- Figure 10 is a flowchart depicting the process of rotating the pole assembly 4, according to an embodiment;

- Figure 11 is a top view of the antenna arrangement, in different positions when rotated in azimuth; and

- Figure 12 shows a rotating layer driver for mechanically driving the rotating layer, according to an embodiment.

DETAILED DESCRIPTION

Referring to figure 1, there is shown an exemplary operational system 100 in which an antenna arrangement 10 according to embodiments of the invention can be implemented. The antenna arrangement 10 comprises a directional antenna assembly 2 integrated into an application system. The application system may be any system in which the antenna arrangement 10 can to be integrated, such as a ship or a land-based system for compound protection for example.

The directional antenna assembly 2 may comprise at least one directional antenna 20, mounted upon a support structure 5. The support structure 5 may be any support structure generally extending according to a vertical axis 11 and presenting an upper surface forming an interface 50 upon which the directional antenna 20 can be mounted, such as a vertical mast. The vertical mast may be a metallic mast for example. The interface 50 of the support structure 5 delimits a surface upon which at least some of the elements of the directional antenna assembly 2 may be arranged.

Although the invention is not limited to such system, the invention has particular advantages for application systems comprising at least one mast forming a support structure 5, such as for example masts on board of ships, on which the antenna arrangement 10 is to be integrated.

Exemplary masts that can be used include with no limitation Pole masts, Tripod masts, Lattice masts, MACK (Mast-Stack) masts, Enclosed masts, Solid masts. The top of such masts forms an optimal position for an antenna arrangement.

In one application of the invention, the mast 5 may be a hollow structure adapted for arranging several equipments inside such an Integrated Mast, also referred to as an I-Mast. In an I-Mast, the mast and the equipments mounted on and inside the mast may be built and tested separately from the ship, while the ship is under construction. When the ship is ready, the mast may be put on the ship as a turnkey system. It offers a simple interface to the ship's power supply, cooling water supply, combat system, and mechanical deck structure, making installation a plug and play operation.

Applications of the invention includes without limitation radar, and satellite communication to obtain information about or from remote objects.

The directional antenna 20 may be configured to transmit and/or receive spatially concentrated electromagnetic radiation in one direction at a time to detect and/or track objects in the environment of the system, such as for example objects between the waves if the application system is a ship.

The directional antenna 20 may be rotatable in azimuth, about the main axis 11.

According to one embodiment of the invention, the antenna arrangement 10 further comprises a pole arrangement 4 comprising at least a rotatable pole 40 (also referred to as "pole mast" or "pole assembly"), the pole 40 being rotatable about the main axis 11 (in azimuth). The pole 40 may be configured to protect the topside structure of the antenna arrangement against lightning and/or support a communication antenna 22 mounted on it. The communication antenna 22 may be an omnidirectional or a directional antenna.

The antenna arrangement 10 may further comprise a rotatable base 3 (also referred to hereinafter as rotatable or rotating layer) for controlling the rotation of the pole assembly 4 in azimuth, about the main axis 11, externally to the directional antenna assembly 2.

The rotatable base 3 for rotating the pole may be mechanically connected to at least one bearing of the directional antenna. The rotating part may be mechanically supported on the stationary part by means of a bearing. The pole 40

- is not blocked by the top of the directional antenna assembly 2 in embodiments where no radome 6 is used.

The angle α may be pre-calculated per specific communication system before installation.

Depending on the application of the invention, the support structure 5 (e.g. mast) may be fixedly mounted on an installation plane of the application system (e.g. ship) and be integral with it. Accordingly, if the application system moves, the support structure 5 undergoes the same movement. The support structure 5 is thus stationary with respect to the application system. As used herein, the “rotating part” of the antenna arrangement 10 with respect to the stationary support structure 5 refers to rotating elements which rotate about the main axis 11, that is:

- the pole 40 (and possibly the communication antenna 22 and/or lightning protection if such communication antenna or lightning protection is mounted on the pole),

- the rotatable base 3.

