CHOKE MEMBER HAVING STEP HEIGHT AND ANTENNA INCLUDING THE SAME

Abstract: A choke member having step height and an antenna including the same for enhancing a front to back ratio characteristic with maintaining good isolation characteristic are disclosed. The antenna includes a reflection plate, at least one radiation element disposed on the reflection plate, and a first choke member disposed outside of the radiation element on the reflection plate. Here, a height of a part of the first choke member is greater than the other parts of the first choke member.
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CHOKE MEMBER HAVING STEP HEIGHT AND ANTENNA

INCLUDING THE SAME

[Technical Field]

Example embodiment of the present invention relates to a choke member and an antenna having the same, more particularly relates to a choke member having step height for enhancing a front to back ratio characteristic and an isolation characteristic and an antenna including the same.

[Background Art]

An antenna outputs a radiation pattern in a specific direction, thereby enabling transmitting/receiving an electromagnetic wave. The antenna has typically a structure shown in below FIG. 1.

FIG. 1 is a perspective view illustrating schematically a common antenna.

In FIG. 1, the antenna includes a reflection plate 100 and radiation elements 102.

The radiation elements 102 are located on the reflection plate 100, and output a radiation pattern in a specific direction in case that certain current is applied thereto.

Many antennas having the above structure are adjacently disposed in a
base station, etc. In this case, radiation energy outputted from one antenna affects to other antennas. Namely, interference may be generated between the antennas. Accordingly, it is important to block or minimize the interference of the antennas due to the radiation energy. Output value of the radiation energy is indicated as a front to back ratio.

The conventional antenna can not block the above radiation energy outputted to other antenna from one antenna, and so the front to back ratio characteristic may be lowered. As a result, interference is generated between the antennas, and thus performance of the antennas may be downed.

The above information disclosed in this Background Art section is only for enhancement of understanding of the background of the invention and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

[Disclosure]

[Technical Problem]

Accordingly, the present invention is provided to substantially obviate one or more problems due to limitations and disadvantages of the related art.

Example embodiment of the present invention provides a choke member having step height and an antenna including the same for enhancing front to back ratio characteristic with maintaining excellent isolation.
characteristic.

[Technical Solution]

An antenna according to one example embodiment of the present invention includes a reflection plate; at least one radiation element disposed on the reflection plate; and a first choke member disposed outside of the radiation element on the reflection plate. Here, a height of a part of the first choke member is greater than the other parts of the first choke member.

The antenna further includes a second choke member disposed, at a location opposed to the first choke member on the basis of corresponding radiation element, on the reflection plate. Here, a height of a part of the second choke member is greater than the other parts of the second choke member.

The second choke member has different structure from the first choke member.

An end of at least one of the choke members is bent in a direction of the radiation element.

The first choke member includes a first sub-choke member; a second sub-choke member connected to the first sub-choke member, and configured to have a height higher than the first sub-choke member. Here, a connection portion of the first sub-choke member and the second sub-choke
member has curve shape or slope shape.

One or more groove is formed at the second sub-choke member.

The radiation elements include first radiation elements using a combination method and second radiation elements using a vector-sum method. Here, a height of a first part, facing to a first portion, of the first choke member is higher than that of a second part, facing to a second portion, or a third part, facing to a third portion, of the first choke member, the first radiation element and the second radiation element being existed in the first portion, only the first radiation element being existed in the second portion and only the second radiation element being existed in the third portion.

The antenna includes a plurality of radiation elements, and wherein a height of a part, facing to a space between the radiation elements, of the first choke member is higher than that a part facing to the radiation element.

The antenna includes first elements, to which a first power higher than a reference power is applied, and second radiation elements to which a second power smaller than the reference power is applied. Here, a height of a part, facing to the first radiation elements, of the first choke member is higher than that of a part, facing to the second radiation elements, of the first choke member.

A choke member disposed on a reflection plate of an antenna
according to one example embodiment of the present invention includes a first sub-choke member; and a second sub-choke member having a height greater than the first sub-choke member.

A least one groove is formed at the second sub-choke member.

An antenna according to another example embodiment of the present invention includes a reflection plate; at least one choke member disposed on the reflection plate; an insulating member as an insulator disposed between the reflection plate and the choke member, thereby separating the choke member from the reflection plate by a certain distance; and a connection member as a conductor configured to connect electrically the choke member to the reflection plate through the insulating member. Here, the choke member has step height.

