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(54) **ANTENNA**

ANTENNE

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Description

TECHNICAL FIELD

[0001] Implementations of this application relate to the field of communications technologies, and in particular, to an antenna.

BACKGROUND

[0002] Currently, printed antennas commonly used in Wi-Fi products mainly include a monopole antenna, a printed inverted F antenna, a loop antenna, and the like. A main feature of such type of printed antennas is that a signal of each printed antenna is radiated in a single direction, offering a limited coverage angle.

[0003] To ensure better coverage performance of a Wi-Fi product, a combination of a plurality of printed antennas needs to be disposed on a circuit board of the Wi-Fi product, so that the Wi-Fi product has a plurality of signal radiation directions, to implement wider coverage.

[0004] However, increasing a quantity of printed antennas on the circuit board of the Wi-Fi product not only increases manufacturing costs, but also occupies more space on the circuit board of the Wi-Fi product.

[0005] US2016336649 relates to antenna and mobile terminal. US2016359231 relates to antenna structure. WO2016138650 relates to multiple input multiple output wireless antenna structures and communication device.

SUMMARY

[0006] Implementations of this application provide an antenna, so that the antenna can send signals in two directions, to increase a radiation range of the antenna.

[0007] The invention has been defined in the independent claims. Further specific technical features have been defined in the dependent claims.

[0008] In this application, a radio frequency signal on the radio frequency circuit of the circuit board passes through the signal feed-in part, the first conductive ground structure, and the second conductive ground structure to feed the loop radiator, and flows to two ends of the loop radiator respectively through the signal feed-in part and the first conductive ground structure. The loop radiator independently generates the first radiation signal based on the function of the current. The loop radiator and the second conductive ground structure further jointly generate the second radiation signal in the opening direction of the groove based on the function of the current. The radiation direction of the first radiation signal is different from the radiation direction of the second radiation signal. Therefore, the antenna provided in this implementation of this application can send signals in two directions, thereby increasing a radiation range of the antenna. Because the antenna provided in this implementation of this application has a wider radiation range, a quantity of antennas on a circuit board of a Wi-Fi product can be decreased, thereby not only reducing manufacturing costs, but also reducing occupied space on the circuit board of the Wi-Fi product.

[0009] Because the opening width of the groove gradually increases from the inside to the outside, enabling wave impedance of the groove in air to gradually increase from the inside to the outside, reflection of the second radiation signal on an inside-to-outside transmission path in the groove is lower, thereby ensuring a better transmission effect of the second radiation signal in the air.

[0010] A current in the radio frequency circuit of the circuit board flows to the signal feed-in part, the first conductive ground structure, and the second conductive ground structure, a current flows to the second radiator through the first conductive ground structure and the first radiator, and a current flows to the third radiator through the signal feed-in part. The second radiator independently generates the first radiation signal based on the function of the current, the third radiator and the second conductive ground structure further jointly generate the second radiation signal in the opening direction of the groove based on the function of the current, and the radiation direction of the first radiation signal is different from the radiation direction of the second radiation signal. Therefore, the antenna provided in this implementation of this application can send signals in two directions, thereby increasing a radiation range of the antenna.

[0011] The current in the radio frequency circuit of the circuit board flows to the second radiator through the first conductive ground structure and the first radiator, and the second radiator independently generates the first radiation signal based on the function of the current. Under the function of the first radiation signal, the at least one horizontal radiator generates a current having a direction the same as a direction of the current in the second radiator. Therefore, under the joint function of the current in the at least one horizontal radiator and the current in the second radiator, the at least one horizontal radiator and the second radiator jointly generate the third radiation signal. Because the third radiation signal is jointly generated by the at least one horizontal radiator and the second radiator, the radiant intensity of the third radiation signal is greater than the radiant intensity of the first radiation signal. Therefore, the at least one horizontal radiator can improve radiant intensity of the antenna.

[0012] A width of the signal feed-in part, a width of the first gap, and a width of the second gap may be adjusted based on an impedance calculation principle of a coplanar waveguide, to ensure that impedance of the antenna matches impedance of the radio frequency circuit of the circuit board. In this way, a signal reflection loss in a feed-in process can be avoided, to ensure that efficiency of feed-in the antenna by the radio frequency circuit of the circuit board is the highest.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

FIG. 1 is a schematic diagram of an antenna 10 according to an implementation not forming part of the claimed invention;

FIG. 2 is a schematic diagram of another antenna 10 according to an implementation not forming part of the claimed invention;

FIG. 3 is a schematic diagram of still another antenna 10 according to an implementation of this application; and

FIG. 4 is a schematic diagram of still another antenna 10 according to an implementation of this application.

DESCRIPTION OF IMPLEMENTATIONS

[0014] To make the objectives, technical solutions, and advantages of this invention clearer, the following further describes various implementations in detail with reference to the accompanying drawings. The implementations described below are not all claimed, they are included to help understanding the context of the invention. While the description refers to various implementations, the embodiments of the invention are those which comprise at least all the features of an independent claim. Any implementation which does not fall within the scope of the claims does not form part of the invention, but rather included as an illustrative example that is useful for understanding the invention.

[0015] As shown in FIG. 1, FIG. 1 is a schematic diagram of an antenna 10 according to an implementation not forming part of the claimed invention. The antenna 10 shown in FIG. 1 is disposed on an insulation medium 21 of a circuit board. The antenna 10 includes a loop radiator 1, a signal feed-in part 2, a first conductive ground structure 3, and a second conductive ground structure 4.