The rotatable part may further include the directional antenna 20 if it is rotatable about the main axis 11.

Such rotatable elements of the antenna arrangement 10 may be rotated at least about the main axis 11, while the support structure 5 remains fixed with respect to the application system (e.g. ship).

In some embodiments, the antenna arrangement 10 may further comprise a radome 6 connected to the support structure 5. The radome 6 delimits an enclosure in which the directional antenna 20 may be arranged. The radome 6 may form a structural enclosure configured to protect the directional antenna 20. The radome 6 may have any form and may be made of any material compatible with the operation of the antenna. In particular, the radome 6 may be configured so that its dimensions allow the free movement of the directional antenna in the enclosure. The radome 6 may further be weatherproof and may be made of a material that attenuates the electromagnetic signal transmitted or received by the directional antenna 20. The

material of the radome 6 may be further configured to conceal the antenna electronic equipment from public view. The radome 6 may be of any shape and size depending on the application of the invention. In the embodiments shown in figure 1, the radome 6 comprises a dome-like cover.

Although the use of a radome 6 may present advantages for some applications of the invention, the skilled person will readily understand that the invention is not limited to the use of such radome and that the invention may also apply to electro optical system 2 deprived of a radome or enclosure. However, to facilitate the understanding of the invention, the following description of some embodiments of the invention will be made mainly with reference to an antenna arrangement 10 comprising a radome 6, for illustration purpose only.

The directional antenna 20 (also referred to as a beam antenna) may be configured to radiate and/or receive power in specific directions. The antenna's beam width may be less than 360 degrees, and preferably as narrow as possible. Although the figures represents a directional antenna of the type dish antenna, the skilled person will readily understand that the invention is not limited to such types of directional antennas and may apply to other types of directional antennas such as a Dish antenna, a Flat antenna, a Patch antenna, a horn antenna, a slotted waveguide antenna or Active Electronically Scanned Array (AESA), etc. The following description of some embodiments of the invention will be made with reference to a directional antenna 20 of dish antenna type for illustrative purpose only.

The steering range of the directional antenna 20 may be full hemispheric or limited to a narrower region.

The directional antenna 20 may be rotatable in azimuth and/or elevation.

To steer (or point), the directional antenna 20 may be configured to rotate about at least one axis. The axes defining the rotation of the directional antenna 20 may comprise an elevation axis and a local azimuth axis. The azimuth axis is vertical as rotating around it changes the azimuth (usually the Z-axis). The azimuth axis coincides with the main axis 11. The local elevation axis 12 shown in figure 1 is the Y-axis as rotating around this axis changes the elevation.

In the following description, reference Cartesian (or rectangular) coordinates (X,Y,Z) will be used, with the antenna system being located at (0, 0, 0), the Y axis designating the elevation axis 12, the Z axis designating the azimuth axis 11, and the X axis designating the axis that is perpendicular to the Y and Z axis, defined by the outer product of Y and Z (Y x Z). The horizontal plane is defined by the axes X and Y. Reference 7 depicts elevation steering of the antenna 20 and reference 8 depicts azimuth steering of the antenna 20.

In Figure 1, the X-Y plane represents the azimuth plane. The elevation plane is then the Z-X plane orthogonal to the azimuth plane. Although, in the figures, the antenna patterns (azimuth and elevation plane patterns) are represented in Cartesian coordinates, it should be noted that he antenna patterns may be also represented as plots in polar coordinates.

In the embodiment of figure 1, the vertical axis 11 (which may be also referred to hereinafter as “rotation” axis) coincides with the axis Z of the directional antenna 20 and is perpendicular to the connection interface 50 of the support structure 5.

In the example of figure 1, the line of sight LoS of the directional antenna coincides with the X axis in the referential (X, Y, Z).

The directional antenna 20 may be preferably as compact as possible with a minimize size of the driving motors, and minimal mass, and volume while being adapted for the system and the application of the invention. The required radar performance may define the dimensioning of the antenna etc.