[Advantageous Effects]

An antenna of the present invention includes a choke member for blocking radiation energy, and so a front to back ratio characteristic of the antenna may be enhanced. Specially, since the choke member has step height, i.e. a part of the choke member has greater height than the other part, the antenna may have excellent isolation characteristic.

In other words, the antenna may enhance the front to back ratio characteristic with maintaining excellent isolation characteristic.
[Description of Drawings]

Example embodiments of the present invention will become more apparent by describing in detail example embodiments of the present invention with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view illustrating schematically an antenna;

FIG. 2 is a perspective view illustrating an antenna according to one example embodiment of the present invention;

FIG. 3 is a view illustrating various choke members according to one example embodiment of the present invention;

FIG. 4 is a view illustrating structure of choke members according to one example embodiment of the present invention;

FIG. 5 is a view illustrating schematically an antenna according to another example embodiment of the present invention;

FIG. 6 is a view illustrating schematically an antenna according to still another example embodiment of the present invention;

FIG. 7 is a view illustrating a choke member according to one example embodiment of the present invention;

FIG. 8 is a view illustrating three kinds of antenna; and

FIG. 9 to FIG. 11 are views illustrating curve related to width of the
beam (beam width), curve related to the FBR characteristic and curve related
to the isolation characteristic for the antennas in FIG. 8.

[Mode for Invention]

Example embodiments of the present invention are disclosed herein. However, specific structural and functional details disclosed herein are merely representative for purposes of describing example embodiments of the present invention, however, example embodiments of the present invention may be embodied in many alternate forms and should not be construed as limited to example embodiments of the present invention set forth herein.

Accordingly, while the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that there is no intent to limit the invention to the particular forms disclosed, but on the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention. Like numbers refer to like elements throughout the description of the figures.

It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one
element from another. For example, a first element could be termed a second element, and, similarly, a second element could be termed a first element, without departing from the scope of the present invention. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present. Other words used to describe the relationship between elements should be interpreted in a like fashion (i.e., "between" versus "directly between", "adjacent" versus "directly adjacent", etc.).

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises", "comprising.", "includes" and/or "including", when used herein, specify the presence of stated features, integers, steps, operations, elements,
and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

FIG. 2 is a perspective view illustrating an antenna according to one example embodiment of the present invention.

In FIG. 2(A), the antenna of the present embodiment outputs a specific beam, and includes a reflection plate 200, at least one radiation element 202, a first choke member 204 and a second choke member 206.

The reflection plate 200 functions as a ground and a reflector, for example has plane shape. However, the reflection plate 200 may have shape bent in a specific direction not the plane shape as shown in FIG. 2(B).

The radiation element 202 outputs a certain radiation pattern, for
example may output a dual polarization, i.e. ±45° polarizations.

The first choke member 204 is disposed outside of the radiation elements 202 on the reflection plate 200 as shown in FIG. 2(A), preferably disposed on one end portion of the reflection plate 200. Here, the first choke member 204 may be formed in a direction crossing over the reflection plate 200, for example in a direction vertical to the reflection plate 200.

The first choke member 204 is extended along a length direction of the reflection plate 200 as shown in FIG. 2(A). In one example embodiment of the present invention, the first choke member 204 may be formed along the length direction of the reflection plate as one body member. In another example embodiment of the present invention, the choke member 204 has a plurality of sub-choke members, which are disposed in sequence along the length direction of the reflection plate 200.

In one example embodiment of the present invention, height of a part (Hereinafter, referred to as "first choke member", 204A) of the first choke member 204 is greater than that of other part (Hereinafter, referred to as "second choke member", 204B) as shown in FIG. 2. That is, the first choke member 204 has step height.

The second choke member 206 is disposed outside of the radiation element 202 on the reflection plate 200 as shown in FIG. 2(A), specially is
disposed at a portion opposed to the first choke member 206, i.e. disposed at the other end portion of the reflection plate 200. Here, the second choke member 206 may be formed in a normal direction of the reflection plate 200.

Height of a part of the second choke member 206 is greater than that of other part, i.e. the second choke member 206 has also step height.

In brief, the choke member 204 or 206 in the antenna has step height.

Hereinafter, function of the choke member 204 or 206 will be described in detail.