[0016] A first end of the loop radiator 1 is connected to the first conductive ground structure 3, a second end of the loop radiator 1 is connected to the signal feed-in part 2, and the loop radiator 1 independently generates a first radiation signal based on a function of a current. The loop radiator 1 and the second conductive ground structure 4 form a groove, the loop radiator 1 and the second conductive ground structure 4 jointly generate a second radiation signal in an opening direction of the groove based on a function of a current, and a radiation direction of the first radiation signal is different from a radiation direction of the second radiation signal. All of the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 are connected to a radio frequency circuit 22 of the circuit board.

[0017] In FIG. 1, the radiation direction of the first radiation signal is perpendicular to a horizontal plane and is upward, and the radiation direction of the second radiation signal is horizontally rightward. Therefore, it can be learned from the implementation of FIG. 1 that the radiation direction of the first radiation signal is different from the radiation direction of the second radiation signal, and the radiation direction of the first radiation signal is perpendicular to the radiation direction of the second radiation signal. Certainly, a shape of the antenna 10 may be fine-adjusted, to adjust the radiation direction of the first radiation signal and the radiation direction of the second radiation signal.

[0018] In the implementation shown in FIG. 1, a radio frequency signal on the radio frequency circuit 22 of the circuit board passes through the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 to feed the loop radiator 1, and a current flows to two ends of the loop radiator 1 respectively through the signal feed-in part 2 and the first conductive ground structure 3. The loop radiator 1 independently generates the first radiation signal based on the function of the current. The loop radiator 1 and the second conductive ground structure 4 further jointly generate the second radiation signal in the opening direction of the groove based on the function of the current. The radiation direction of the first radiation signal is different from the radiation direction of the second radiation signal. Therefore, the antenna 10 provided in this implementation of this application can send signals in two directions, thereby increasing a radiation range of the antenna 10. Because the antenna 10 provided in this implementation of this application has a wider radiation range, a quantity of antennas 10 on a circuit board of a Wi-Fi product can be decreased, thereby not only reducing manufacturing costs, but also reducing occupied space on the circuit board of the Wi-Fi product.

[0019] As shown in FIG. 1, in an optional technical solution, an opening of the groove is outward, and an opening width of the groove gradually increases from the inside to the outside.

[0020] In the technical solution provided in this implementation because the opening width of the groove gradually increases from the inside to the outside, enabling wave impedance of the groove in air to gradually increase from the inside to the outside, reflection of the second radiation signal on an inside-to-outside transmission path in the groove is lower, thereby ensuring a better transmission effect of the second radiation signal in the air.

[0021] As shown in FIG. 1, in an optional technical solution, an opening width of a tail end of the groove is a quarter wavelength corresponding to a center frequency of the antenna 10.

[0022] In the technical solution provided in this implementation a wavelength may be calculated according to a formula $r=c/f$, where r represents a wavelength in a unit of meter, c represents a speed of light in a unit of meter/second, and f is the center frequency of the antenna 10 in a unit of Hz.

[0023] As shown in FIG. 1, in an optional technical solution, all of the loop radiator 1, the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 are printed on the insulation medium 21 of the circuit board. Certainly, the loop radiator 1, the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 may be directly printed on the insulation medium 21 of the circuit board of the Wi-Fi product. In addition, the loop radiator 1, the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 may be alternatively printed on an insulation medium 21 of a micro circuit board having a relatively small area, and then the micro circuit board is inserted into or welded onto the circuit board of the Wi-Fi product for use. Therefore, requirements of different Wi-Fi products are met by using different printing manners.

[0024] As shown in FIG. 1, in an optional technical solution, all of the loop radiator 1, the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 are fixedly connected to the insulation medium 21 of the circuit board, and all of the loop radiator 1, the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 are made of metal materials.

[0025] There are a plurality of fixed connection manners. For example, all of the loop radiator 1, the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 may be adhered to the insulation medium 21 of the circuit board.

[0026] After all of the loop radiator 1, the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4 are fixedly connected to the insulation medium 21 of the micro circuit board, the micro circuit board may be inserted into or welded onto the circuit board of the Wi-Fi product for use.

[0027] As shown in FIG. 2, FIG. 2 is a schematic diagram of another antenna 10 according to an implementation not forming part of the claimed invention. Compared with the implementation shown in FIG. 1, a specific structure of the loop radiator 1 is described in more details in the implementation shown in FIG. 2. The loop radiator 1 includes a first radiator 11, a second radiator 12, and a third radiator 13.

[0028] A first end of the first radiator 11 is connected to the first conductive ground structure 3, a second end of the first radiator 11 is connected to a first end of the second radiator 12, a second end of the second radiator 12 is connected to a first end of the third radiator 13, and a second end of the third radiator 13 is connected to the signal feed-in part 2. The second radiator 12 independently generates the first radiation signal based on the function of the current, and the radiation direction of the first radiation signal is perpendicular to the second radiator 12. The third radiator 13 and the second conductive ground structure 14 jointly form the groove whose opening is outward, and the third radiator 13 and the second conductive ground structure 4 jointly generate the second radiation signal in the opening direction of the groove based on the function of the current.

