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(54) **CONICAL MONOPOLE ANTENNA**

KONISCHE MONOPOLANTENNE

ANTENNE UNIPOLAIRE CONIQUE

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a conical monopole antenna according to the preamble of the appended independent claim.

BACKGROUND OF THE INVENTION

[0002] Wideband antennas are well known in the prior art and are widely used in various communications systems. An example of such a wideband antenna is a conical monopole antenna, also known as a moncone antenna that provides a low VSWR (Voltage Standing Wave Ratio) over a relatively wide frequency band.

[0003] A conventional conical monopole antenna comprises a ground plate and a conical member, which are arranged at a small distance from each other such that the apex of the conical member is pointing toward the ground plate and the axis of the conical member is perpendicular to the plane of the ground plate. The lower cut-off frequency of the conventional conical monopole antenna is determined by the diameter of the base of the conical member and the height of the conical member. The higher cut-off frequency of the conventional conical monopole antenna is provided by making the diameter at the apex of the conical member to correspond to that associated with the highest frequency of interest. The conventional conical monopole antenna comprises a coaxial feeder with an inner conductor connected to the apex of the conical member, and an outer conductor connected to the ground plate. The coaxial feeder extends outwardly from the ground plate on a side thereof opposite the apex of the conical member.

[0004] A problem associated with the conventional conical monopole antenna is that the VSWR of the antenna is too high for many applications. The problem arises especially at low frequencies where the VSWR typically increases rapidly below a certain cut-off frequency. This cut-off frequency can be decreased by increasing the size of the conical member. This, however, increases the VSWR at high frequencies. It also increases the size of the antenna. Z Monopole antennas that have a conical part and a cylindrical part are for example disclosed in US2724052, EP2154752 and US2006/0012528

OBJECTIVES OF THE INVENTION

[0005] It is the main objective of the present invention to reduce or even eliminate prior art problems presented above.

[0006] It is an objective of the present invention to provide a conical monopole antenna that provides a very low VSWR over a wide frequency band. Especially, it is an objective of the invention to improve the VSWR performance of a conical monopole antenna at low and high frequencies. In other words, it is an objective of the in-

vention to decrease the lower cut-off frequency and to increase the higher cut-off frequency of a conical monopole antenna.

[0007] It is also an objective of the present invention to provide a conical monopole antenna that is small-sized and easy to manufacture, and has a good performance in a wide frequency band.

[0008] In order to realise the above-mentioned objectives, the conical monopole antenna according to the invention is characterised by what is presented in the characterising part of the appended independent claim. Advantageous embodiments of the invention are described in the dependent claims.

DESCRIPTION OF THE INVENTION

[0009] A typical conical monopole antenna according to the invention comprises a first ground plate having a first and a second side, and a conical member having an apex and a base, the apex of the conical member being directed towards the first side of the first ground plate and the axis of the conical member being perpendicular to the plane of the first ground plate. The typical conical monopole antenna according to the invention further comprises a cylindrical member having a first and a second end, the first end of the cylindrical member being directed towards the base of the conical member and the axis of the cylindrical member being perpendicular to the plane of the first ground plate, and a plurality of connecting members connecting the cylindrical member to the conical member in such a manner that the cylindrical member and the conical member are at a distance from each other.

[0010] The first ground plate and the conical member form the basic structure of the conical monopole antenna. The apex of the conical member is pointing toward and arranged at a distance from the first side of the first ground plate. The conical member is a right circular cone that is arranged with respect to the first ground plate such that its (longitudinal) axis is perpendicular to the plane of the first ground plate. The apex of the conical member is connected to an inner conductor of a coaxial connector, and the first ground plate is connected to an outer conductor of the coaxial connector. The coaxial connector may be mounted to the first ground plate. A coaxial cable can be connected to the coaxial connector through the second side of the first ground plate.

[0011] The first ground plate and the conical member are preferably made of an electrically conductive material. The first ground plate and the conical member can be made, for example, of a metal, such as copper, aluminium or brass, or of an electrically conductive polymer or plastic. The first ground plate can have various shapes and dimensions depending on the requirements of the antenna. However, preferably the first ground plate is a disc, the diameter of which is chosen according to the diameter of the base of the conical member. When the first ground plate is a disc, the axis of the conical member

is preferably arranged to pass through the centre of the disc. The thickness of the first ground plate can be chosen according to the height of the cylindrical member; as the height of the cylindrical member is increased also the thickness of the first ground plate should be increased. The first ground plate is preferably solid. The diameter of the first ground plate can be, for example, 80-100 mm, and the thickness of the first ground plate can be, for example, 15-25 mm. The conical member can be solid or hollow. A hollow conical member can be made of a metal sheet that is cut into a suitable shape and then rolled into a cone. The dimensions of the conical member are chosen according to the requirements of the antenna. The diameter of the base of the conical member and the height of the conical member affect the lower cut-off frequency of the conical monopole antenna. The diameter of the base of the conical member can be, for example, 80-100 mm, and the height of the conical member can be, for example, 60-80 mm. The opening angle of the conical member can be, for example, 30-100 degrees, 40-90 degrees, 50-80 degrees or 60-70 degrees.