Firstly, the choke members 204 and 206 control width of a beam (radiation pattern) outputted from the antenna. Particularly, the width of the beam is narrower according as the choke members 204 and 206 are away from the radiation elements 202, and is widened according as the choke members 204 and 206 are closer to the radiation elements 202. Accordingly, a user may set location of the choke members 204 and 206 considering desired width of the beam to be outputted from the antenna. Namely, the location of the choke members 204 and 206 is not limited as end portions of the reflection plate 200.

Secondly, the choke members 204 and 206 enhance a front to back ratio FBR of the antenna. Particularly, since the antennas established in e.g. a base station are adjacently disposed, it is important to minimize
interference between the antennas.

The antenna of the present embodiment minimizes the interference between the antennas by blocking a radiation energy outputted to exterior area of the reflection plate 200 using the choke members 204 and 206. In other words, the antenna of the present embodiment improves the FBR by using the choke members 204 and 206, and thus performance of the antennas in the base station may be enhanced.

The FBR characteristic is more enhanced according as height of the choke members 204 and 106 is increased as described below. However, isolation between channels may be more lowered according as the height of the choke members 204 and 206 is increased. Hence, the antenna of the present embodiment sets a part of the choke member 204 or 206 to have greater height than the other part considering the FBR characteristic. That is, a part of the choke member 204 or 206 is set to have smaller height than the other part considering the isolation characteristic.

In brief, unlike the conventional antenna which can not block radiation energy, the antenna of the present embodiment blocks the radiation energy using the choke members 204 and 206. Accordingly, the antenna of the present embodiment has the FBR characteristic improved compared to in the conventional antenna.
In addition, since the choke member 204 or 206 has step height, the isolation characteristic may be also excellently maintained.

In above description, the choke member 204 or 206 is directly contacted on the reflection plate 200. However, the choke member 204 or 206 may be disposed over the reflection plate 200 as shown in FIG. 2(B).

In FIG. 2(B), an insulating member 210 is located between the reflection plate 200 and the choke member 204 or 206 so that the choke member 204 or 206 is separated from the reflection plate 200. Here, the choke member 204 or 206 is electrically connected to the reflection plate 200 through a connection member 212, as a conductor, such as a bolt, etc. However, structure of the insulating member 210 and the connection member 212 may be variously modified.

Hereinafter, various structures of the choke members 204 and 206 will be described in detail. Here, the choke member 204 will be assumed as an example of the choke members 204 and 206 for the purpose of convenience of the description.

FIG. 3 is a view illustrating various choke members according to one example embodiment of the present invention.

Referring to FIG. 3(A), a first sub-choke member 204A and a second sub-choke member 204B are disposed in turns, and have e.g. square wave
shape. Here, the first sub-choke member 204A having height greater than the second sub-choke member 204B is disposed at a location facing the radiation element 202.

Referring to FIG. 3(B), a first sub-choke member 204A has a length longer than in FIG. 3(A). Hence, the first sub-choke member 204A may face to at least two radiation elements 202 unlike in the FIG. 3(A).

Referring to FIG. 3(C), a first sub-choke member 204A faces to one radiation elements 202. However, a second sub-choke member 204B faces to plural radiation elements 202.

In other words, the first sub-choke member 204A faces to at least one radiation element 202 as shown in FIG. 3(A) to FIG. 3(C). On the other hand, in one antenna, some of first choke members 204A face to one radiation element 202 and the other first sub-choke member 204A face to plural radiation elements 202. That is, number and disposition of the sub-choke members may be variously modified as long as the first choke member 204 has step height.

Referring to FIG. 3(D), sub-choke members 204A and 204B may be variously disposed like in FIG. 3(A) to FIG. 3(C). However, connection part K or L of adjoining sub-choke members 204A and 204B may have various shapes such as curve shape, slope shape, etc. as shown in FIG. 3(D).
Namely, the connection part of adjoining sub-choke members 204A and 204B may be variously modified in accordance with user's objection.

In addition, the first sub-choke member 204A may have one or more groove as shown in "M".

In other words, the first sub-choke member 204A has height greater than the second sub-choke member 204B considering the FBR characteristic, but some of the first sub-choke member 204A has height smaller than the other parts considering the isolation characteristic.

In short, in the antenna of the present invention, shape and disposition of the choke member 204 or 206 may be variously modified as long as the choke member 204 or 206 has step height.