[0029] In the implementation shown in FIG. 2, a current in the radio frequency circuit 22 of the circuit board flows to the signal feed-in part 2, the first conductive ground structure 3, and the second conductive ground structure 4, a current flows to the second radiator 12 through the first conductive ground structure 3 and the first radiator 11, and a current flows to the third radiator 13 through the signal feed-in part 2. The second radiator 12 independently generates the first radiation signal based on the function of the current, the third radiator 13 and the second conductive ground structure 4 further jointly generate the second radiation signal in the opening direction of the groove based on the function of the current, and the radiation direction of the first radiation signal is different from the radiation direction of the second radiation signal. Therefore, the antenna 10 provided in this implementation can send signals in two directions, thereby increasing a radiation range of the antenna 10.

[0030] As shown in FIG. 3, FIG. 3 is a schematic diagram of an antenna 10 according to the present invention. Based on the implementation shown in FIG. 2, an extra component is added in the implementation shown in FIG. 3. The antenna 10 may further include at least one horizontal radiator 5.

[0031] The at least one horizontal radiator 5 is disposed on a side surface of the second radiator 12, the at least one horizontal radiator 5 and the second radiator 12 jointly generate a third radiation signal based on a function of a current, a radiation direction of the third radiation signal is the same as the radiation direction of the first radiation signal, and radiant intensity of the third radiation signal is greater than radiant intensity of the first radiation signal.

[0032] In the implementation shown in FIG. 3, the current in the radio frequency circuit 22 of the circuit board flows to the second radiator 12 through the first conductive ground structure 3 and the first radiator 11, and the second radiator 12 independently generates the first radiation signal based on the function of the current. Under the function of the first radiation signal, the at least one horizontal radiator 5 generates a current having a direction the same as a direction of the current in the second radiator 12. Therefore, under the joint function of the current in the at least one horizontal radiator 5 and the current in the second radiator 12, the at least one horizontal radiator 5 and the second radiator 12 jointly generate the third radiation signal. Because the third radiation signal is jointly generated by the at least one horizontal radiator 5 and the second radiator 12, the radiant intensity of the third radiation signal is greater than the radiant intensity of the first radiation signal. Therefore, the at least one horizontal radiator 5 can improve radiant intensity of the antenna 10.

[0033] As shown in FIG. 4, FIG. 4 is a schematic diagram of another antenna 10 according to the present invention. In the implementation shown in FIG. 4, there are three horizontal radiators 5. In the implementation shown in FIG. 3, there is one horizontal radiator 5. Certainly, a quantity of the horizontal radiators 5 is not limited in this implementation of this application. The quantities of the horizontal radiators 5 in FIG. 3 and FIG. 4 are merely for the convenience of a user to better understand the technical solution.

[0034] As shown in FIG. 3 and FIG. 4, in an optional technical solution, a length range of the at least one horizontal radiator 5 is the quarter wavelength to a half wavelength corresponding to the center frequency of the antenna 10. A wavelength may be calculated according to the formula r=c/f in the foregoing implementation, where r represents a wavelength in a unit of meter, c represents a speed of light in a unit of meter/second, and f is the center frequency of the antenna 10 in a unit of Hz.

[0035] As shown in FIG. 3 and FIG. 4, in an optional technical solution, the third radiator 13 may be of a straight line structure or a curved structure. If the third radiator 1 is of the curved structure, the third radiator 1 protrudes towards the opening direction of the groove, so that the third radiator 1 forms the curved structure.

[0036] As shown in FIG. 3 and FIG. 4, in an optional technical solution, a first gap is formed between the signal feed-in part 2 and the first conductive ground structure 3, and an opening formed between the first radiator 11 and the third radiator 13 communicates with the first gap. A second gap is formed between the signal feed-in part 2 and the second conductive ground structure 4, and the groove formed between the third radiator 13 and the second conductive ground structure 4 communicates with the second gap.

[0037] In the technical solution provided in this implementation of this application, a width of the signal feed-in part 2, a width of the first gap, and a width of the second gap may be adjusted based on an impedance calculation principle of a coplanar waveguide, to ensure that impedance of the antenna 10 matches impedance of the radio frequency circuit 22 of the circuit board. In this way, a signal reflection loss in a feed-in process can be avoided, to ensure that efficiency of feed-in the antenna 10 by the radio frequency circuit 22 of the circuit board is the highest.

[0038] In the implementations shown in FIG. 1 to FIG. 4, small arrows on each component of the antenna 10 represents a direction of a current, and large arrows outside the antenna 10 represent a radiation direction of a radiation signal.

[0039] The scope of protection shall be defined by the appended claims.

Claims

1. An antenna (10), wherein the antenna is configured to be disposed on an insulation medium (21) of a circuit board, and the antenna comprises a loop radiator (1), a signal feed-in part (2), a first conductive ground structure (3), and a second conductive ground structure (4), wherein

   a first end of the loop radiator is connected to the first conductive ground structure, a second end of the loop radiator is connected to the signal feed-in part, and the loop radiator is configured to independently generate a first radiation signal based on a function of a current, wherein the radiation direction of the first radiation signal is perpendicular to a horizontal plane;

   the loop radiator and the second conductive ground structure form a groove, the loop radiator and the second conductive ground structure are configured to jointly generate a second radiation signal in an opening direction of the groove based on a function of a current such that a radiation direction of the first radiation signal is different from a radiation direction of the second radiation signal; and

   all of the signal feed-in part, the first conductive ground structure, and the second conductive ground structure are connectable to a radio frequency circuit (22) of the circuit board;