[0012] The cylindrical member is connected to the conical member with the plurality of connecting members in such a manner that the cylindrical member and the conical member are separated from each other by a distance, which is preferably at least 1 mm. In other words, there is a gap between the cylindrical member and the conical member. The cylindrical member is galvanically connected to the conical member through the connecting members. On the other hand, since the cylindrical member and the conical member are separated by a distance from each other, the cylindrical member and the conical member are also capacitively connected to one another. The cylindrical member is preferably arranged concentric with the conical member, so that the axis of the cylindrical member is congruent with the axis of the conical member.

[0013] The connecting members define with the cylindrical member and the conical member a plurality of openings. Each connecting member is preferably connected to an outer edge of the first end of the cylindrical member, and to an outer edge of the base of the conical member. Preferably, the connecting members are symmetrically arranged so that the distances between adjacent connecting members are essentially equal.

[0014] The cylindrical member and the connecting members are preferably made of an electrically conductive material. The cylindrical member and the connecting members can be made, for example, of a metal, such as copper, aluminium or brass, or of an electrically conductive polymer or plastic. The cylindrical member can be solid or hollow. A hollow cylindrical member can be made of a metal sheet that is cut into a suitable shape and then rolled into a cylinder. Preferably, the diameter of the cylindrical member is equal to the diameter of the base of the conical member. The diameter of the cylindrical member can be, for example, 80-100 mm, and the height of the cylindrical member can be, for example, 15-25 mm. The connecting members are preferably bars or wires,

the first ends of which are connected to the first end of the cylindrical member, and the second ends of which are connected to the base of the conical member. By optimising the size and the amount of the connecting members the resonant frequencies can be kept out from the operating frequencies of the conical monopole antenna.

[0015] The cylindrical member, which is galvanically connected to the conical member with the connecting members, extends the length of the conical monopole antenna without increasing its diameter. This decreases the lower cut-off frequency of the conical monopole antenna, and as a result the VSWR performance of the conical monopole antenna is improved at low frequencies. In the present invention, the cylindrical member is also capacitively connected to the conical member since the cylindrical member is arranged at a distance from the conical member. Due to this capacitive connection, the higher cut-off frequency of the conical monopole antenna is increased, and thus the VSWR performance of the conical monopole antenna is also improved at high frequencies. The air gap between the conical member and the cylindrical member improves the radiation pattern performance at frequencies over 2 GHz and especially in the range of 5 to 18 GHz. The VSWR performance of the conical monopole antenna remains good at high frequencies. A construction without an air gap would have a usable radiation pattern performance only up to 2 GHz resulting in negative gains for 2.4 GHz and 5.8 GHz WiFi bands. The conical monopole antenna according to the invention provides a very low VSWR over a wide frequency band. With the conical monopole antenna according to the invention, the average wideband VSWR performance in the 1 GHz to 18 GHz communication band can be as low as 1.2:1. On specific communication bands the VSWR can even be 1.1:1.

[0016] According to an embodiment of the invention the diameter of the cylindrical member is equal to the diameter of the base of the conical member. This is an optimal choice from the point of view of the VSWR performance.

[0017] According to an embodiment of the invention the diameter of the first ground plate is at most equal to the diameter of the base of the conical member. A larger diameter of the first ground plate would result in the radiation pattern of the antenna being lifted at high frequencies. A larger diameter of the first ground plate would also degrade the VSWR performance at high frequencies.

[0018] According to an embodiment of the invention the distance between the cylindrical member and the conical member is 1-5 mm. The optimal distance depends on the dimensions of the cylindrical member and the conical member. In many applications, a good choice for the distance between the cylindrical member and the conical member from the point of view of the VSWR performance is 2-3 mm.

[0019] According to an embodiment of the invention

the number of the plurality of connecting members is 3-10. Preferably, the number of the connecting members is 6-8. The width of each connecting member can be, for example, 1-10 mm, preferably 2-8 mm, and more preferably 4-6 mm. The optimal number and the size of the connecting members depend on the size of the cylindrical member.

[0020] According to an embodiment of the invention the conical monopole antenna comprises a second ground plate having a first and a second side, the first side of the second ground plate being attached to the second side of the first ground plate, and the diameter of the second ground plate being larger than the diameter of the first ground plate. The second ground plate, the diameter of which is larger than the diameter of the first ground plate, improves the VSWR performance of the conical monopole antenna at low frequencies. The first and the second ground plate form a staggered structure that allows decreasing the lower cut-off frequency without degrading the VSWR performance at high frequencies. The features of this embodiment can also be applied with the same advantages in a conical monopole antenna that does not comprise a cylindrical member and a plurality of connecting members.

[0021] The staggered (tapered) structure of the first and the second ground plate reduces the electrical diameter of the required ground area of the conical monopole antenna having the cylindrical member connected to the conical member. The staggered ground plate structure allows a direct installation of the conical monopole antenna on a large metal surface without degrading effects to the radiation pattern and the VSWR performance. A single ground plate causes the radiation pattern to tilt upwards resulting in a negative gain in the horizon. The staggered ground plate structure together with the air gap between the conical and the cylindrical member improves the antenna gain and the radiation pattern even more towards the horizon.

