

MULTIFUNCTIONAL BROADBAND SECTOR ANTENNA

The invention especially relates to a very high frequency/ultra-high frequency (VHF/UHF) wideband or ultra-wideband antenna having a sectorial
5 radiation pattern. It more generally relates to the field of antennae and systems of arrayed antennae for emitting, for example with powers of a few tens to a few hundred watts, and receiving, in the VHF/UHF bands, linearly polarized electromagnetic waves.

For certain applications, antenna use must meet needs for
10 integration into a carrier structure and a requirement of producibility of antennae and arrays of antennae usable for a plurality of functions. The first objective demands the radiation and impedance performance of the antennae be maintained after integration into complex carrier structures. These structures may be surface vessels (naval application), land vehicles or
15 aircraft. Moreover, performance must be maintained over a very wide band (a half decade or even a decade). The second objective is related to the multifunctionality demanded by users. The ever increasing number of functions integrated into carriers is accompanied by an increase in the number of antennae to be integrated into their structure. This integration,
20 which is made difficult by mechanical, performance and electromagnetic-compatibility constraints, may be obtained by mutualizing the radiating elements. However, this mutualization poses the problem of unification of the requirements inherited from the various systems in which the antennae and arrays of antennae participate.

25 Many articles relating to ultra-wideband dipole antennae may be cited. When it is a question of modifying this simple architecture for integration in proximity to a ground plane (the structure) while preserving satisfactory radiation properties and an impedance match allowing it to be used over a very wide frequency band, the available corpus is already more
30 limited. On this topic, patent application FR 3011685 describes a dipole-loop antenna. With overall dimensions of 1x1 m for a height of 0.25 m, it is usable

in a band ranging from 100 MHz to 500 MHz, via an impedance-matching circuit. It may also be arrayed in a circular array.

The antenna of Rhode and Schwartz referenced AD066FW also describes a wideband antennae array structure usable between 118 MHz
5 and 453 MHz for communication functions improved by virtue of a beam-forming system.

Another form of antenna is described in the publication entitled "*The Self-Grounded Bow-Tie Antenna*" by J. Yang and A. Kishk, IEEE AP-S/URSI 2011. Designed to operate between 2 GHz and 15 GHz, it
10 advantageously takes advantage of a short-circuit obtained by folding the elements of the dipole to:

- Widen the useful frequency band,
- Obtain what is more widely known as a "Vivaldi" antenna profile, which limits distortion effects when the antenna is electrically large.

15 However, with a minimum frequency of 2 GHz for dimensions of 54(L)x58(l)x24 (h) mm, transposition to frequencies of 100 MHz and above shows that this solution is not adapted for the applications envisaged for the present invention.

Despite all the advantages of the prior-art solutions, the latter have
20 certain drawbacks because of their design and their bulk that decreases their integration and networking capacities. When bulk is contained, the standing wave ratio, more widely known by the abbreviation SWR, and the resulting gains do not allow quality-of-service requirements to be met. When bulk is excessively great, an array configuration allowing an omnidirectional channel
25 to be obtained is not obvious. Moreover, the dipole-loop antenna of the aforementioned patent requires an additional impedance-matching circuit that possibly limits power rating in certain applications.

In summary, the solutions described in the prior art and known to the Applicant do not in particular allow the following to be obtained
30 simultaneously:

- An SWR lower than 3 and a gain higher than 2 dBi, in the main emission/reception direction, over the entire frequency band desired for one antenna alone,
- A stable radiation pattern not exhibiting distortion effects,
- 5 • An optimized height (smaller than or equal to 1 metre) and a small width (smaller than or equal to 40 cm) in order to facilitate its integration and its arrangement in a (circular or otherwise) array,
- A shallow depth (smaller than or equal to 25 cm) to be easily integratable into the structure,
- 10 • Self-matching to a given impedance, for example 50 Ω , avoiding the need for an added impedance-matching circuit.

The object of the present invention is to provide an arrayable antenna adapted to work in a wideband or ultra-wideband filed, that in particular is easily integrated into a given location and that exhibits stability in
15 its operating pattern.