The directional antenna 20 may be mounted upon the support structure 5 by means of a connection assembly 200 in some embodiments. The connection assembly 200 may be configured to rotate the antenna in azimuth and/or elevation during the operation of the directional antenna 20. The directional antenna 20 may be mounted upon the support structure 5 through a connection base 201.

In embodiments where the directional antenna 20 is a dish-like antenna, the directional antenna may comprise a dish 202 mounted on an arm 203 which is rotatably connected to a rod 204 via a pivot (not shown). The axis of the pivot is the

position of the pole 40 thus describing an arc of a circle in the X-Y plane, having a radius R equal to the distance between the axis 13 and the vertical axis 11.

Advantageously, the pole 40 may be placed in the antenna arrangement 10 such that the pole 40 (possibly surmounted with the communication antenna 22 and/or lightning protection) does not collide with an element of the directional antenna assembly 2, this element of the directional antenna assembly 2 being:

- the directional antenna 20 itself, in embodiments where no radome or enclosure is used to protect the directional antenna, or

- the radome 6 encompassing the directional antenna 3, in embodiments using such radome.

In one embodiment, the antenna arrangement 10 may comprise a control unit for controlling the rotation of the pole 40 and of the directional antenna 20 about the main axis 11 (and so the operation of the actuators controlling the rotation of the pole 40 and of the directional antenna 20) so as to avoid collision between the pole 40 and the directional antenna assembly 2. The input of the control unit may be the azimuth position of the directional antenna as set by the system. The control unit may be configured to calculate the shortest route from the current position (from the previous control) to the new position. The control unit may accordingly calculate a position for the pole outside the free view of the directional antenna.

In another embodiment, the distance between the pole 40 and the antenna assembly 2 may be predefined to avoid collision between the pole 40 and the directional antenna assembly 2 whatever the rotational movement of the pole 40 and of the directional antenna assembly 2, while being as minimal as possible to optimize the compactness of the antenna arrangement. In one embodiment, this distance may be advantageously minimal such that rotation is possible.

Further, the position of the pole 40 may be varied according to an arc of circle of radius R from an initial position, the length of the arc of circle being predefined to ensure that the pole 40 remains outside the line-of-sight of the radar transmitting a RF beam in the transmission direction.

Embodiments of the invention thus provide a true unobstructed free field of view (FOV) using at least one pole 40 and a directional antenna 20. As used herein, the FOV refers to the angular cone perceivable by the directional antenna 20 at a particular time instant.

Embodiments of the invention offer a compact solution for integrating an antenna arrangement 10 upon a support structure 5. As a result, the outer surface of the structure support 5 is freed and can be used for possible installation of additional equipments such as additional sensors, while in the prior art such surface is used to arrange communication antennas on specific mounted yardarms.

Embodiments of the invention further allow electromagnetic isolation between a transmitting antenna 20 and a receiving antenna 22, in embodiments where the directional antenna 20 is used for the transmission while an omnidirectional antenna 22 is mounted on the pole 40.

Embodiments of the invention make it possible to install the antenna arrangement 10, possibly surmounted with a communication antenna 22 and with a directional antenna 20 mounted upon the support structure, at minimum mass and costs.

This makes it further possible to access the directional antenna 20 via inside the support structure 5 if the support structure is a hollow structure such as a mast structure.

In a preferred embodiment, as shown in figure 1, the upper end of the pole A may lie above the upper point of the directional antenna assembly B (above the radome 6 or above the directional antenna 20 if no radome is used).

In some embodiments, a communication antenna 22 may be mounted on the pole 40, the communication antenna forming a wireless transmitting or receiving antenna that radiates or intercepts radio-frequency (RF) electromagnetic fields.

The communication antenna 22 may be a directional antenna that transmits or receive beams in a transmission or reception direction or an omnidirectional antenna configured to transmit or emit substantially equally in all horizontal directions in a flat,

radius R_{out}. In a cross-section view, the rotatable base 3 may surround the connection base 201 of the directional antenna assembly 2, the rotatable base and the connection base 201 being both centered at the vertical axis 11.