[0022] The second ground plate has also other advantages. It can function as a mechanical support for a radome. It also enables the conical monopole antenna to be installed on a wide conductive surface, such as a metal roof of a building, a vehicle or a vessel, without performance degradation of the antenna. The second ground plate may also function at the same time as a mounting plate comprising holes for mounting screws.

[0023] The second ground plate is preferably made of an electrically conductive material. The second ground plate can be made, for example, of a metal, such as copper, aluminium or brass, or of an electrically conductive polymer or plastic. The second ground plate can have various shapes and dimensions depending on the requirements of the antenna. However, preferably the second ground plate is a disc, the diameter of which can be chosen according to the height of the conical member and/or the cylindrical member. The diameter of the second ground plate can be, for example, 130-150 mm, and the thickness of the second ground plate can be, for ex-

ample, 4-10 mm. The second ground plate is preferably solid.

[0024] The conical monopole antenna may comprise more than two ground plates, each having a different diameter. The ground plates are arranged in a staggered manner so that the uppermost ground plate has the smallest diameter and the lowermost ground plate has the largest diameter.

[0025] According to an embodiment of the invention the first and/or the second ground plate comprises a plurality of metal layers arranged one upon the other. The parasitic capacitance due to the layered structure enables to achieve the same performance with thinner ground plates. The metal layers can be arranged directly one upon the other, or using electrically non-conductive layers between the metal layers. The thickness of the metal layers can be, for example, less than 1 mm, 0.5-1 mm, 1-2 mm or 2-4 mm.

[0026] According to an embodiment of the invention the first and the second ground plate are made from a single block.

[0027] According to an embodiment of the invention the conical monopole antenna comprises a tubular member arranged partly inside the conical member, the longitudinal axis of the tubular member being perpendicular to the plane of the first ground plate. The tubular member is used to extend the frequency band of the conical monopole antenna to a desired low frequency communication band, such as VHF or TETRA. The length of the tubular member is chosen to correspond to the desired communication band. The first end of the tubular member that is inside the conical member can be galvanically or capacitively connected to the conical member. The features of this embodiment can also be applied with the same advantages in a conical monopole antenna that does not comprise a cylindrical member and a plurality of connecting members.

[0028] The tubular member is preferably made of an electrically conductive material. The tubular member can be made of various materials, for example of a metal, such as copper, aluminium or brass, or of an electrically conductive polymer or plastic. The tubular member can be solid or hollow. Preferably, the tubular member is a tube that is arranged concentric with the conical member, so that the longitudinal axis of the tube is congruent with the axis of the conical member. The length of the tubular member can be, for example, 100-400 mm, and the diameter of the tubular member can be, for example, 5-30 mm.

[0029] According to an embodiment of the invention the tubular member is capacitively connected to the conical member. Capacitive connection between the tubular member and the conical member enables to use a shorter tubular member compared to a situation where the tubular member is galvanically connected to the conical member. The tubular member can be attached to the conical member using a support that is made of electrically non-conductive material. Alternatively, the tubular member

can be attached to a radome.

[0030] According to an embodiment of the invention the tubular member is made of carbon fibre. An advantage of the carbon fibre is that it widens the narrowband response produced by the tubular member compared to other materials such as metals.

[0031] According to an embodiment of the invention the conical monopole antenna comprises at least one grounding wire connected between the conical member and the first ground plate. Because of the grounding wire, a static discharge can be prevented in the conical monopole antenna, and thus the sensitivity is improved. The grounding wire also acts as a lightning protection for a communication system and it conducts EMC disturbances to a ground potential when the ground plate(s) is(are) electrically conductive and installed on a larger electrically conductive surface or when another grounding structure is used. Preferably, the first end of the grounding wire is connected to the base of the conical member, and the second end of the grounding wire is connected to the first side of the first ground plate. The grounding wires can be symmetrically distributed around the conical member. This improves the VSWR performance when only one ground plate is used.

[0032] According to an embodiment of the invention the conical monopole antenna comprises a coaxial connector having an inner and an outer conductor, the inner conductor being connected to the conical member, and the outer conductor being connected to the first ground plate. The inner conductor is connected to the apex of the conical member. The coaxial connector is mounted to the first ground plate. A coaxial cable can be connected to the coaxial connector through the second side of the first ground plate and possibly also through the second ground plate.

[0033] According to an embodiment of the invention the conical member and/or the cylindrical member and/or the tubular member are hollow.

[0034] According to an embodiment of the invention the conical member and/or the cylindrical member and/or the tubular member comprise an electrically non-conductive core covered with an electrically conductive layer. In other words, the inner part is made of electrically non-conductive material, whereas the outer part is made of electrically conductive material. An advantage of this structure is that it is easy and cheap to manufacture. The electrically non-conductive material can be, for example, PTFE (Teflon), glass fibre, ASA or some other RF neutral material.

