include the first side wall part 22A, the second side wall part 22B, the third side wall part 22C and a fourth side wall part 22D.

[0070]

The third side wall part 22C and the fourth side wall part 22D are side wall parts 22 which are next to the first side wall part 22A. CL shown in Fig. 15 represents a separation between the first side wall part 22A and the third side wall part 22C and a separation between the first side wall part 22A and the fourth side wall part 22D. The separation CL that is predetermined is provided between the first side wall part 22A and the third side wall part 22C such that the first side wall part 22A and the third side wall part 22C are not electromagnetically coupled to each other, and is provided between the first side wall part 22A and the fourth side wall part 22D such that the first side wall part 22A and the fourth side wall part 22D are not electromagnetically coupled to each other. Other side wall parts 22 are similar to the above description.

[0071]

When one side wall part 22 is electromagnetically coupled to another side wall part 22, a current path is changed, and the above effects cannot be obtained. The separation CL may be a value greater than or equal to one hundredth of a wavelength of the target radio wave.

[0072]

According to the above configuration, the length Lx of the patch facing part 21 in the X-axis direction can be further reduced than that according to the fourth modification example. Further, according to the above configuration, the entire region of the patch facing part 21 is equivalent to the width arrangement region Ar.

[0073]

[Sixth modification example]

As shown in Fig. 16, a combination of the side wall part 22 and the back surface part 23 may be located at each of four edges of the patch facing part 21 that is a rectangular shape. In other words, the ground pattern 20 may include the first back surface part 23A, the second back surface part 23B, a third back surface part 23C and a fourth back surface part 23D. Each of the back surface parts 23 is separated from a back surface part 23 that is next to the each of the

CLAIMS

1. An antenna device comprising:

a radiation element that is a conductive member electrically connected with an internal conductor of a coaxial cable; and

a flat plate part that is a conductive member being a flat plate shape and electrically connected with an external conductor of the coaxial cable, wherein

the radiation element is to be located to be opposite to the flat plate part with a separation that is predetermined or to be located to extend from the flat plate part,

the flat plate part is a line symmetrical shape and is a shape including a width arrangement region that is a part where a length from one end part to another end part opposite to the one end part via a symmetrical axis of the flat plate part is set to be shorter than a half wavelength of a radio wave that is a target of transmission and reception,

at least one of the two end parts that are parallel to the symmetrical axis and define the width arrangement region is provided with a side wall part that is a conductive member to extend along the at least one of the two end parts toward a direction viewed from the flat plate part where the radiation element does not exist, and

the radiation element outwardly projects from the flat plate part beyond each of the two end parts of the flat plate part in a direction parallel to a plane of the flat plate part.

2. The antenna device according to claim 1, wherein

the side wall part includes a first side wall part and a second side wall part that are located at the two end parts parallel to the symmetrical axis which define the width arrangement region.

3. The antenna device according to claim 2, wherein

the first side wall part and the second side wall part have lengths in a direction orthogonal to the flat plate part which are set in a manner that a peripheral length from an end part of the first side wall part which is not in contact

with the flat plate part to an end part of the second side wall part which is not in contact with the flat plate part matches a half wavelength of the radio wave.

4. The antenna device according to claim 1, wherein

an end part, which is not in contact with the flat plate part, of the end parts included in the side wall parts in a direction orthogonal to the flat plate part, is provided with a back surface part that is a conductive member being a flat plate shape to be opposite to the flat plate part.

5. The antenna device according to claim 4, wherein

the side wall part includes a first side wall part and a second side wall part that are located at the two end parts parallel to the symmetrical axis which define the width arrangement region, and

the back surface part includes a first back surface part and a second back surface part that are located at the first side wall part and the second side wall part, respectively.

6. The antenna device according to claim 5, wherein

the width arrangement region, the first side wall part and the second side wall part are defined in a manner that a peripheral length from an end part of the first side wall part which is not in contact with the flat plate part to an end part of the second side wall part which is not in contact with the flat plate part is shorter than a half wavelength of the radio wave.

7. The antenna device according to claim 6, wherein

a peripheral length from an end part of the first back surface part that is the back surface part located at the first side wall part where the second side wall part exists to an end part of the second back surface part that is the back surface part located at the second side wall part where the first side wall part exists, is longer than the half wavelength of the radio wave.

8. The antenna device according to any one of claims 1 to 7, wherein

the flat plate part is defined to be a rectangular shape where a length of each of edges of the flat plate part is set to be less than the half wavelength of the radio wave,

the side wall part is located at each of the edges of the flat plate part, and

one of the side wall parts and a side wall part next to the one of the side wall parts define a separation that is predetermined.

9. An antenna device comprising:

a radiation element that is a conductive member electrically connected with an internal conductor of a coaxial cable; and

a flat plate part that is a conductive member being a flat plate shape and electrically connected with an external conductor of the coaxial cable, wherein

the radiation element is to be located to be opposite to the flat plate part with a separation that is predetermined or to be located to extend from the flat plate part,

the flat plate part is a shape including a first edge part and a second edge part which are straight shape and opposite to each other,

a distance between the first edge part and the second edge part is set to be shorter than a half wavelength of a radio wave that is a target of transmission and reception,

at least one of the first edge part and the second edge part is provided with a side wall part that is a conductive member to extend along the at least one of the first edge part and the second edge part toward a direction viewed from the flat plate part where the radiation element does not exist, and

the radiation element outwardly projects from the flat plate part beyond each of the first edge part and the second edge part of the flat plate part in a direction parallel to a plane of the flat plate part.

10. The antenna device according to claim 9, wherein

an end part, which is not in contact with the flat plate part, of the end parts included in the side wall parts in a direction orthogonal to the flat plate part, is provided with a back surface part that is a conductive member being a flat plate shape to be opposite to the flat plate part.

11. The antenna device configured to operate as a patch antenna according to any one of claims 1 to 9, wherein

the radiation element is located to be parallel to the flat plate part.