   wherein

   the loop radiator comprises a first radiator (11), a second radiator (12), and a third radiator (13), wherein

   a first end of the first radiator is connected to the first conductive ground structure, a second end of the first radiator is connected to a first end of the second radiator, a second end of the second radiator is connected to a first end of the third radiator, and a second end of the third radiator is connected to the signal feed-in part;

   the second radiator is configured to independently generate the first radiation signal based on the function of the current, such that

   the radiation direction of the first radiation signal is perpendicular to the second radiator; and

   the third radiator and the second conductive ground structure are configured to jointly form the groove whose opening is outward, such that the third radiator and the second conductive ground structure jointly generate the second radiation signal in the opening direction of the groove based on the function of the current;

   wherein the antenna further comprises at least one horizontal radiator (5), wherein the at least one horizontal radiator is disposed on a side surface of the second radiator, the at least one horizontal radiator and the second radiator are configured to jointly generate a third radiation signal based on a function of a current, such that a radiation direction of the third radiation signal is the same as the radiation direction of the first radiation signal, and radiant intensity of the third radiation signal is greater than radiant intensity of the first radiation signal.

2. The antenna according to claim 1, wherein an open-

ing width of the groove gradually increases from the inside to the outside.

3. The antenna according to claim 1 or 2, wherein an opening width of a tail end of the groove is a quarter wavelength corresponding to a center frequency of the antenna.

4. The antenna according to any one of claims 1 to 3, wherein a length range of the at least one horizontal radiator is the quarter wavelength to a half wavelength corresponding to the center frequency of the antenna.

5. The antenna according to any one of claims 1 to 3, wherein

a first gap is formed between the signal feed-in part and the first conductive ground structure, and an opening formed between the first radiator and the third radiator communicates with the first gap; and
a second gap is formed between the signal feed-in part and the second conductive ground structure, and the groove formed between the third radiator and the second conductive ground structure communicates with the second gap.

6. The antenna according to any one of claims 1 to 3, wherein the third radiator is of a straight line structure or a curved structure.

7. The antenna according to claim 1, wherein all of the loop radiator, the signal feed-in part, the first conductive ground structure, and the second conductive ground structure are printable on the insulation medium of the circuit board.

8. The antenna according to claim 1, wherein all of the loop radiator, the signal feed-in part, the first conductive ground structure, and the second conductive ground structure are fixedly connectable to the insulation medium of the circuit board, and all of the loop radiator, the signal feed-in part, the first conductive ground structure, and the second conductive ground structure are made of metal materials.

Patentansprüche

1. Antenne (10), wobei die Antenne konfiguriert ist, um auf einem Isolationsmedium (21) einer Leiterplatte eingerichtet zu werden, und wobei die Antenne einen Schleifenstrahler (1), einen Signaleinspeisungsteil (2), eine erste leitfähige Bodenstruktur (3) und eine zweite leitfähige Bodenstruktur (4) umfasst, wobei ein erstes Ende des Schleifenstrahlers mit der ersten leitfähigen Bodenstuktur verbunden ist, ein zweites Ende des Schleifenstrahlers mit dem Signaleinspeisungsteil verbunden ist, und der Schleifenstrahler konfiguriert ist, um ein erstes Strahlungssignal basierend auf einer Funktion eines Stroms unabhängig zu erzeugen, wobei die Strahlungsrichtung des ersten Strahlungssignals senkrecht zu einer Horizontalebene ist;
der Schleifenstrahler und die zweite leitfähige Bodenstruktur eine Nut ausbilden, der Schleifenstrahler und die zweite leitfähige Bodenstruktur konfiguriert sind, um ein zweites Strahlungssignal in einer Öffnungsrichtung der Nut basierend auf einer Funktion eines Stroms derart gemeinsam zu erzeugen, dass eine Strahlungsrichtung des ersten Strahlungssignals sich von einer Strahlungsrichtung des zweiten Strahlungssignals unterscheidet; und
der Signaleinspeisungsteil, die erste leitfähige Bodenstruktur und die zweite leitfähige Bodenstruktur alle mit einem Hochfrequenzschaltkreis (22) der Leiterplatte verbindbar sind;
wobei

der Schleifenstrahler einen ersten Strahler (11), einen zweiten Strahler (12) und einen dritten Strahler (13) umfasst, wobei
ein erstes Ende des ersten Strahlers mit der ersten leitfähigen Bodenstruktur verbunden ist, ein zweites Ende des ersten Strahlers mit einem ersten Ende des zweiten Strahlers verbunden ist, ein zweites Ende des zweiten Strahlers mit einem ersten Ende des dritten Strahlers verbunden ist, und ein zweites Ende des dritten Strahlers mit dem Signaleinspeisungsteil verbunden ist;
der zweite Strahler konfiguriert ist, um das erste Strahlungssignal basierend auf der Funktion des Stroms derart unabhängig zu erzeugen, dass die Strahlungsrichtung des ersten Strahlungssignals senkrecht zu dem zweiten Strahler ist; und
der dritte Strahler und die zweite leitfähige Bodenstruktur konfiguriert sind, um die Nut gemeinsam auszubilden, deren Öffnung derart nach außen gerichtet ist, dass der dritte Strahler und die zweite leitfähige Bodenstruktur das zweite Strahlungssignal in der Öffnungsrichtung der Nut basierend auf der Funktion des Stroms gemeinsam erzeugen;
wobei die Antenne ferner mindestens einen Horizontalstrahler (5) umfasst, wobei
der mindestens eine Horizontalstrahler auf einer Seitenoberfläche des zweiten Strahlers eingerichtet ist, der mindestens eine

Horizontalstrahler und der zweite Strahler konfiguriert sind, um ein drittes Strahlungssignal basierend auf einer Funktion eines Stroms derart gemeinsam zu erzeugen, dass eine Strahlungsrichtung des dritten Strahlungssignals die gleiche wie die Strahlungsrichtung des ersten Strahlungssignals ist und eine Strahlungsstärke des dritten Strahlungssignals größer als die Strahlungsstärke des ersten Strahlungssignals ist.