[0035] According to an embodiment a conical monopole antenna is provided that comprises a first ground plate having a first and a second side, and a conical member having an apex and a base, the apex of the conical member being directed towards the first side of the first ground plate and the axis of the conical member being perpendicular to the plane of the first ground plate. The conical monopole antenna according to this embodiment further comprises a second ground plate having a first and a

second side, the first side of the second ground plate being attached to the second side of the first ground plate, and the diameter of the second ground plate being larger than the diameter of the first ground plate.

[0036] According to an embodiment a conical monopole antenna is provided that comprises a first ground plate having a first and a second side, and a conical member having an apex and a base, the apex of the conical member being directed towards the first side of the first ground plate and the axis of the conical member being perpendicular to the plane of the first ground plate. The conical monopole antenna according to this embodiment further comprises a tubular member arranged partly inside the conical member, the longitudinal axis of the tubular member being perpendicular to the plane of the first ground plate.

[0037] According to an embodiment of the invention the conical monopole antenna comprises a second cylindrical member having a first and a second end, the first end of the second cylindrical member being directed towards the second end of the first cylindrical member and the axis of the second cylindrical member being perpendicular to the plane of the first ground plate, and a plurality of second connecting members connecting the second cylindrical member to the first cylindrical member in such a manner that the first and the second cylindrical member are at a distance from each other. An advantage of the second cylindrical member is that it further decreases the lower cut-off frequency of the conical monopole antenna. Furthermore, the use of the second cylindrical member electrically shortens the antenna compared to a construction with only one long cylindrical member.

[0038] The exemplary embodiments of the invention presented in this text are not interpreted to pose limitations to the applicability of the appended claims. The verb "to comprise" is used in this text as an open limitation that does not exclude the existence of also unrecited features. The features recited in the dependent claims are mutually freely combinable unless otherwise explicitly stated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039]

- Fig. 1 illustrates a conical monopole antenna according to a first embodiment of the invention,
- fig. 2 illustrates a conical monopole antenna according to a second embodiment of the invention,
- fig. 3 illustrates a conical monopole antenna according to a third embodiment of the invention, and
- fig. 4 illustrates a conical monopole antenna according to a fourth embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0040] The same reference signs are used of the same or like components in different embodiments.

[0041] Fig. 1 illustrates a conical monopole antenna according to a first embodiment of the invention. The conical monopole antenna comprises a first ground plate 101 and a conical member 102, the apex of which is directed towards and arranged at a distance from the first side of the first ground plate 101. The conical member 102 is arranged with respect to the first ground plate 101 such that its axis is perpendicular to the plane of the first ground plate 101 and passes through the centre of the first ground plate 101. The diameter of the first ground plate 101 is equal to the diameter of the base of the conical member 102.

[0042] The conical monopole antenna comprises a coaxial connector 103 that is mounted to the first ground plate 101. An inner conductor 104 of the coaxial connector 103 is connected to the apex of the conical member 102, and an outer conductor 105 of the coaxial connector 103 is connected to the first ground plate 101. A coaxial cable (not shown in fig. 1) can be connected to the coaxial connector 103 through the second side of the first ground plate 101.

[0043] The conical monopole antenna comprises a cylindrical member 106 that is connected to the conical member 102 with a plurality of connecting members 107 such that the cylindrical member 106 and the conical member 102 are at a distance from each other. The first end of the cylindrical member 106 is facing the base of the conical member 102 and the axis of the cylindrical member 106 is arranged perpendicular to the plane of the first ground plate 101. The cylindrical member 106 is arranged concentric with the conical member 102, so that the axis of the cylindrical member 106 is congruent with the axis of the conical member 102. The diameter of the cylindrical member 106 is equal to the diameter of the base of the conical member 102.

[0044] Each connecting member 107 is connected to an outer edge of the first end of the cylindrical member 106 and to an outer edge of the base of the conical member 102. The connecting members 107 are symmetrically arranged on the circumference of the base of the conical member 102 and the first end of the cylindrical member 106 so that the distances between adjacent connecting members 107 are essentially equal.

[0045] The cylindrical member 106, which is galvanically connected to the conical member 102 through the connecting members 107, extends the length of the conical monopole antenna without increasing its diameter. This decreases the lower cut-off frequency of the antenna, and as a result the VSWR performance of the antenna is improved at low frequencies. The cylindrical member 106 and the conical member 102 are also capacitively connected to one another, because the cylindrical member 106 and the conical member 102 are separated by a distance. Due to this capacitive connection, the higher

cut-off frequency of the antenna is increased, and thus the VSWR performance of the antenna is also improved at high frequencies.

[0046] Fig. 2 illustrates a conical monopole antenna according to a second embodiment of the invention, which differs from the embodiment of fig. 1 in that the conical monopole antenna also comprises a second ground plate 201 and a grounding wire 202.

[0047] The first side of the second ground plate 201 is attached to the second side of the first ground plate 101. The diameter of the second ground plate 201 is larger than the diameter of the first ground plate 101, whereby the first and the second ground plate 101, 201 form a staggered structure that allows decreasing the lower cut-off frequency of the antenna without degrading the VSWR performance at high frequencies.