FIG. 4 is a view illustrating structure of choke members according to one example embodiment of the present invention.

As shown in FIG. 4, a first sub-choke member 204A of the first choke member 204 has height greater than the second sub-choke member 204B. Additionally, a first sub-choke member 206A of the second choke member 206 has height greater than a second sub-choke member 206B. Here, the first sub-choke member 204A of the first choke member 204 faces to the second sub-choke member 206B of the second choke member 206. Furthermore, the second sub-choke member 204B of the first choke member
204 faces to the first sub-choke member 206A of the second choke member 206. In other words, the first choke member 204 and the second choke member 206 have respectively square wave shape, but have different structures.

In brief, the first choke member 204 and the second choke member 206 may have the same structure or different shapes.

FIG. 5 is a view illustrating schematically an antenna according to another example embodiment of the present invention.

In FIG. 5(A), a first sub-choke member 204A of the first choke member 204 has height greater than a second sub-choke member 204B, and faces to a space between the radiation elements 202.

That is, in the antenna of the present embodiment unlike embodiments in FIG. 2 to FIG. 4 in which the first sub-choke member 204A faces to the radiation element 202, the first sub-choke member 204A faces to the space between the radiation elements 202.

However, it is desirable that the first sub-choke member 204A having higher height is disposed at a location facing to the radiation element 202 considering the FBR characteristic because the radiation energy is outputted from the radiation element 202.

In FIG. 5(B), a part of first sub-choke members 204A having higher
height is disposed at a location facing to corresponding radiation element 202, and the other first sub-choke members are disposed at a location facing to a space between the radiation elements 202.

In short, the first sub-choke member 204A may be disposed at the location facing to the radiation element 202 or be disposed at the location facing to the space between the radiation elements 202. On the other hand, the second choke member 206 may be variously disposed like the first choke member 204.

FIG. 6 is a view illustrating schematically an antenna according to still another example embodiment of the present invention.

In FIG. 6(A), an antenna of the present embodiment includes two kinds of radiation elements 202A and 202B.

The radiation element 202A uses a vector-sum method, and the radiation element 202B uses a combination method.

Hereinafter, the vector-sum method and the combination method will be described in detail.

In FIG. 6(B), the radiation element 202B includes four dipole elements 600A, 600B, 600C and 600D.

In case that specific current is applied to a part of the dipole elements 600A, 600B, 600C and 600D, e.g. the first dipole element 600A and the third
dipole element 600C, electric fields 610A and 610B are generated from the
dipole elements 600A and 600C. Then, +45° polarization 612 is generated
by combination of the electric fields 610A and 610B. Here, the second
dipole element 600B and the fourth dipole element 600D do not affect to

In case that given current is applied to the second dipole element
600B and the fourth dipole element 600D, which is not shown, -45°
polarization is generated. Here, the first dipole element 600A and the third
dipole element 600C do not affect to generation of -45° polarization.

The above method of generating ±45° polarizations is referred to as
the combination method.

In FIG. 6(C), the radiation element 202A includes four dipole
elements 600A, 600B, 600C and 600D.

In case that a specific current is applied to four dipole elements 600A,
600B, 600C and 600D, electric fields 620A, 620B, 620C and 620D are
generated from the dipole elements 600A, 600B, 600C and 600D, and so
+45° polarization 622 is generated in accordance with vector sum of the
electric fields 620A, 620B, 620C and 620D.

On the other hand, direction of electric fields generated from the
dipole elements 600A, 600B, 600C and 600D may be changed in accordance
with a method of applying given current, which is not shown, and so -45 ° polarization is generated in accordance with vector sum of the electric fields.

The above method of generating ±45° polarizations is referred to as the vector-sum method.

In short, the radiation element 202 may output the radiation pattern through the combination method or the vector-sum method. In other words, a method of outputting the radiation pattern is not limited.

Now referring to FIG. 6(A), the radiation element 202A using the vector-sum method and the radiation element 202B using the combination method may be coexisted in the antenna.

For example, the antenna may include a portion in which the radiation element 202A and the radiation element 202B coexist and a portion in which only radiation element 202A exists as shown in FIG. 6(A).