2. Antenne nach Anspruch 1, wobei sich eine Öffnungsbreite der Nut von der Innenseite zu der Außenseite allmählich steigert.

3. Antenne nach Anspruch 1 oder 2, wobei eine Öffnungsbreite eines hinteren Endes der Nut eine Viertelwellenlänge ist, die einer Mittenfrequenz der Antenne entspricht.

4. Antenne nach einem der Ansprüche 1 bis 3, wobei ein Längenbereich des mindestens einen Horizontalstrahlers die Viertelwellenlänge bis eine Halbwellenlänge ist, die der Mittenfrequenz der Antenne entspricht.

5. Antenne nach einem der Ansprüche 1 bis 3, wobei

eine erste Lücke zwischen dem Signaleinspeisungsteil und der ersten leitfähigen Bodenstruktur ausgebildet ist und eine Öffnung, die zwischen dem ersten Strahler und dem dritten Strahler ausgebildet ist, mit der ersten Lücke kommuniziert; und
eine zweite Lücke zwischen dem Signaleinspeisungsteil und der zweiten leitfähigen Bodenstruktur ausgebildet ist und die Nut, die zwischen dem dritten Stahler und der zweiten leitfähigen Bodenstruktur ausgebildet ist, mit der zweiten Lücke kommuniziert.

6. Antenne nach einem der Ansprüche 1 bis 3, wobei der dritte Strahler eine gerade Linienstruktur oder eine gekrümmte Struktur aufweist.

7. Antenne nach Anspruch 1, wobei der Schleifenstrahler, der Signaleinspeisungsteil, die erste leitfähige Bodenstruktur und die zweite leitfähige Bodenstruktur alle auf das Isolationsmedium der Leiterplatte druckbar sind.

8. Antenne nach Anspruch 1, wobei der Schleifenstrahler, der Signaleinspeisungsteil, die erste leitfähige Bodenstruktur und die zweite leitfähige Bodenstruktur alle mit dem Isolationsmedium der Leiterplatte fest verbindbar sind, und der Schleifenstrahler, der Signaleinspeisungsteil, die erste leitfähige Bodenstruktur und die zweite leitfähige Bodenstruktur alle aus Metallmaterialien hergestellt sind.

Revendications

1. Antenne (10), l'antenne étant configurée pour être disposée sur un milieu isolant (21) d'une carte de circuit imprimé, et l'antenne comprenant un radiateur en forme d'anneau (1), une partie d'introduction de signal (2), une première structure de masse conductrice (3) et une seconde structure de masse conductrice (4), dans laquelle une première extrémité du radiateur en forme d'anneau est connectée à la première structure de masse conductrice, une seconde extrémité du radiateur en forme d'anneau est connectée à la partie d'introduction de signal et le radiateur en forme d'anneau est configuré pour générer indépendamment un premier signal de rayonnement sur la base d'une fonction d'un courant, la direction de rayonnement du premier signal de rayonnement étant perpendiculaire à un plan horizontal ;

le radiateur en forme d'anneau et la seconde structure de masse conductrice forment une rainure, le radiateur en forme d'anneau et la seconde structure de masse conductrice sont configurés pour générer conjointement un deuxième signal de rayonnement dans une direction d'ouverture de la rainure sur la base d'une fonction d'un courant de telle sorte qu'une direction de rayonnement du premier signal de rayonnement est différente d'une direction de rayonnement du deuxième signal de rayonnement ; et
toute la partie d'introduction de signal, la première structure de masse conductrice et la seconde structure de masse conductrice peuvent être connectées à un circuit radiofréquence (22) de la carte de circuit imprimé ;
dans laquelle
le radiateur en forme d'anneau comprend un premier radiateur en forme d'anneau (11), un deuxième radiateur en forme d'anneau (12) et un troisième radiateur en forme d'anneau (13), une première extrémité du premier radiateur en forme d'anneau étant connectée à la première structure de masse conductrice, une seconde extrémité du premier radiateur en forme d'anneau étant connectée à une première extrémité du deuxième radiateur en forme d'anneau, une seconde extrémité du deuxième radiateur en forme d'anneau étant connectée à une première extrémité du troisième radiateur en forme d'anneau, et une seconde extrémité du troisième radiateur en forme d'anneau étant connectée à la partie d'introduction de signal ;
le deuxième radiateur en forme d'anneau étant