[0048] The grounding wire 202 is connected between the conical member 102 and the first ground plate 101 to prevent a static discharge in the conical monopole antenna. The first end of the grounding wire 202 is connected to the base of the conical member 102, and the second end of the grounding wire 202 is connected to the first side of the first ground plate 101.

[0049] Fig. 3 illustrates a conical monopole antenna according to a third embodiment of the invention, which differs from the embodiment of fig. 1 in that the conical monopole antenna also comprises a second ground plate 201, a tubular member 301 that is used to extend the frequency band of the conical monopole antenna to a desired low frequency communication band, and a radome 302 for protecting the conical monopole antenna.

[0050] The second end of the tubular member 301 is attached to the radome 302 in such a manner that the tubular member 301 passes through the cylindrical member 106 inside the conical member 102. The first end of the tubular member 301 is separated by a distance from the conical member 102 so that the tubular member 301 is capacitively connected to the conical member 102. The longitudinal axis of the tubular member 301 is perpendicular to the plane of the first ground plate 101.

[0051] Fig. 4 illustrates a conical monopole antenna according to a fourth embodiment of the invention, which differs from the embodiment of fig. 1 in that the conical monopole antenna also comprises a second cylindrical member 401 and a plurality of second connecting members 402. The second cylindrical member 401 is connected to the first cylindrical member 106 with the second connecting members 402 such that the first and the second cylindrical member 106, 401 are at a distance from each other. The second connecting members 402 are symmetrically arranged on the circumference of the first end of the second cylindrical member 401 and the second end of the first cylindrical member 106 so that the distances between adjacent connecting members 402 are essentially equal.

[0052] The first end of the second cylindrical member 401 is facing the second end of the first cylindrical member 106. The second cylindrical member 401 is arranged

concentric with the first cylindrical member 106, so that the axis of the second cylindrical member 401 is congruent with the axis of the first cylindrical member 106. The diameter of the second cylindrical member 401 is equal to the diameter of the first cylindrical member 106.

[0053] Only advantageous exemplary embodiments of the invention are described in the figures. It is clear to a person skilled in the art that the invention is not restricted only to the examples presented above, but the invention may vary within the limits of the claims presented hereafter. Some possible embodiments of the invention are described in the dependent claims, and they are not to be considered to restrict the scope of protection of the invention as such.

Claims

1. A conical monopole antenna, comprising:

- a first ground plate (101) having a first and a second side, and
- a conical member (102) having an apex and a base, the apex of the conical member (102) being directed towards the first side of the first ground plate (101) and the axis of the conical member (102) being perpendicular to the plane of the first ground plate (101), and
- a cylindrical member (106) having a first and a second end, the first end of the cylindrical member (106) being directed towards the base of the conical member (102) and the axis of the cylindrical member (106) being perpendicular to the plane of the first ground plate (101),

characterised in that the conical monopole antenna comprises:

- a plurality of connecting members (107) connecting the cylindrical member (106) to the conical member (102) in such a manner that the cylindrical member (106) and the conical member (102) are at a distance from each other, the connecting members (107) defining with the cylindrical member (106) and the conical member (102) a plurality of openings.

2. The conical monopole antenna according to claim 1, **characterised in that** the diameter of the cylindrical member (106) is equal to the diameter of the base of the conical member (102).

3. The conical monopole antenna according to claim 1 or 2, **characterised in that** the diameter of the first ground plate (101) is at most equal to the diameter of the base of the conical member (102).

4. The conical monopole antenna according to any of

the preceding claims, **characterised in that** the distance between the cylindrical member (106) and the conical member (102) is 1-5 mm.

5. The conical monopole antenna according to any of the preceding claims, **characterised in that** the number of the plurality of connecting members (107) is 3-10.

6. The conical monopole antenna according to any of the preceding claims, **characterised in that** the conical monopole antenna comprises a second ground plate (201) having a first and a second side, the first side of the second ground plate (201) being attached to the second side of the first ground plate (101), and the diameter of the second ground plate (201) being larger than the diameter of the first ground plate (101).

7. The conical monopole antenna according to claim 6, **characterised in that** the first and/or the second ground plate (101, 201) comprises a plurality of metal layers arranged one upon the other.

8. The conical monopole antenna according to claim 6, **characterised in that** the first and the second ground plate (101, 201) are made from a single block.

9. The conical monopole antenna according to any of the preceding claims, **characterised in that** the conical monopole antenna comprises a tubular member (301) arranged partly inside the conical member (102), the longitudinal axis of the tubular member (301) being perpendicular to the plane of the first ground plate (101).

10. The conical monopole antenna according to claim 9, **characterised in that** the tubular member (301) is capacitively connected to the conical member (102).

11. The conical monopole antenna according to claim 9 or 10, **characterised in that** the tubular member (301) is made of carbon fibre.

12. The conical monopole antenna according to any of the preceding claims, **characterised in that** the conical monopole antenna comprises at least one grounding wire (202) connected between the conical member (102) and the first ground plate (101).

