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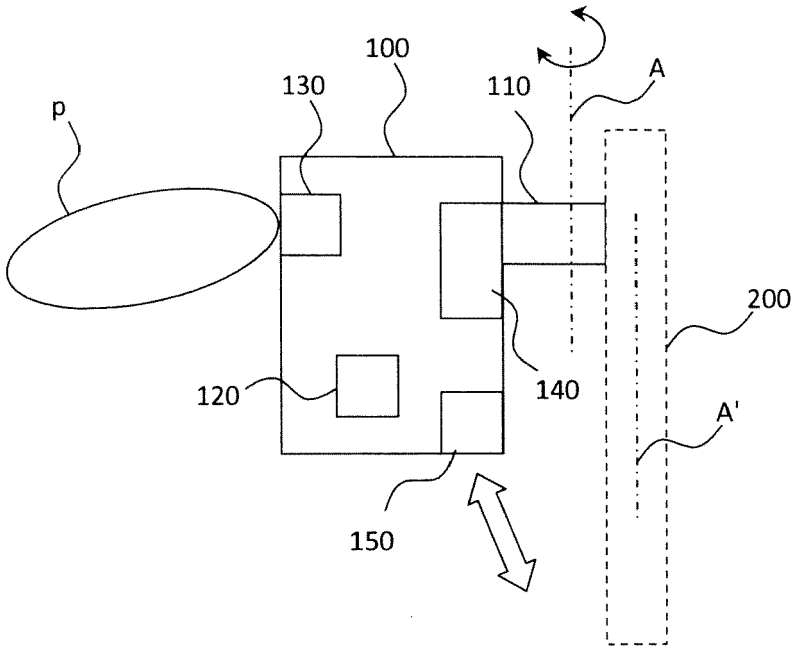
Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Radio device and method of operating a radio device**

(57) The invention relates to a radio device (100), particularly for a base station of a cellular communications network, wherein said radio device (100) comprises a mounting device (110) for mounting said radio device (100) to a support structure (200), wherein said mounting device (110) is configured such that said radio device (100) may be movably, preferably rotatably, attached to said support structure (200).

Fig. 1



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Description

Field of the invention

[0001] The invention relates to a radio device, particularly for a base station of a cellular communications network, wherein said radio device comprises a mounting device for mounting said radio device to a support structure.

[0002] The invention further relates to a method of operating such radio device.

Background

[0003] Conventional radio devices are usually fixedly attached to a support structure such as a top of a building or the like. When attaching radio devices to support structures such as mounting poles with a comparatively small diameter, the additional wind load, that is effected by the radio device, can pose a risk to the structural integrity of the mounting pole. Thus, many existing structures such as lamp posts or poles of traffic signs and the like cannot be used for attaching a radio device thereto in order to provide further radio coverage. With the conventional approach, rather, additional support structures for new radio devices have to be built.

Summary

[0004] Thus, it is an object of the present invention to provide an improved radio device and an improved method of operating such radio device which avoid the above mentioned disadvantages.

[0005] Regarding the radio device of the afore-mentioned type, according to the embodiments, this object is achieved by said mounting device being configured such that said radio device may be movably, preferably rotatably, attached to said support structure. Thus, the radio device may e.g. move under the influence of a wind force to a specific configuration which reduces, or minimizes, the effective wind load thus reducing mechanical stress on the mounting structure. Advantageously, according to an embodiment, the radio device may rotate, preferably freely (particularly without any limitation of a degree of rotation in either direction), around an axis of rotation provided by the mounting device. As a consequence, existing structures such as lamp posts or poles of traffic signs and the like may advantageously be used for mounting radio devices according to the embodiments, even if their structural strength is comparatively low so that a conventional fixed mounting of a conventional radio device would not be recommendable in view of the additional wind load.

[0006] The mounting device, according to an embodiment, may e.g. comprise a hinge mechanism and/or any other suitable mechanism that enables free movement, preferably rotation, of the radio device with respect to a mounting point the mounting device is attached to.

[0007] According to a further embodiment, the mounting device may e.g. comprise a clamp by means of which it can be attached to a mounting pole or the like. In this case, preferably, a connecting mechanism between the clamp and the further components of the radio device is provided which enables the radio device to move freely, preferably rotate freely, with respect to the clamp.