In Figure 2, the pole is rotating of an angle -β (β >45 degrees in the example shown) with respect to axis X (corresponding to an angle of 0°), while the line of Sight of the directional antenna 20 is rotated of an angle δ with respect to the axis X (δ <45 degrees in the example shown). This ensures that the pole 40 and the communication antenna 22 possibly mounted upon the pole do not obstruct the Free Field of View of the directional antenna 20 and create no interferences.

In some embodiments, the system may define the azimuth position of the directional antenna 20. At the same time, the system may steer the pole 40 outside the free field of view of the directional antenna for example by steering the pole to a position defined by the azimuth direction of the directional antenna plus 180°. Accordingly, if for example the azimuth position equals 45°, then the steering position of the pole will be 225°. It should be noted however that to be outside the free field of view of the directional antenna, the 180° angle is not required. More generally, the steering position of the pole 40 can be the azimuth position of the directional antenna plus or minus the beam width of the transmitted RF beam by the directional antenna.

By adjustment of the rotation of the rotatable base 3, the communication antenna 22 can be kept out of the free field of view of the directional antenna 20 (which may be for example a satellite communication antenna or radar antenna), thereby ensuring unobstructed view of the directional antenna 20.

In some embodiments, the radome 6 may be mounted on the rotating layer 3, as shown in figure 1. In such embodiment, the directional antenna 20 rotates within the space encompassed by the radome 6, the rotation of the directional antenna 20 being actuated by the rotatable base 3 connected thereto.

In such embodiments, the rotatable layer 3 may be arranged between the base of the radome 6 and the connection interface 50 of the support structure 5, in

layer. Alternatively, the rotating layer may be connected to the structure or the ship installation.

Figure 4 accordingly represents an antenna system 100 in which the rotatable base 3 is directly arranged on the system installation plane below the support structure 5, according to another embodiment. For example, if the support structure 5 is a mast, the rotatable base 3 may be mounted at or below the ship installation plane 120 while surrounding the mast.

In some embodiments, as shown in figure 4, the pole 40 may be used to protect the antenna system against lightning 400. In such embodiment, the pole assembly 4 comprises a lightning arrestor 42 mounted upon the pole 40. The lightning arrestor 42 is configured to protect the directional antenna 20 against lightning near strikes (or other corona or static discharges) that might cause the antenna 20 to act as a "sponge" to the lightning energy and to conduct the high voltage to other electronic components of the antenna system 100. In some embodiments, the lightning arrestor 42 may comprise high voltage-capable capacitors such as high pass filters configured to cancel the frequency and the direct current energy associated with the lightning. The lightning arrestor 42 may be mounted on the pole 40 via connectors. In an embodiment, a preloaded bearing may be used, the arrestor being connected to the bearing so that a high current goes from the arrestor through the bearing (as described for example in EP 2795144 A1).

In some embodiments, the rotatable pole 40 may be both used to support a communication antenna 22 and a lightning arrestor.

Figure 5 represents an antenna system 100 comprising a pole 40 supporting a communication antenna 22 which itself comprises a lightning arrestor 42, according to an embodiment. The communication antenna 22 may be for example an omnidirectional antenna of UHF (Ultra High Frequency) or VHF (Very High Frequency) type.

In such embodiment, the communication antenna 22 is the main lightning attraction point. The communication antenna 22 can advantageously handle direct lightning hit by use of the lightning arrestor 42. The arrestor 42 may be arranged on

Figure 7 is a cross section view showing the connection between the rotatable base 3 and the stationary support structure 5, according to some embodiments.

As shown, the rotating part generally designated by reference 600 comprises the pole 40 and the rotatable base 3, which are integral and can be rotated about the rotation axis 11. The elements of the rotating part 600 are represented by hashed lines.

The stationary part generally designated by reference 500 comprises the support structure 5 (e.g. mast) which is stationary with respect to the system (e.g. ship) on which it is mounted through the interface 55.