13. The conical monopole antenna according to any of the preceding claims, **characterised in that** the conical monopole antenna comprises a coaxial connector (103) having an inner and an outer conductor (104, 105), the inner conductor (104) being connected to the conical member (102), and the outer conductor (105) being connected to the first ground plate

(101).

14. The conical monopole antenna according to any of the preceding claims, **characterised in that** the conical member (102) and/or the cylindrical member (106) and/or the tubular member (301) are hollow.
15. The conical monopole antenna according to any of the preceding claims, **characterised in that** the conical member (102) and/or the cylindrical member (106) and/or the tubular member (301) comprise an electrically non-conductive core covered with an electrically conductive layer.

Patentansprüche

1. Konische Monopolantenne, umfassend:

- eine erste Erdungsplatte (101), die eine erste und eine zweite Seite aufweist, und
- ein konisches Element (102), das eine Spitze und eine Basis aufweist, wobei die Spitze des konischen Elements (102) auf die erste Seite der ersten Erdungsplatte (101) gerichtet ist und die Achse des konischen Elements (102) senkrecht zu der Ebene der ersten Erdungsplatte (101) ist, und
- ein zylindrisches Element (106), das ein erstes und ein zweites Ende aufweist, wobei das erste Ende des zylindrischen Elements (106) auf die Basis des konischen Elements (102) gerichtet ist und die Achse des zylindrischen Elements (106) senkrecht zu der Ebene der ersten Erdungsplatte (101) ist,

dadurch gekennzeichnet, dass die konische Monopolantenne Folgendes umfasst:

- eine Vielzahl von Verbindungselementen (107), die das zylindrische Element (106) derart mit dem konischen Element (102) verbinden, dass das zylindrische Element (106) und das konische Element (102) voneinander beabstandet sind, wobei die Verbindungselemente (107) mit dem zylindrischen Element (106) und dem konischen Element (102) eine Vielzahl von Öffnungen definieren.

2. Konische Monopolantenne nach Anspruch 1, **dadurch gekennzeichnet, dass** der Durchmesser des zylindrischen Elements (106) gleich dem Durchmesser der Basis des konischen Elements (102) ist.
3. Konische Monopolantenne nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Durchmesser der ersten Erdungsplatte (101) höchstens gleich dem Durchmesser der Basis des konischen Ele-

ments (102) ist.

4. Konische Monopolantenne nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Abstand zwischen dem zylindrischen Element (106) und dem konischen Element (102) 1-5 mm beträgt.
5. Konische Monopolantenne nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Anzahl der Vielzahl von Verbindungselementen (107) 3-10 beträgt.
6. Konische Monopolantenne nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die konische Monopolantenne eine zweite Erdungsplatte (201) umfasst, die eine erste und eine zweite Seite aufweist, wobei die erste Seite der zweiten Erdungsplatte (201) an der zweiten Seite der ersten Erdungsplatte (101) angebracht ist und der Durchmesser der zweiten Erdungsplatte (201) größer als der Durchmesser der ersten Erdungsplatte (101) ist.
7. Konische Monopolantenne nach Anspruch 6, **dadurch gekennzeichnet, dass** die erste und/oder die zweite Erdungsplatte (101, 201) eine Vielzahl von übereinander angeordneten Metallschichten umfassen/umfasst.
8. Konische Monopolantenne nach Anspruch 6, **dadurch gekennzeichnet, dass** die erste und die zweite Erdungsplatte (101, 201) aus einem einzigen Block hergestellt sind.
9. Konische Monopolantenne nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die konische Monopolantenne ein rohrförmiges Element (301) umfasst, das teilweise innerhalb des konischen Elements (102) angeordnet ist, wobei die Längsachse des rohrförmigen Elements (301) senkrecht zu der Ebene der ersten Erdungsplatte (101) ist.
10. Konische Monopolantenne nach Anspruch 9, **dadurch gekennzeichnet, dass** das rohrförmige Element (301) kapazitiv an das konische Element (102) angeschlossen ist.
11. Konische Monopolantenne nach Anspruch 9 oder 10, **dadurch gekennzeichnet, dass** das rohrförmige Element (301) aus Kohlefaser hergestellt ist.
12. Konische Monopolantenne nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die konische Monopolantenne mindestens eine Erdungsleitung (202) umfasst, die zwischen dem konischen Element (102) und der ersten Erdungs-

platte (101)geschlossen ist.

13. Konische Monopolantenne nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die konische Monopolantenne einen Koaxialverbinder (103) umfasst, der einen Innen- und einen Außenleiter (104, 105) aufweist, wobei der Innenleiter (104) an das konische Element (102) angeschlossen ist und der Außenleiter (105) an die erste Erdsplatte (101) angeschlossen ist.
14. Konische Monopolantenne nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das konische Element (102) und/oder das zylindrische Element (106) und/oder das rohrförmige Element (301) hohl sind.
15. Konische Monopolantenne nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das konische Element (102) und/oder das zylindrische Element (106) und/oder das rohrförmige Element (301) einen elektrisch nicht leitfähigen Kern umfassen, der mit einer elektrisch leitfähigen Schicht bedeckt ist.