configuré pour générer indépendamment le premier signal de rayonnement sur la base de la fonction du courant, de telle sorte que la direction de rayonnement du premier signal de rayonnement est perpendiculaire au deuxième radiateur en forme d'anneau ; et le troisième radiateur en forme d'anneau et la seconde structure de masse conductrice étant configurés pour former conjointement la rainure dont l'ouverture est vers l'extérieur, de telle sorte que le troisième radiateur en forme d'anneau et la seconde structure de masse conductrice génèrent conjointement le deuxième signal de rayonnement dans la direction d'ouverture de la rainure sur la base de la fonction du courant ;

l'antenne comprenant en outre au moins un radiateur en forme d'anneau horizontal (5), l'au moins un radiateur en forme d'anneau horizontal étant disposé sur une surface latérale du deuxième radiateur en forme d'anneau, l'au moins un radiateur en forme d'anneau horizontal et le deuxième radiateur en forme d'anneau étant configurés pour générer conjointement un troisième signal de rayonnement sur la base d'une fonction d'un courant, de telle sorte qu'une direction de rayonnement du troisième signal de rayonnement est la même que la direction de rayonnement du premier signal de rayonnement, et que l'intensité de rayonnement du troisième signal de rayonnement est supérieure à l'intensité de rayonnement du premier signal de rayonnement.

2. Antenne selon la revendication 1, dans laquelle une largeur d'ouverture de la rainure augmente progressivement de l'intérieur vers l'extérieur.

3. Antenne selon la revendication 1 ou 2, dans laquelle une largeur d'ouverture d'une extrémité arrière de la rainure est un quart de longueur d'onde correspondant à une fréquence centrale de l'antenne.

4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel
une plage de longueurs de l'au moins un radiateur en forme d'anneau horizontal est le quart de longueur d'onde à une demi-longueur d'onde correspondant à la fréquence centrale de l'antenne.

5. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel

un premier espace est formé entre la partie d'introduction de signal et la première structure de masse conductrice, et une ouverture formée entre le premier radiateur en forme d'anneau et le troisième radiateur en forme d'anneau communique avec le premier espace ; et

un second espace est formé entre la partie d'introduction de signal et la seconde structure de masse conductrice, et la rainure formée entre le troisième radiateur en forme d'anneau et la seconde structure de masse conductrice communique avec le second espace.

6. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel le troisième radiateur en forme d'anneau est de structure linéaire ou courbe.

7. Antenne selon la revendication 1, dans laquelle
le radiateur en forme d'anneau, la partie d'introduction de signal, la première structure de masse conductrice et la seconde structure de masse conductrice sont tous imprimables sur le support d'isolation de la carte de circuit imprimé.

8. Antenne selon la revendication 1, dans laquelle
le radiateur en forme d'anneau, la partie d'alimentation de signal, la première structure de masse conductrice et la seconde structure de masse conductrice peuvent tous être connectés de manière fixe au support d'isolation de la carte de circuit imprimé, et le radiateur en forme d'anneau, la partie d'alimentation de signal, la première structure de masse conductrice et la seconde structure de masse conductrice sont tous en matériaux métalliques.

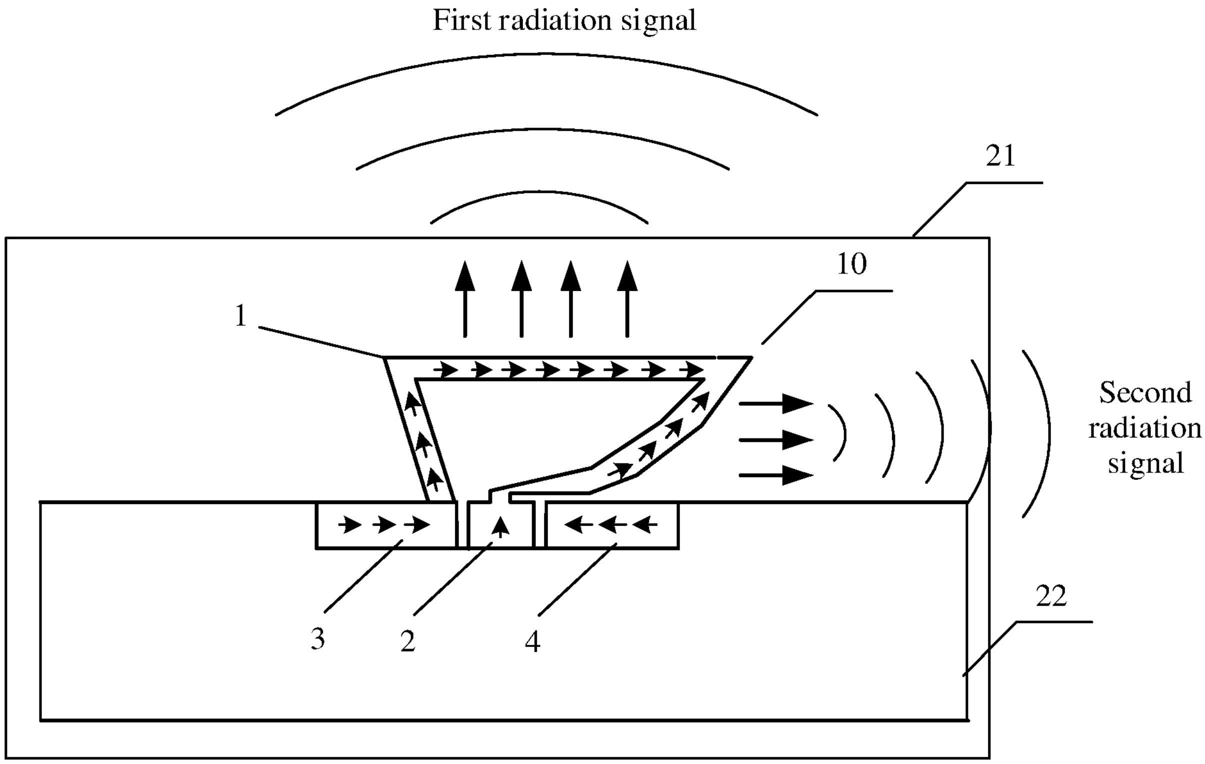
First radiation signal
21
10
1
Second
radiation
signal
3
2
4
22