The invention relates to a wideband or ultra-wideband sector antenna having a height H, a depth D and a width W, including a ground plane acting as a reflector plane, at least one antenna array comprising at least one first element and at least one second element, the antenna
20 operating in a frequency range $[f_1, f_2]$, characterized in that

- One element has a folded shape, an inside curvature F_1, F'_1 starting from a point A, A' positioned towards the centre O of the antenna, and an outside curvature F_2, F'_2 located in the extension of the first inside curvature F_1, F'_1 ;
- 25 • The shape of the inside curvature F_1, F'_1 is defined in order to guarantee the stability of the radiation pattern at the maximum operating frequency of the antenna;
- The shape of the outside curvature F_2, F'_2 is defined in order to guarantee the stability of the impedance that the antenna exhibits
30 across its supply terminals at the minimum operating frequency; and

- The first element and the second element are supplied in phase opposition.
 - The curvature of one element is, for example, characterized in the following way:
- 5
- If the Cartesian coordinates of three points A, B and C, A-B belonging to the inside curvature F_1 , B-C belonging to the outside curvature F_2 , the origin 0 of the Cartesian coordinate system corresponding to the centre of the ground plane, are
- $$A = \begin{pmatrix} x_A \\ 0 \\ z_A \end{pmatrix}, B = \begin{pmatrix} x_B \\ 0 \\ z_B \end{pmatrix} \text{ and } C = \begin{pmatrix} x_C \\ 0 \\ z_C \end{pmatrix}$$
- 10
- then the inside curve F_1 of one element is defined by:
 - $(F_1) : X = x_B + (x_A - x_B) \frac{e^{z_C c_1} - e^{z_B c_1}}{e^{z_A c_1} - e^{z_B c_1}}, \forall z \in [z_A, z_B]$
 - and the outside curve F_2 of one element is defined by:
 - $(F_2) : X = x_B + (x_C - x_B) \frac{e^{z_C c_2} - e^{z_B c_2}}{e^{z_C c_2} - e^{z_B c_2}}, \forall z \in [z_B, z_C]$
 - where x_A, x_B, x_C, z_A, z_B and z_C are the coordinates of the points A, B and C in a Cartesian coordinate system and c_1 and c_2 are two curvature parameters.
- 15

According to one variant embodiment, the sector antenna according to the invention is characterized in that the shape of one element seen from the front corresponds to the intersection of a first ellipse E_1 having a first radius R_1 corresponding to the major axis and a second radius R_2 corresponding to the minor axis, with a second ellipse E_2 having a first radius R_2 corresponding to the major axis substantially identical to the radius of the minor axis of the first ellipse, and a second radius R_3 , the value of R_2 being chosen depending on the width of the antenna, and the ratio R_1/R_3 being

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chosen in order to optimize transitions in the supply of the antenna and the terminal fold of the element.

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The parameters of one antenna are defined such that, for an operating frequency range $[f_1, f_2]$ and a central frequency f_0 :
D is comprised in the interval $[\lambda_0/5, \lambda_0/3]$;

H is substantially equal to λ_0 ;

W is comprised in the interval $[\lambda_0/3, \lambda_0/2]$;

R_3 is comprised between $0.6 \cdot R_1$ and $0.8 \cdot R_1$; and

$R_2 \approx W/2$.

5 According to one variant embodiment, the depth of the antenna D is chosen to be substantially equal to one quarter of the wavelength λ_0 , the height H of the antenna is substantially equal to the wavelength λ_0 , and the width W of the antenna is substantially equal to $2 \cdot \lambda_0/5$.

The sector antenna is for example characterized in that:

- 10 • The ground plane includes two folds forming two capacitive roofs;
- The first elliptical element and the second elliptical element are folded at the centre of the antenna towards the ground plane;
- A first end of the first element is located at a first point A in proximity to the ground plane and a first end of the second element is level with a
- 15 second point A' in proximity to the ground plane;
- A second end of the first element and a second end of the second element are respectively positioned at two points C, C' corresponding to a point the position of which is such that z_C is substantially equal to $0.48 \lambda_0$;
- 20 • $R_1 + R_3$ is equal to $z_C - z_A$; and
- R_2 is substantially equal to $W/2$.

The sector antenna according to the invention may include a plurality of arrays each composed of two elements having an elliptical shape.

25 The antenna is for example supplied via connecting means that are supplied in phase opposition by virtue of a balun or a $0/180^\circ$ hybrid coupler.

The antenna may include at least two RF connectors chosen depending on the operating frequency range of the antenna and on the desired power rating, the connectors being supplied in phase opposition.

30 The sector antenna operates at a frequency belonging to the VHF/UHF domain with, for the emission, powers of a few tens to a few

hundred watts, and a reception in the VHF/UHF bands of linearly polarized electromagnetic waves.