The communication antenna 22 and/or the lightning arrestor 42 may be installed on the rotating part 600 through the pole 40 while connection base 201 (pedestal) of the directional antenna 20 is installed on the stationary part 500. The radome 6 of the directional antenna assembly 2 may be installed on the rotatable part or directly on the upper interface of the support structure 5 on the interface 50 before the rotatable base 3.

Advantageously, the stationary and rotatable parts 600 and 500 may have a hollow configuration which delimits an inner space. This inner space may be used, at least partially, to arrange a connection cable 30 for connecting the two parts 600 and 500 while allowing the rotation of the rotatable part 600 and at least one actuator for controlling the actuating of the rotation of the rotatable part 600 and other equipments related to the operation of the rotatable part 600. The inner space of the support structure 5 (e.g. mast) may further comprise additional space 51 for integrating electronics and/or mechanics equipments related to the operation of the directional antenna assembly 2, such as one or more actuator for controlling actuation of the directional antenna 20. Depending on the size of the support structure 5, additional electronics and/or mechanics equipments may be integrated for use by the support system (e.g. ship). The area 51 in figure 7 designates the space provided stationary support of the directional antenna 20.

untwisted cable 30 after traversal of the stationary part 500 and transmit the cable at the other end to the rotating part 600 in an untwisted form, the cable being twisted inside the connection component 32.The cable twist 32 may use different twist schemes.

In some embodiments, the cable 30 may be a conductive screened cable configured to direct lightning currents that might hit the communication antenna 22 and/or the pole 40 outside the antenna system.

Such antenna arrangement 10 is advantageously adapted for various dimensions or diameters of the support structure 5.

In an alternative embodiment, the connection component 32 may comprise a hollow rotary joint (also referred to as a rotary union) instead of the cable twist 32. Such rotary joint may comprise two bodies to connect the stationary part 500 to the rotatable part 600 while providing sliding contact channels to provide the interconnection between the stationary part 500 and rotating part 600. The rotary joint may be further selected depending on the environmental conditions (temperatures, pressures, rotation speed, etc.) of the antenna system 100.

The antenna arrangement 10 may further comprise at least one bearing 34 configured to mechanically support the rotating part 600 on the stationary part 500. Each bearing 34 may comprise at least one inner race, one outer race and a plurality of rolling elements, such bearing components being loaded by loading means arranged in such a manner that a direct electrical connection exists between these components to ensure protection against high voltage transients, as described in EP 2795144 A1.

The stationary part 500 may further comprise the bearing 34, a seal element 35 arranged between the stationary part 500 and the rotating part 600, and an actuator 36 configured to actuate the rotation of the rotating part 600.

The support structure 5 may comprise a seal to protect the equipments arranged inside the support structure from the effect of the weather environment.

Figure 8 is a top view of the connection zone in an embodiment where a cable twist 32 is used as an alternative to a rotary joint, according to three exemplary positions noted P1 (-270, 0), P2 (0,0), and P3 (+270,0). The cable twist 32 may comprise a first body 320 connected to the stationary support structure 5 and a second body 321 connected to the rotatable part 600, the bodies 320 and 321 being rotatable with respect to each other about the rotary joint axis 322.

In position P1, the position of the cable run 30 is moved of -270 degrees.

In position P2, the position of the cable run 30 is moved of 0 degrees (the cable is returned to the same position).

In position P3, the position of the cable run 30 is moved of +270 degrees.

Figure 9 is a view of an exemplary rotary joint 32 with two rotating bodies 320 and 321, showing the input 301/output 302 of the cable 30.

In some embodiment, the antennas 20 and 22 may be installed as high as possible to maximize their radio horizon. More generally the height of the antennas 20 and 22 above the support structure may be defined depending on the application of the invention, the height of the communication antenna 22 being preferably higher that the height of the directional antenna 20.

The invention is generally applicable for integration of an antenna arrangement upon any support structure.

Although not limited to such applications, the invention has particular advantages in applications where the support system (e.g. ship) or the support structure 5 offers limited available space.