FIG. 1

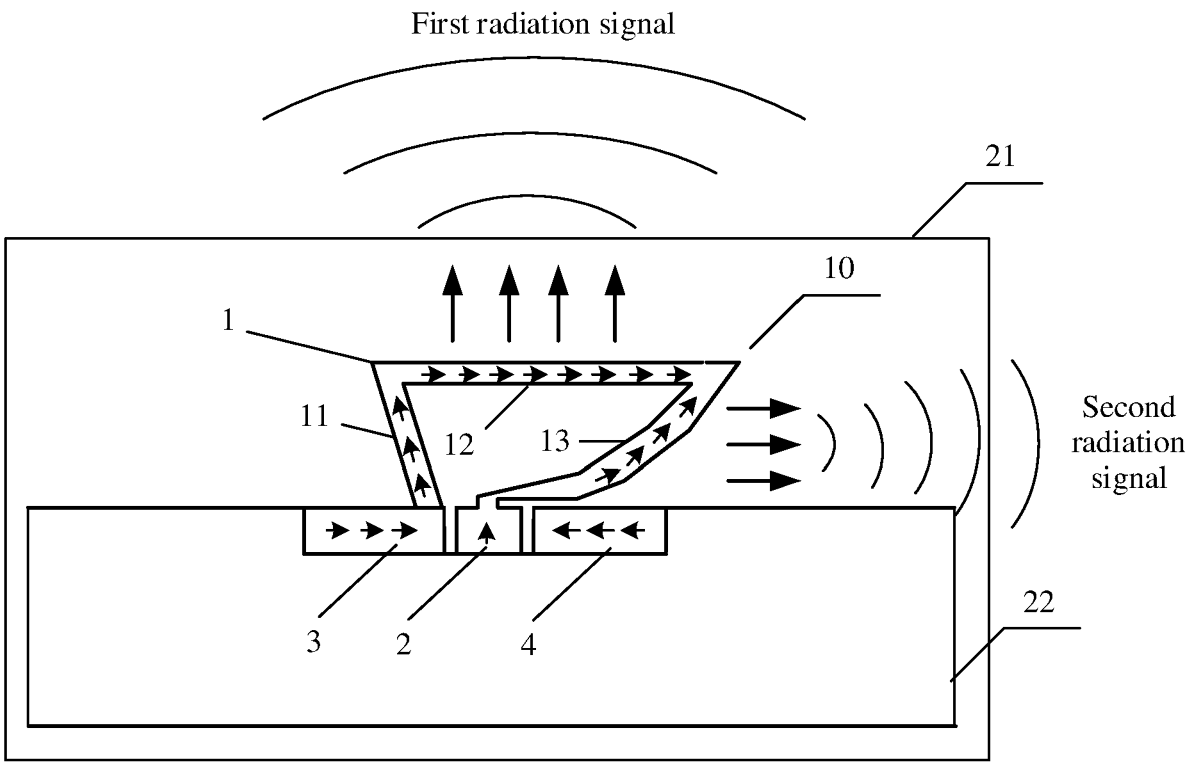
First radiation signal
21
10
1
11
12
13
Second
radiation
signal
3
2
4
22