In case that the radiation elements 202A and 202B coexist in the antenna, the first sub-choke member 204A of the choke member 204 or 206 is disposed at a location facing to the portion in which the radiation elements 202A and 202B coexist, and the second sub-choke member 204B is disposed at a location facing to the portion in which only radiation element 202A exists. Here, since the radiation element 202A using the vector-sum method is more sensitive to the height of the choke member 204 or 206, the second
sub-choke member 204B having smaller height is disposed at the location facing to the portion in which only radiation element 202A exists. However, the antenna having the radiation elements 202A and 202B may have different disposition.

In one example embodiment of the present invention, magnitude of a power applied to the radiation element 202A may be different from that of a power applied to the radiation element 202B. In this case, the first sub-choke member 204A having higher height may face to the radiation element to which greater power is applied, and the second sub-choke member 204B having smaller height may face to the radiation element to which smaller power is applied. This is because the radiation element, to which smaller power is applied, is less affected by the height of the choke member 204 or 206.

FIG. 7 is a view illustrating a choke member according to one example embodiment of the present invention.

In FIG. 7, the choke members 204 and 206 are disposed outside of the radiation element 202 having a feeding line 700 and a dipole element 702.

The choke member 204 or 206 has a vertical member 710 vertical to the reflection plate 200 and a bending member 712 bent at an end of the vertical member 710.
The bending member 712 adjusts width of the beam and the isolation characteristic. On the other hand, the choke member 204 or 206 may be made up of only the vertical member 710 without the bending member 712.

FIG. 8 is a view illustrating three kinds of antenna. FIG. 9 to FIG. 11 are views illustrating curve related to width of the beam (beam width), curve related to the FBR characteristic and curve related to the isolation characteristic for the antennas in FIG. 8.

In FIG. 8(A), a choke member 800 has constant low height.

In FIG. 8(B), the choke member 204 of the present embodiment is made up of a first sub-choke member having high height and a second sub-choke member having low height. That is, the choke member 204 has step height.

In FIG. 8(C), a choke member 802 has constant high height. Here, the height of the choke member 802 is greater than that of the choke member 800, is identical to that of the first sub-choke member, and is higher than the second sub-choke member.

Hereinafter, beam width characteristic, the FBR characteristic and the isolation characteristic for the above three antennas will be described in detail.

Firstly, the beam width characteristic will be described.
Referring to FIG. 9, it is verified that the beam width is changed on the basis of about 2040MHz. Particularly, in a frequency less than 2040MHz, the beam width is increased in an order of a beam width curve 904 for the choke member 802 having high height, a beam width curve 902 for the choke member 204 of the present invention, and a beam width curve 900 for the choke member 800 having low height. However, in a frequency more than 2040MHz, the beam width is decreased in an order of the beam width curve 904 for the choke member 802, the beam width curve 902 for the choke member 204 of the present invention, and the beam width curve 900 for the choke member 800.

Accordingly, since the beam width is proportional or inverse-proportional to the height of the choke member, a user may embody desired beam width by adjusting the height of the choke member.

Secondly, the FBR characteristic will be described.

In FIG. 10, a FBR curve 1004 for the choke member 802 and a FBR curve 1002 of the choke member 204 have respectively side value of approximately -40dB, but a FBR curve 1000 for the choke member 800 has side value of approximately -31dB.

In other words, the FBR characteristic of the choke member 204 of the present invention is similar to that of the choke member 802 having high
height. However, the FBR characteristic of the choke member 204 of the present invention is enhanced compared to that of the choke member 800 having low height.

Third, the isolation characteristic will be described.

In FIG. 11, an isolation curve 1102 for the choke member 204 of the present invention is similar to an isolation curve 1100 of the choke member 800 having low height. In addition, the isolation curve 1102 has a value smaller than an isolation curve 1104 of the choke member 802 having high height.

That is, the isolation of the choke member 204 of the present invention is similar to that of the choke member 800 having low height, but is enhanced compared to that of the choke member 802 having high height.

In brief, the antenna of the present invention enhances the isolation characteristic and the FBR characteristic by using the choke member 204 or 206 having step height. Particularly, the choke member 204 or 206 of the present invention has the FBR characteristic enhanced compared to in the choke member 800 having low height with maintaining the FBR characteristic similar to that of the choke member 802 having high height. Furthermore, the choke member 204 or 206 of the present invention has the isolation characteristic enhanced compared to in the choke member 802
having high height with maintaining the isolation characteristic similar to that of the choke member 800 having low height. Namely, the choke member 204 or 206 of the present invention may enhance the FBR characteristic with maintaining excellent isolation characteristic.

Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to affect such feature, structure, or characteristic in connection with other ones of the embodiments.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are
possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.
[CLAIMS]

[Claim 1]

490 An antenna comprising:

a reflection plate;

at least one radiation element disposed on the reflection plate; and

a first choke member disposed outside of the radiation element on the reflection plate,

495 wherein a height of a part of the first choke member is greater than the other parts of the first choke member.

[Claim 2]

The antenna of claim 1, further comprising;

a second choke member disposed, at a location opposed to the first choke member on the basis of corresponding radiation element, on the reflection plate.

wherein a height of a part of the second choke member is greater than the other parts of the second choke member.

[Claim 3]

505 The antenna of claim 2, wherein the second choke member has different structure from the first choke member.
[Claim 4]

The antenna of claim 2, wherein an end of at least one of the choke members is bent in a direction of the radiation element.

[Claim 5]

The antenna of claim 1, wherein the first choke member includes:

a first sub-choke member;

a second sub-choke member connected to the first sub-choke member, and configured to have a height higher than the first sub-choke member,

and wherein a connection portion of the first sub-choke member and the second sub-choke member has curve shape or slope shape.

[Claim 6]

The antenna of claim 5, wherein one or more groove is formed at the second sub-choke member.

[Claim 7]

The antenna of claim 1, wherein the radiation elements include first radiation elements using a combination method and second radiation elements using a vector-sum method,

and wherein a height of a first part, facing to a first portion, of the first choke member is higher than that of a second part, facing to a second portion, or a third part, facing to a third portion, of the first choke member,
the first radiation element and the second radiation element being coexisted in the first portion, only the first radiation element being existed in the second portion and only the second radiation element being existed in the third portion.

[Claim 8]

The antenna of claim 1, wherein the antenna includes a plurality of radiation elements,

and wherein a height of a part, facing to a space between the radiation elements, of the first choke member is higher than that a part facing to the radiation element.

[Claim 9]

The antenna of claim 1, wherein the antenna includes first elements, to which a first power higher than a reference power is applied, and second radiation elements to which a second power smaller than the reference power is applied,

and wherein a height of a part, facing to the first radiation elements, of the first choke member is higher than that of a part, facing to the second radiation elements, of the first choke member.

[Claim 10]

A choke member disposed on a reflection plate of an antenna, the
choke member comprising:

- a first sub-choke member; and
- a second sub-choke member having a height greater than the first sub-choke member.

[Claim 11]

The choke member of claim 10, wherein at least one groove is formed at the second sub-choke member.

[Claim 12]

An antenna comprising:

- a reflection plate;
- at least one choke member disposed on the reflection plate;
- an insulating member as an insulator disposed between the reflection plate and the choke member, thereby separating the choke member from the reflection plate by a certain distance; and
- a connection member as a conductor configured to connect electrically the choke member to the reflection plate through the insulating member,

wherein the choke member has step height.
【Figure 10】

【Figure 11】
A. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 HOIQ

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for utility models since 1975
Japanese Utility models and applications for utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS(KIPO Internal)
"Keywords antenna, reflector, choke, deflector, step"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>KR 1020030039928 A (LG TELECOM ,LTD et al ) 22 MAY 2003 See the abstract, figures 1-4, pages 2, 3, and claims 1-4</td>
<td>1-12</td>
</tr>
<tr>
<td>A</td>
<td>KR 1019960036199 A (ACE TECHNOLOGY CO , LTD ) 28 OCTOBER 1996 See the abstract, figure 3, page 3, and claim 1</td>
<td>1-12</td>
</tr>
<tr>
<td>A</td>
<td>KR 1019980013799 A (HIGHGAIN ANTENNA CO , LTD ) 15 MAY 1998 See the abstract, figures 1-4, pages 2, 3, and claims 1-4</td>
<td>1-12</td>
</tr>
<tr>
<td>A</td>
<td>US 7196674 B2 (TIMOFEEV, IGOR et al ) 27 MARCH 2007 See the abstract, figures 1-4, column 5 line 45 - column 6 line 56, and claims 10, 15, 22</td>
<td>1-12</td>
</tr>
</tbody>
</table>

* Further documents are listed in the continuation of Box C

[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

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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