Revendications

1. Antenne monopôle conique, comprenant :

- une première plaque de masse (101) ayant un premier et un second côté, et
- un élément conique (102) ayant un sommet et une base, le sommet de l'élément conique (102) étant dirigé vers le premier côté de la première plaque de masse (101) et l'axe de l'élément conique (102) étant perpendiculaire au plan de la première plaque de masse (101), et
- un élément cylindrique (106) ayant une première et une seconde extrémité, la première extrémité de l'élément cylindrique (106) étant dirigée vers la base de l'élément conique (102) et l'axe de l'élément cylindrique (106) étant perpendiculaire au plan de la première plaque de masse (101),

caractérisé en ce que l'antenne monopôle conique comprend :

- une pluralité d'éléments de connexion (107) reliant l'élément cylindrique (106) à l'élément conique (102) de sorte que l'élément cylindrique (106) et l'élément conique (102) sont à une distance l'un de l'autre, les éléments de connexion (107) définissant avec l'élément cylindrique (106) et l'élément conique (102) une pluralité d'ouvertures.

2. Antenne monopôle conique selon la revendication 1, **caractérisée en ce que** le diamètre de l'élément cylindrique (106) est égal au diamètre de la base de l'élément conique (102).
3. Antenne monopôle conique selon la revendication 1 ou 2, **caractérisée en ce que** le diamètre de la première plaque de masse (101) est au plus égal au diamètre de la base de l'élément conique (102).
4. Antenne monopôle conique selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la distance entre l'élément cylindrique (106) et l'élément conique (102) est de 1 à 5 mm.
5. Antenne monopôle conique selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le nombre de la pluralité d'éléments de connexion (107) est de 3 à 10.
6. Antenne monopôle conique selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'antenne monopôle conique comprend une seconde plaque de masse (201) ayant un premier et un second côté, le premier côté de la seconde plaque de masse (201) étant fixé au second côté de la première plaque de masse (101), et le diamètre de la seconde plaque de masse (201) étant plus grand que le diamètre de la première plaque de masse (101).
7. Antenne monopôle conique selon la revendication 6, **caractérisée en ce que** la première et/ou la seconde plaque de masse (101, 201) comprend une pluralité de couches métalliques disposées les unes sur les autres.
8. Antenne monopôle conique selon la revendication 6, **caractérisée en ce que** la première et la deuxième plaque de masse (101, 201) sont constituées d'un seul bloc.
9. Antenne monopôle conique selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'antenne monopôle conique comprend un élément tubulaire (301) disposé partiellement à l'intérieur de l'élément conique (102), l'axe longitudinal de l'élément tubulaire (301) étant perpendiculaire au plan de la première plaque de masse (101).
10. Antenne monopôle conique selon la revendication 9, **caractérisée en ce que** l'élément tubulaire (301) est relié capacitivement à l'élément conique (102).
11. Antenne monopôle conique selon la revendication 9 ou 10, **caractérisée en ce que** l'élément tubulaire (301) est en fibre de carbone.

12. Antenne monopôle conique selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'antenne monopôle conique comprend au moins un fil de mise à la terre (202) relié entre l'élément conique (102) et la première plaque de masse (101). 5
13. Antenne monopôle conique selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'antenne monopôle conique comprend un connecteur coaxial (103) ayant un conducteur intérieur et un conducteur extérieur (104, 105), le conducteur intérieur (104) étant relié à l'élément conique (102) et le conducteur extérieur (105) étant connecté à la première plaque de masse (101). 10 15
14. Antenne monopôle conique selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'élément conique (102) et/ou l'élément cylindrique (106) et/ou l'élément tubulaire (301) sont creux. 20
15. Antenne monopôle conique selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'élément conique (102) et/ou l'élément cylindrique (106) et/ou l'élément tubulaire (301) comprennent un noyau électriquement non conducteur recouvert d'une couche électriquement conductrice. 25

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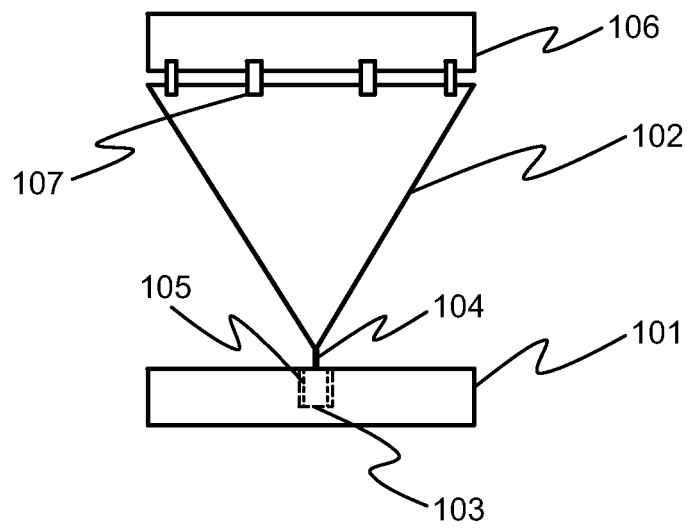