In an exemplary application of the antenna, the pole 40 can be surmounted with an omnidirectional naval communication Line-of-Sight antenna 20 extending beyond the Line-of-Sight (LoS) of the directional antenna 20, for example for Satellite Communication.

Figure 10 is a flowchart depicting the process of rotating the pole assembly 4, according to an embodiment.

In block 800, the next direction (azimuth) to which the directional system 2 is to be pointing at a certain time is defined by the ship system.

In step 802, the directional system 2 is rotated to the specified direction.

In step 804, a specific task to be performed by the directional system 2 is executed. For example, in step 804, RF energy is transmitted or received by a radar or a communication system.

Further, in step 801, it is checked if the pole is mechanically slaved to the directional system 20. If so, in block 803, the pole 40 mechanically remains outside the free field of view of the directional system 2 and no further action is required.

Otherwise, if the pole 40 is not mechanically slaved to the directional system 20, in step 805 an interval FFOV (Free Field Of View) is determined with positions defining the free field of view of the directional antenna 20.

In step 807, it may be further determined if the current position of the pole 40 is inside the interval FFOV determined in step 805. The current position of the pole 40 may be determined by measurement or be known by the system from the previous action.

If the current position of the pole 40 is inside the interval FFOV, in step 809, the pole 40 may be steered to the mean value of the FFOV plus a predefined angle, such as 180 degrees, or to the nearest boundary value of the FFOV with respect to the current position of the pole.

Otherwise, if the current position of the pole 40 is outside the interval FFOV, no further action is needed (block 810).

Figure 11 shows a top view of the antenna arrangement, in different positions when rotated around axis 11. In one embodiment, the rotating layer 3 may be mechanically driven by a rotating layer driver such as the rotating layer director 210 depicted in Figure 12. Alternatively, the mechanical driver may be replaced by

one or more proximity sensors configured to enable electrical actuation (either ON (Left or Right) or OFF).

Embodiments of the present invention thus provide an integrated antenna arrangement in a space as compact as possible depending on the required equipments, with possible lightning protection. The arrangement is adapted to provide unobstructed field of view for the directional antenna 20, and of the communication antenna 22 by controlling the rotation of the rotating base 3 when such communication antenna 22 is mounted on the pole 40. The antenna arrangement 10 further ensures that the aperture of the directional antenna 20 is not blocked and that the electromagnetic interference between the antennas 20 and 22 does not occur. Accordingly, the performances of both antennas 20 and 22 can be optimized.

In an exemplary application of the invention to a support system of ship type using a mast as a support structure 5 (Navy or shipyard application), the mast 5 may be bolted or welded to the ship, hooked up to the power supply, coolant system and/or data transmission and may be operational very quickly (in only two or three weeks), while conventional systems require one year for the installation, integration and tests. In such application, the antenna arrangement may be used as a surface surveillance radar for detecting and tracking small objects between the waves (including “asymmetric” threats such as unmanned air vehicles, fast inshore attack craft, gliders, dinghies, swimmers or mines), thereby contributing to situational awareness in littoral environments. The mast 5 forms a structurally self-supporting module for the integrated antenna arrangement 10. In embodiments in which a communication antenna 22 is used, although the communication antenna 22 and the directional antenna 20 are relatively close to each other, the operation of the antenna arrangement 10 is not affected by interference between the antennas 20 and 22. Further, unlike many conventional integrated antenna arrangements, it is not needed to switch one antenna 20 or 22 off before the other antenna can be used. The compactness of the antenna arrangement 10 makes it possible to concentrate the antenna arrangement equipments or components above or inside the mast 5, the

CLAIMS

1. An antenna arrangement (10) comprising a directional antenna assembly (2), the directional antenna assembly comprising a directional antenna (20) mounted on an interface (50) delimited by a stationary support structure (5) through a connection base of the directional antenna, the directional antenna generally extending along a main vertical axis (11) perpendicular to the plane defined by said interface, wherein the antenna arrangement (10) further comprises a rotatable base (3) mounted on said interface and a pole assembly (4) comprising a pole (40) integral with said rotatable base (3), said pole extending in the direction of said main axis, the rotational base being a base different from the connection base of the directional antenna assembly, said rotatable base (3) being rotatable about the main axis (11), said rotational base (3) being configured to control the rotation of the pole assembly (4) in azimuth, about the main axis (11), a rotation of said rotatable base actuating and controlling the rotation of the pole (40) about the main axis (11), so as to enable relocation of the pole (40), outside the line-of-sight of the directional antenna (20), the upper end of the pole (40) lying above the upper point of the directional antenna assembly (2).