According to one variant embodiment, the sector antenna according to the invention, is adapted for integration into a mobile unit or a
5 fixed infrastructure.

Other features and advantages of the present invention will become more clearly apparent on reading the following description of one exemplary appended embodiment of the figures, which show:

- figure 1, a 3D view of an exemplary antenna according to the
10 invention;
- figure 2, a profile view of the antenna in figure 1;
- figure 3, a schematic allowing the specific shape of the elements of the antenna to be described;
- figure 4, radiation patterns in the vertical plane of the antenna at
15 various frequencies;
- figure 5, a representation of a gain of the antenna in the main emission direction as a function of frequency; and
- figure 6, an SWR of the antenna as a function of frequency.

Before describing one exemplary embodiment of an antenna
20 according to the invention, the following are defined by the Applicant:

- f_1 : the minimum operating frequency in Hz;
- f_2 : the maximum operating frequency in Hz;
- f_0 : the central operating frequency in Hz and such that $f_0 = (f_1 + f_2)/2$;
- λ_x : the wavelength (in metres) associated with the frequency f_x and
25 such that $\lambda_x = c/f_x$, where c is the propagation speed of the waves (in m/s), x being a generic index corresponding to the indices 0, 1, 2 of the frequencies; and
- the points A, B and C (figure 2) that will allow the profile of an element to be defined, the locations of which are specified by a system of
30 Cartesian coordinates in the direct orthonormal coordinate system X,

Y and Z such that the origin is at the centre of the antenna, X points forwards from the antenna (i.e. in the main emission direction) and Z points upward.

The following are the general dimensions of the antenna:

- 5 • The first defined parameter D is the depth of the antenna, which is chosen such that D is comprised in the interval $[\lambda_0/5, \lambda_0/3]$ and preferably such that $D \approx \lambda_0/4$. This parameter also defines x_B (the x-axis coordinate of the point B in figure 2), i.e. $x_B = D$;
- 10 • The second set parameter H is the height of the antenna, which is chosen such that H is substantially equal or equal to λ_0 ;
- Lastly, to satisfy the operating requirements at the minimum frequency, the width W of the antenna is chosen such that W is comprised between $\lambda_0/3$ and $\lambda_0/2$ and preferably such that $W \approx 2*\lambda_0/5$.

Figure 1 schematically shows a three-dimensional view of an exemplary wideband or ultra-wideband antenna 1 according to the invention that will be detailed using figure 2. The antenna 1 is composed of a first elliptical strand 101 (or element) and a second elliptical strand 102, the two elliptical elements being folded towards a ground plane 2 at the centre O of the antenna 1, a first end 101a (figure 2) of the first strand being located at a first point A (x_A, z_A) located in proximity to the ground plane and a first end 102a of the second strand 102 being located at a second point A' (x'_A, z'_A) located in proximity to the ground plane 2. A second end 101b of the first strand and a second end 102b of the second strand are positioned at two points C, C' the positions of which are given with respect to the ground plane as will be explained a little further on. The antenna 1 is bordered by a first fold 31 and a second fold 32 that are perpendicular to the ground plane and which form what may be termed "capacitive pseudo roofs".

The two strands 101, 102 have, in this example, an elliptical shape and are placed symmetrically with respect to an axis Ox. The two strands are fed in phase opposition by two connecting means 30, 30' by means of a Balun or a $0^\circ/180^\circ$ hybrid coupler known to those skilled in the art. The

connecting means 30, 30' may be RF connectors or any other type of suitable connection known to those skilled in the art, depending on the frequency and the power rating.

Figure 2 and figure 3 allow the definition and shape of the strands to be illustrated using an elliptical representation. The front view of the strands is generated by the intersection of a first ellipse E_1 that possesses a first radius R_1 for the major axis and a second radius R_2 for the minor axis, with a second ellipse E_2 possessing the same radius R_2 for the major axis and the radius R_3 for the minor axis. The intersection I of the two ellipses E_1 and E_2 is shown by the thicker line in figure 3.

Figure 2 shows, in a system of Cartesian coordinates in which the point of origin O corresponds to the midpoint of the antenna, the profile of the strands. Each strand has a shape constituted from a first curve F_1 (A-B), F'_1 (A'-B'), called the inside curve (inside with respect to the centre O of the antenna) followed by a second curve F_2 (B-C), F'_2 (B'-C') or outside curve. The two strands have a substantially identical shape that is symmetric with respect to the axis OX or, more generally, with respect to an axis perpendicular to the antenna and passing through the centre O.