Fig. 1

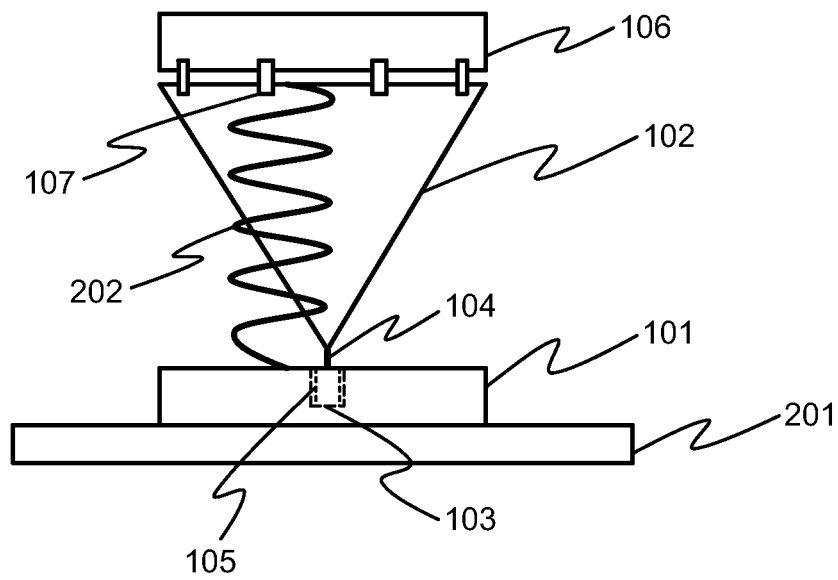


Fig. 2

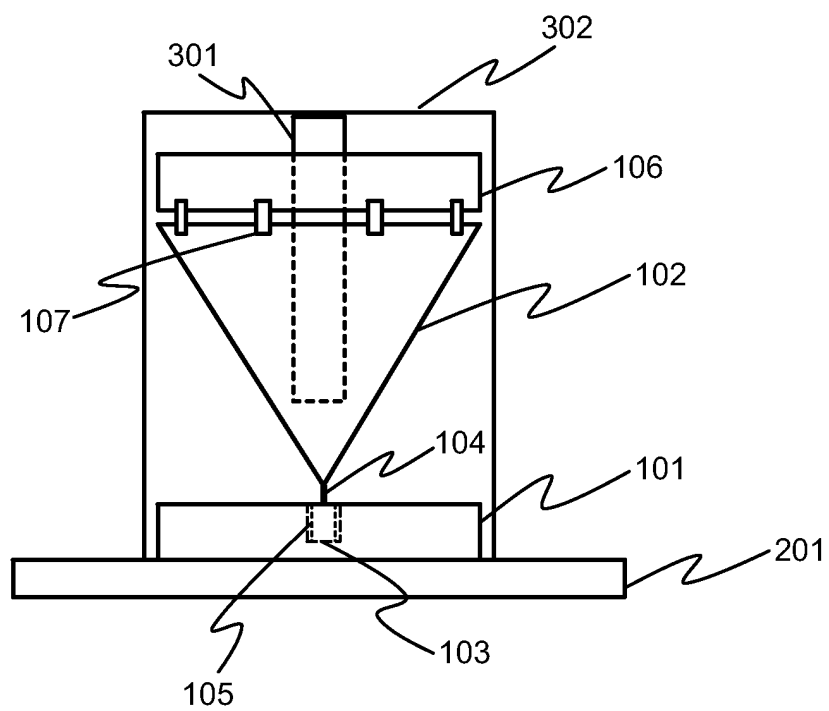


Fig. 3

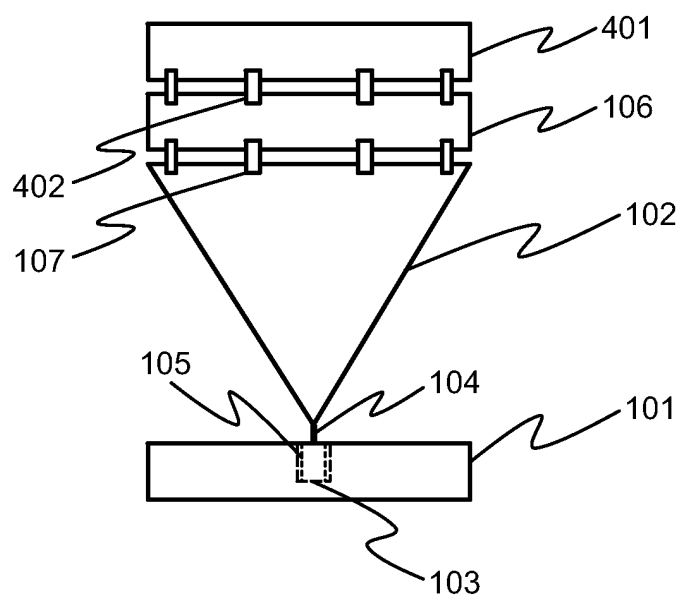


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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