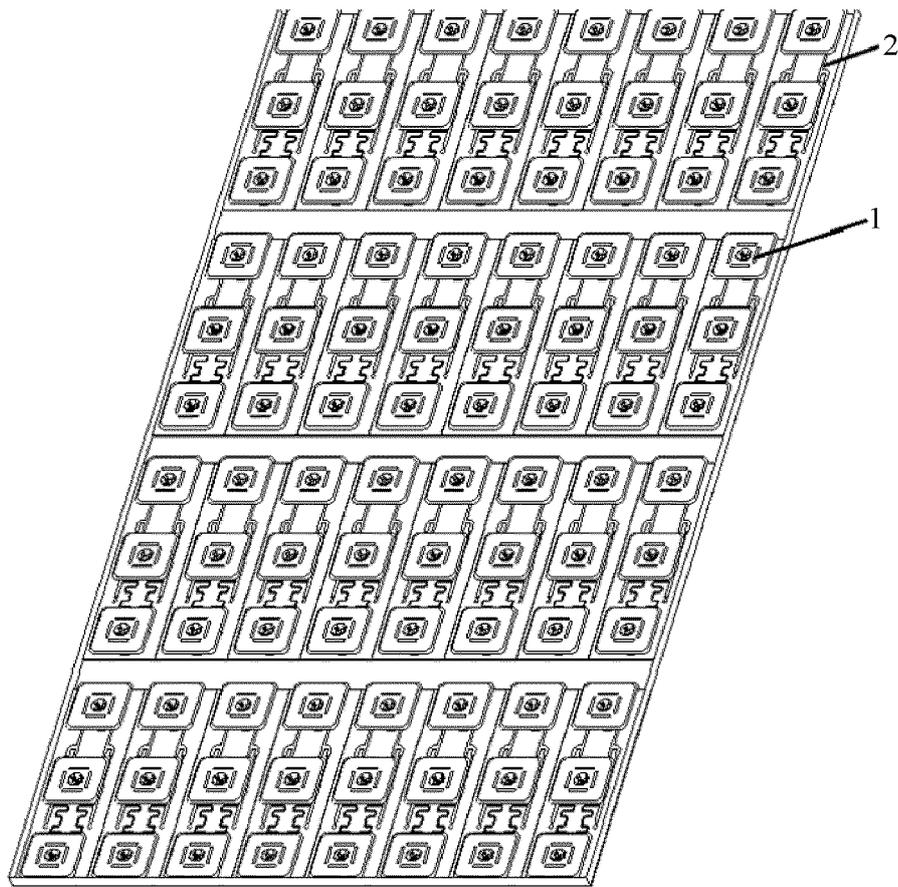


FIG. 6

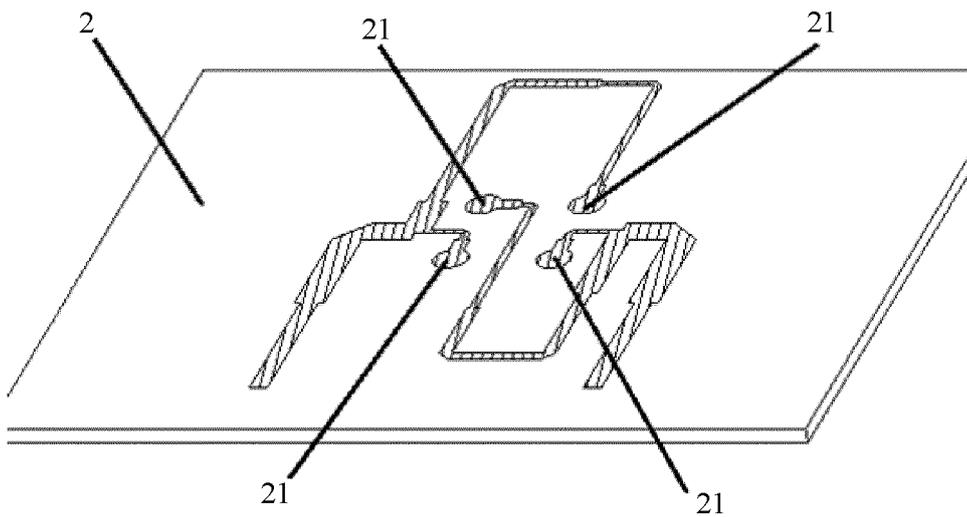


FIG. 7

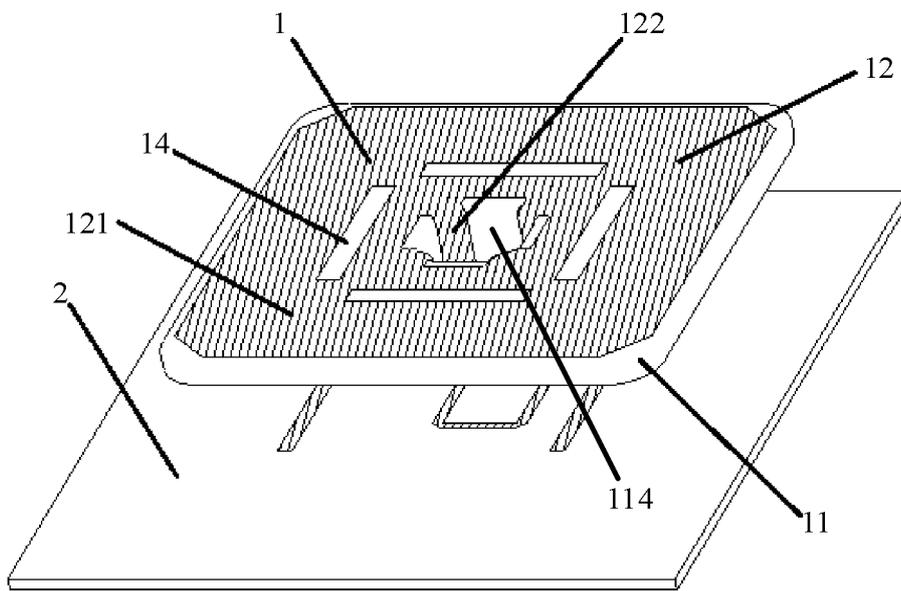


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/115523

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A. CLASSIFICATION OF SUBJECT MATTER	
H01Q 1/12(2006.01)i; H01Q 1/38(2006.01)i; H01Q 1/50(2006.01)i; H01Q 21/00(2006.01)i; H01Q 21/06(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, CNKL, VEN, USTXT, WOTXT, EPTXT, IEE: 微带, 贴片, 天线, 双极化, 支撑, 焊接, 馈电网络, 馈电电路, 馈电柱, microstrip, patch, antenna, aerial, dual polarise, dual polarize, support, solder, jointing, feeding, post, via	
C. DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages
PX	CN 109755721 A (WUHAN HONGXIN TELECOMMUNICATION TECHNOLOGIES CO., LTD.) 14 May 2019 (2019-05-14) claims 1-10
X	CN 108899644 A (SHENZHEN SHENDA WAVETONETECH TECHNOLOGY CO., LTD.) 27 November 2018 (2018-11-27) description, paragraphs 0022-0039, and figures 1-7
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* Special categories of cited documents:	“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
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“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)	“&” document member of the same patent family
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Date of the actual completion of the international search 21 January 2020	Date of mailing of the international search report 01 February 2020
Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/CN) No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China	Authorized officer
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