The various parameters allowing the strands of the antenna to be generated are defined with reference to figure 2 and figure 3:

- Seen from in front or projected onto the yOz plane, a radiating strand is generated by the intersection of two ellipses sharing the same transverse radius R_2 , the latter setting the total width of the antenna. Next, the ratio R_1/R_3 is chosen to optimize feed transitions and the terminal fold of the strand,
- Seen in profile, the curvature of the element towards the ground plane is defined by the points A, B, C and by the equations of the curves F_1 and F_2 . The bottom portion of the intersection of the two ellipses is then set at A (feed point of the element) then passes via B and C.

If the Cartesian coordinates of points A, B and C, are such that:

$$A = \begin{pmatrix} x_A \\ 0 \\ z_A \end{pmatrix}, B = \begin{pmatrix} x_B \\ 0 \\ z_B \end{pmatrix} \text{ and } C = \begin{pmatrix} x_C \\ 0 \\ z_C \end{pmatrix}$$

the equations of the curves are given by two additional curvature parameters: c_1 and c_2 . The equation of F_1 is such that:

$$(F_1) : X = x_B + (x_A - x_B) \frac{e^{zC_1} - e^{z_B c_1}}{e^{z_A c_1} - e^{z_B c_1}}, \forall z \in [z_A, z_B].$$

Likewise, the equation of F_2 is such that:

$$5 \quad (F_2) : X = x_B + (x_C - x_B) \frac{e^{zC_2} - e^{z_B c_2}}{e^{z_C c_2} - e^{z_B c_2}}, \forall z \in [z_B, z_C].$$

The second strand is then generated by X-axis symmetry, the above formulae applying for the points referenced A', B' and C' in figure 2.

To define the format of the strands as seen from in front the following parameters will for example be used:

- 10 • Firstly, the coordinates of the points A, A' are adjusted by means of electromagnetic simulations and depending on integration constraints due to the connecting means 30, 30'. For example, for the 100-500 MHz band, the x-axis coordinates x_A , $x_{A'}$ are each about equal to 5 mm and the positions z_A , $z_{A'}$ are each similarly about equal to 5 mm.
- 15 However, for higher frequency applications, these coordinates may be smaller. The values of the positions will especially be chosen depending on the operating frequency band;
- 20 • To improve the impedance matching, the structure that receives the antenna is formed by folding the ground plane twice, at the top and bottom when the antenna is considered in a vertical position as is shown in figure 1. The proximity of the end of the strands to these capacitive roofs 31, 32 is determined by the position of the point C, i.e. such that $z_C = \gamma^* \lambda_0 \approx 0.48^* \lambda_0$;
- 25 • It is deduced from the preceding definitions that $R_1 + R_3 = z_C - z_A$;
- Following an optimization by electromagnetic simulation, R_3 is also defined in the interval $[0.6^* R_1, 0.8^* R_1]$ with $R_3 \approx 0.7^* R_1$;
- Lastly, $R_2 \approx W/2$.

One way of obtaining the curvature of the strands is described below and with reference to figure 2:

- The elements are curved in the plane containing the vectors X and Z (axis OX, OZ) according to two exponential functions F_1 (F_1') and F_2 (F_2');
- The junction between these two functions is parameterized by the position of the point B (point B') which is determined by optimization by electromagnetic simulation, namely z_B about equal to $1/3 \lambda_0$;
- The inside curvature of the strands corresponding to the portion of the curve extending from A to B (A' to B') is generated by the exponential type function F_1 , (F_1'), which receives as parameters the coordinates of the points A and B and a curvature parameter c_1 such that c_1 varies from $-20/\lambda_0$ to $-15/\lambda_0$ and preferably $c_1 \approx -18/\lambda_0$, for example. This curvature serves to guarantee the stability of the radiation pattern at the maximum frequency;
- The outside curvature of the strands corresponding to the portion B-C (B'-C') is generated by the exponential type function F_2 , (F_2'), which receives as parameters the coordinates of the points B and C (B' and C') and a curvature parameter c_2 such that $c_2 \approx 30/\lambda_0$, for example. This curvature serves to guarantee the stability of the impedance that the antenna exhibits across its terminals at the minimum frequency.

The curvature parameters c_1 and c_2 are defined by electromagnetic simulation using simulation tools known to those skilled in the art, for example a full-wave electromagnetic simulation method. All the parameters may be adjusted to optimize performance.