FIG. 2

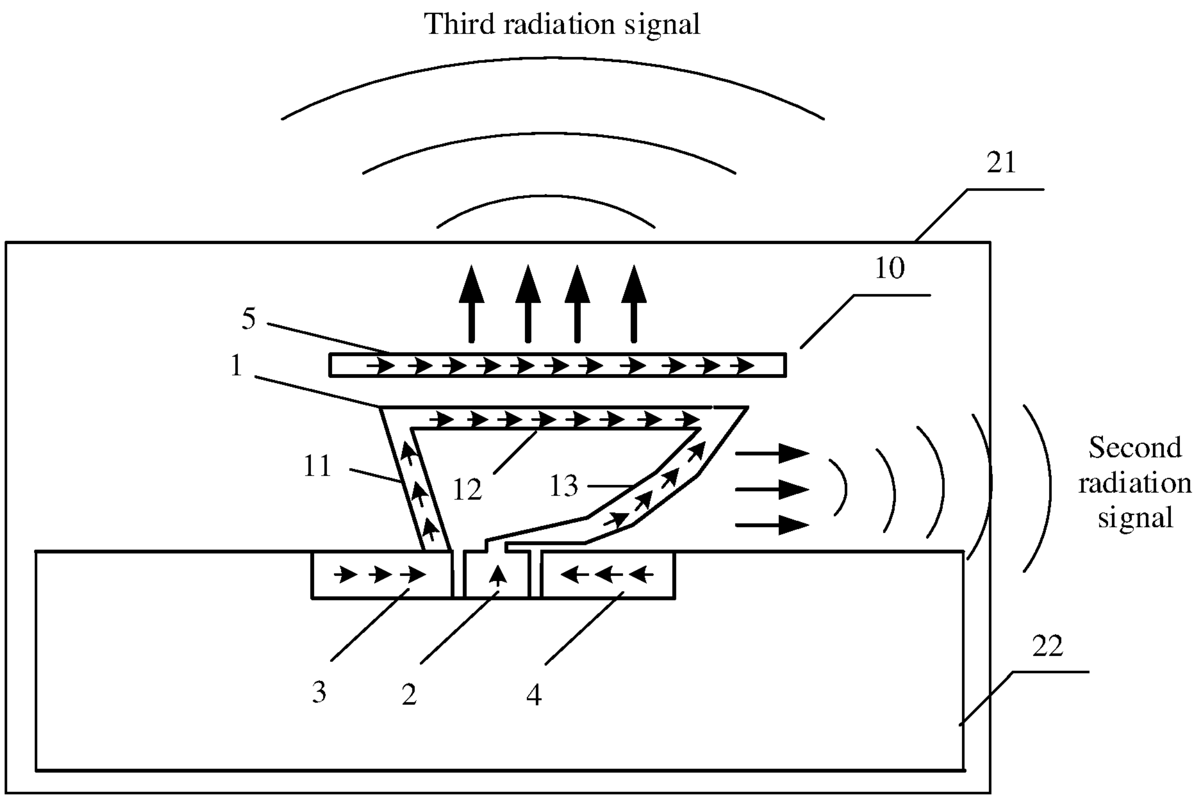
Third radiation signal
21
10
5
1
11
12
13
Second
radiation
signal
3
2
4
22

FIG. 3

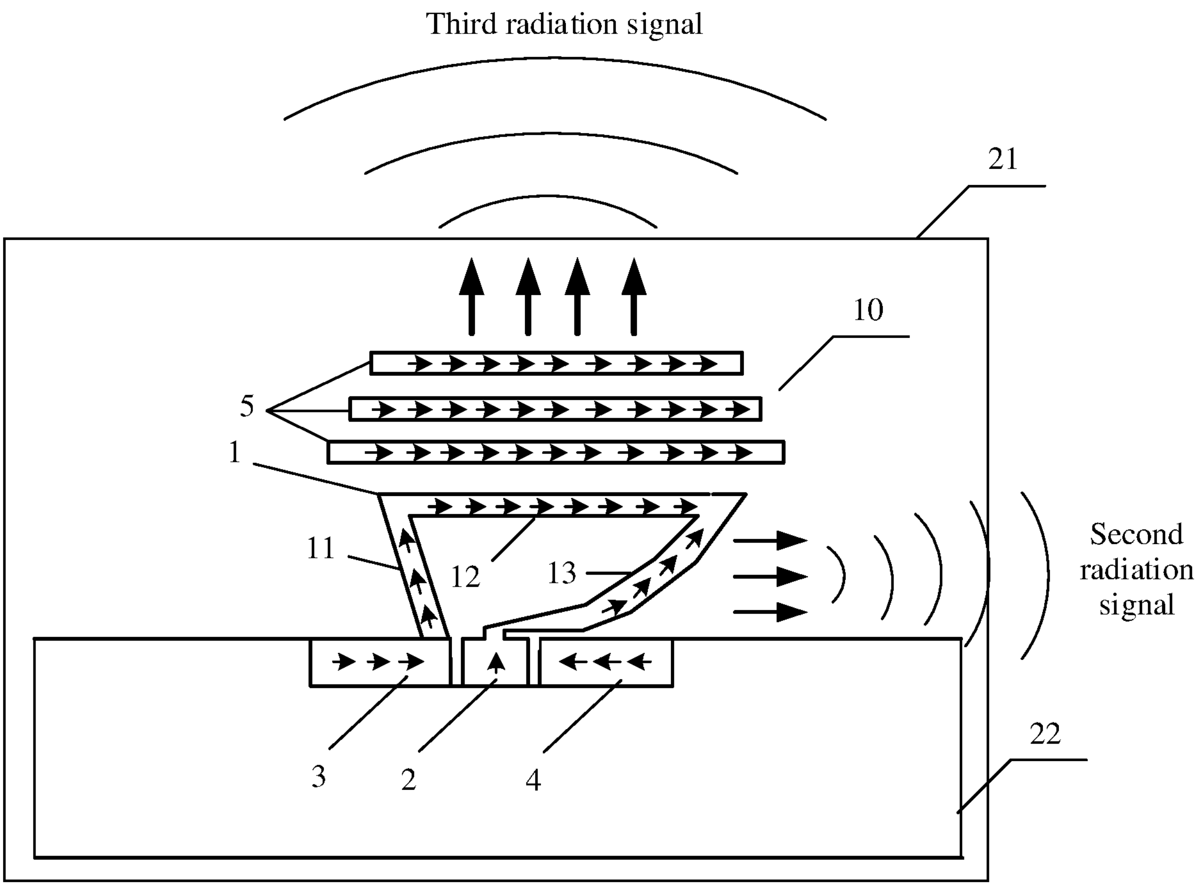
Third radiation signal
21
10
5
1
11
12
13
Second radiation signal
3
2
4
22

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- US 2016336649 A **[0005]**
- US 2016359231 A **[0005]**
- WO 2016138650 A **[0005]**