2. The antenna arrangement of claim 1, wherein the pole (4) is configured to rotate outside the field of view of directional antenna (20).

3. The antenna arrangement of claim 1 or 2, wherein said antenna arrangement comprises a rotating control unit for controlling the rotation of the pole (4).

4. The antenna arrangement of any one of the preceding claims, wherein the directional antenna is rotatable at least about the main axis (11), the rotation of the directional antenna about the main axis defining the azimuth rotation of the directional antenna.

5. The antenna arrangement of any one of the preceding claims, wherein said antenna arrangement comprises a communication antenna (22) mounted on the pole (40).

6. The antenna arrangement of claim 5, wherein the communication antenna (22) is selected in the group consisting of an omnidirectional antenna and a directional antenna.

7. The antenna arrangement of any claim 5 or 6, wherein the communication antenna comprises a set of elementary antennas stacked in the direction of the main axis.

8. The antenna arrangement of any one of the preceding claims, wherein the directional antenna assembly (2) comprises a radome (6) in which the directional antenna is enclosed.

9. The antenna arrangement of claim 8, wherein the base of the radome (6) is mounted upon the rotatable base (3).

10. The antenna arrangement of claim 8, wherein the base of the radome (6) is surrounded by the rotatable base (3).

11. The antenna arrangement of any one of the preceding claims, wherein said antenna arrangement comprises a lightning arrestor (42) arranged on the pole (40).

12. The antenna arrangement of claim 11 when dependent on any one of claims 5-7, wherein the lightning arrestor (42) is arranged above the communication antenna.

13. An antenna system (100) comprising an antenna arrangement according to any one of claims 1 to 12, said support structure (5) being mounted on a support system (12), said support structure being hollow, wherein the support structure (5) comprises a through hole, the rotatable base (3) delimiting an inner passage communicatively coupled with said through hole of the support structure (5) and with an inner passage of the pole, the antenna arrangement comprising a cable running from a fixation point on the support system to the upper end of the pole (40), the cable passing through the support structure to the rotatable base via the through hole and said inner passages.

14. The antenna system of claim 13, wherein the cable is a conductive screened cable.

15. The antenna system of claim 14, wherein it comprises a connection component (32) to connect the rotatable base (3) to the support structure, said connection component (32) being arranged at the level of said through hole and enabling the passage of the cable.

16. The antenna system of claim 15, wherein the connection component (32) is a cable twist.

17. The antenna system of claim 15, wherein the connection component (32) is a rotary joint.

18. The antenna arrangement of any one of claims 1 to 12, wherein the directional antenna (20) is rotatable.

19. The antenna arrangement of claim 18, wherein the rotatable base (3) is mechanically slaved to the rotation of the directional antenna (20).

ABSTRACT

INTEGRATED ANTENNA ARRANGEMENT

There is provided an antenna arrangement (10) comprising a directional antenna assembly (2), the directional antenna assembly comprising a directional antenna (20) intended to be mounted on an interface (50) delimited by a stationary support structure (5), the directional antenna generally extending according to a main axis (11) perpendicular to the plane defined by said interface, wherein the antenna arrangement (10) further comprises a rotatable base (3) mounted on said interface, said rotatable base (3) comprising a pole (40) integral with said rotatable base (3), said pole extending in the direction of said main axis, said rotatable base (3) being rotatable about the main axis (11), a rotation of said rotatable base actuating the rotation of the pole (40) about the main axis.

(FIGURE 2)