In fine, the proposed antenna therefore has a 5:1 frequency passband (or operating range) with a standing wave ratio (SWR) lower than 3.

The following example is a numerical example given for an ultra-wideband antenna; for a useful band extending from 100 MHz to 500 MHz the dimensions of the antenna are:

- Height (H): 1 metre;

- Width (W): 0.4 metre;
- Depth (D): 0.25 metre;
- The spacing between the two feed points A-A' is 1 cm.

The fold towards the centre makes it possible to obtain a Vivaldi
 5 antenna profile that channels high-frequency radiation in order to minimise
 distortion effects in the radiation pattern in the vertical plane of the antenna
 as is illustrated in figure 4 for a useful band extending from 100 MHz to 500
 MHz.

The addition of perpendicular folds towards the strands makes it
 10 possible to minimise bulk while maintaining a gain in the main emission
 direction higher than 2 dBi over the entire band, as it is shown in figure 5 in
 which the gain of the antenna in the main emission direction as a function of
 working frequency is plotted.

Figure 6 schematically shows the SWR of the antenna as a
 15 function of frequency with respect to a characteristic impedance of 50 Ω .
 With the two-point feed allowing the impedance that the antenna exhibits
 across its terminals to be decreased, the proposed solution makes it possible
 to avoid the need for an impedance-matching circuit. The antenna is then
 self-matching with an SWR lower than 2.5 with respect to a characteristic
 20 impedance of 50 Ω .

Via its sectorial radiation pattern, the proposed solution makes it
 possible to favour one direction in space, and thus enhance its gain with
 respect to a solution based on omnidirectional antennae. Using this solution
 in an array arrangement makes it possible to encircle the carrier structure in
 25 order to better disregard the latter. Generally, this feature enables use for
 V/UHF communications. Lastly, when arrayed, its ultra-wideband character
 makes it possible to envision radiogoniometry uses.

Generally, the antenna may be made of conductive metal (copper,
 aluminium, etc.) or of (carbon, etc.) composite.

30 The antenna according to the invention may easily be integrated
 into a mobile unit, such as a ship, on the surface of a wall, or on a mast of a

vehicle or even a ground infrastructure. A single fed antenna has a sectorial radiation pattern while minimising the impact of the structure on the operation of the antenna.

Without departing from the scope of the invention, the description
5 of the steps for defining a shape for the antennae strands applies to non-elliptical elements such as other ultra-wideband shapes known to those skilled in the art.

The shape of the antenna according to the invention allows
10 occupation of the available space to be optimized in order to improve gain and impedance matching. Indeed, the elliptical shape of the strands makes it possible to contribute to the ultra-wideband character of the antenna.

Antennae according to the invention may especially allow
antennae and antennae arrays to be integrated into a carrier structure, and used in a number of functions.

15 The advantages of the proposed solution are:

- a sectorial radiation pattern that is stable as a function of frequency for wideband or ultra-wideband frequencies;
- a self-matching design, i.e. no impedance-matching circuit required;
- it has a narrow profile (small thickness and width), which facilitates
20 integration into a structure;
- it is easily arrayed into a circular array to obtain an omnidirectional coverage in azimuth;
- it is usable for communication functions (emission and reception), radiogoniometry or spectrum monitoring, by virtue of its
25 performance;
- It has a simple shape allowing transposition to other frequency bands (VHF, UHF and SHF) and usable in a conformal configuration.

CLAIMS

1 – Wideband or ultra-wideband Sector antenna (1) having a height H, a depth D and a width W, including a first ground plane (2) acting as a reflector plane, at least one antenna array comprising at least one first element (101) and at least one second element (102), the antenna operating in a frequency range $[f_1, f_2]$, characterized in that:

- One element (101, 102) has a folded shape, an inside curvature F_1, F'_1 starting from a point A, A' positioned towards the centre O of the antenna, and an outside curvature F_2, F'_2 located in the extension of the first inside curvature F_1, F'_1 ;
- The inside curvature F_1, F'_1 is defined in order to guarantee the stability of the radiation pattern at the maximum operating frequency of the antenna;
- The outside curvature F_2, F'_2 is defined in order to guarantee the stability of the impedance that the antenna exhibits across its supply terminals at the minimum operating frequency; and
- The first element (101) and the second element (102) are supplied in phase opposition,

wherein the curvature of one element is characterized in the following way:

If the Cartesian coordinates of three points A, B and C, A-B belonging to the inside curvature F_1, F'_1 , B-C belonging to the outside curvature F_2, F'_2 , the origin 0 of the Cartesian coordinate system corresponding to the centre of the ground plane, are

$$A = \begin{pmatrix} x_A \\ 0 \\ z_A \end{pmatrix}, B = \begin{pmatrix} x_B \\ 0 \\ z_B \end{pmatrix} \text{ and } C = \begin{pmatrix} x_C \\ 0 \\ z_C \end{pmatrix}$$

then the inside curve F_1 of one element is defined by:

$$(F_1) : X = x_B + (x_A - x_B) \frac{e^{z_C} - e^{z_B}}{e^{z_A} - e^{z_B}}, \forall z \in [z_A, z_B]$$

and the outside curve F_2 of one element is defined by:

$$(F_2) : X = x_B + (x_C - x_B) \frac{e^{z_C} - e^{z_B}}{e^{z_C} - e^{z_B}}, \forall z \in [z_B, z_C]$$

where x_A , x_B , x_C , z_A , z_B and z_C are the coordinates of the points A, B and C in a Cartesian coordinate system and c_1 and c_2 are two curvature parameters.

2 – Sector antenna according to Claim 1, characterized in that the shape of one
 5 element seen from the front corresponds to the intersection of a first ellipse E_1
 having a first radius R_1 corresponding to the major axis and a second radius R_2
 corresponding to the minor axis, with a second ellipse E_2 having a first radius R_2
 corresponding to the major axis substantially identical to the radius of the minor
 axis of the first ellipse, and a second radius R_3 , the value of R_2 being chosen
 10 depending on the width of the antenna, and the ratio R_1/R_3 being chosen in
 order to optimize transitions in the supply of the antenna and the terminal fold of
 the element.

3 – Sector antenna according to either of Claims 1 and 2, characterized in that
 15 the parameters of one antenna are such that for an operating frequency range
 $[f_1, f_2]$ and a central frequency f_0 :

D is comprised in the interval $[\lambda_0/5, \lambda_0/3]$;

H is substantially equal to λ_0 ;

W is comprised in the interval $[\lambda_0/3, \lambda_0/2]$;

20 R_3 is comprised between $0.6 \cdot R_1$ and $0.8 \cdot R_1$;

$R_2 \approx W/2$; and

$c_1 - 20/\lambda_0$ to $-15/\lambda_0$ and $c_2 \approx 30/\lambda_0$.

4 – Sector antenna according to Claim 3, characterized in that the depth of the
 25 antenna D is substantially equal to one quarter of the wavelength λ_0 , the height
 H of the antenna is substantially equal to the wavelength λ_0 , and the width W of
 the antenna is substantially equal to $2 \cdot \lambda_0/5$.

5 – Sector antenna according to one of Claims 2 to 4, characterized in that:

- 30 • The ground plane includes two folds forming two capacitive roofs (31,
 32);

- The two elliptical elements (101), (102) are folded towards the ground plane (2) at the centre of the antenna (1);
- A first end (101a) of the first element (101) is located at a first point A in proximity to the ground plane (2) and a first end (102a) of the second element (102) are level with a second point A' in proximity to the ground plane (2);
- A second end (101b) of the first element (101) and a second end (102b) of the second element (102) are respectively positioned at two points C, C' corresponding to a point the position of which is such that z_C is substantially equal to $0.48 \lambda_0$;
- $R_1 + R_3$ is equal to $z_C - z_A$; and
- R_2 is substantially equal to $W/2$.

6 – Sector antenna according to one of the preceding claims, characterized in that it includes a plurality of arrays composed of two elements having an elliptical shape.

7 – Sector antenna according to one of Claims 1 to 6, characterized in that it is supplied via connecting means (30) that are supplied in phase opposition by virtue of a balun or a $0/180^\circ$ hybrid coupler.

8 – Sector antenna according to Claim 7, characterized in that it includes at least two RF connectors (30) chosen depending on the operating frequency range of the antenna and on the desired power rating, the connectors being supplied in phase opposition.

9 – Sector antenna according to one of the preceding claims, characterized in that the operating frequency belongs to the VHF/UHF domain with, for the emission, powers of a few tens to a few hundred watts, and a reception in the VHF/UHF bands of linearly polarized electromagnetic waves.

10 – Sector antenna according to one of the preceding claims, characterized in that it is adapted for integration into a mobile unit or a fixed infrastructure.