[0008] A further solution to the object of the present invention is given by a radio device which comprises a first component and a second component, wherein said second component is movably, or preferably rotatably, attached to said first component. In this case, e.g. the first component may be fixedly attached to a supporting structure such as a mounting pole, and the second component may move freely with respect to the first component, e.g. rotate free. According to an embodiment, said first and second components may comprise parts of a housing of said radio device, as well as components arranged therein (e.g., electronic devices such as amplifiers, up-/downconverters, antennas). Thus, the movable or rotatable second component of the radio device can still advantageously contribute to a dynamic reduction of a wind load to an overall configuration comprising the radio device and a supporting structure.

[0009] According to a preferred embodiment, said radio device comprises an orientation sensor device configured to provide information on a spatial orientation of said radio device, whereby the radio device can gain information on its orientation in space and optionally adapt its operational state accordingly. According to an embodiment, said orientation sensor device may also be configured to determine such information (information on a spatial orientation) only with respect to a component of the radio device, e.g. information on a spatial orientation of an antenna system of the radio device or the like.

[0010] According to an embodiment, said orientation sensor device may be configured to determine a degree of rotation of the radio device with respect to a support structure the mounting device is attached to. For example, if the mounting device according to an embodiment comprises a hinge mechanism for rotation, the orientation sensor device may e.g. comprise an angular rotation sensor.

[0011] According to further embodiments, the orientation sensor device may comprise one or more inertial sensors which are configured to determine an orientation in space of the radio device (or at least one of its components such as an antenna system) depending on acceleration vectors of the radio device detected over time by the sensor device.

[0012] According to a further embodiment, said radio device comprises an antenna system a beam pattern of which is controllable, and wherein said radio device is preferably configured to control said beam pattern depending on a spatial orientation of said radio device (or a component thereof). Thus, according to this embodiment, the radio device may advantageously adjust its beam pattern such as e.g. a direction of a main lobe of

the beam pattern or generally the beam characteristics of the antenna system depending on a spatial orientation of the radio device. Thereby, e.g. the direction of a main lobe of the antenna beam pattern may be kept constant even if the radio device (with its antenna system) is moving around the support structure in accordance with an embodiment.

[0013] According to a preferred embodiment, said beam pattern may e.g. be controlled depending on the orientation of the radio device which is obtained by the orientation sensor device. According to a further embodiment, the antenna system may comprise at least one smart antenna which may e.g. comprise an electronically controllable antenna pattern. According to a further embodiment, the antenna system may comprise one or more regular antennas or antenna arrays, e.g. such antenna arrays which have different beam characteristics, and the antenna system may switch between using one or more of said antennas depending on the operational state of the radio device or its spatial orientation, for example.

[0014] Also, according to a further embodiment, it is possible to fixedly mount at least an antenna system of the radio device to a support structure, and to movably attach further (preferably all remaining) components of said radio device to the support structure to enable wind load reduction at least by movement of said further components.

[0015] According to a further embodiment, said radio device comprises an electrical generator which is configured to transform a movement of said radio device or of at least one component of said radio device into electrical energy. Thus, the radio device according to the embodiment may not only reduce the wind load on its support structure, but simultaneously gain electrical energy from its movement caused by the wind load reduction.

[0016] According to a further embodiment, said radio device comprises at least one wireless interface for wirelessly exchanging data and/or electrical energy with a further device. Thus, e.g. baseband data which is to be processed by the radio device and/or to be up-converted or transmitted in form of an RF signal according to the well-known mobile communications standards such as 3GPP, LTE, and the like, may be provided to the radio device wirelessly, whereby the movable or rotatable attachment of the radio device of the support structure is not impeded by cabled connections. Alternative or in addition to the wireless interface, a cabled connection with correspondingly flexible cables may also be provided.

[0017] According to a further embodiment, a wireless interface may also be used for exchanging electrical energy with a further device. For example, an electrical energy transfer system may be provided by means of an electromagnetic induction generator which provides a magnetic field with an alternating component from which the radio device with its wireless interface may collect electromagnetic energy thus wirelessly providing said radio device with electrical energy. When mounting the radio device to a lamp post, the electromagnetic induction generator may e.g. be supplied from the same electric connector as the lamp of the lamp post.

[0018] A further solution of the object according to the present invention is given by a method according to claim 8. Further advantageous embodiments are presented by the dependent claims.

Brief description of the figures

[0019] Further features, aspects and advantages of the present invention are given in the following detailed description with reference to the drawings in which:

Figure 1 schematically depicts a radio device according to an embodiment,

Figure 2 schematically depicts a top view of a radio device according to an embodiment in different operational states,

Figure 3 schematically depicts a simplified flow chart of a method according to an embodiment, and

Figure 4 schematically depicts a radio device according to a further embodiment.

Description of the embodiments

[0020] Figure 1 schematically depicts a side view of a radio device 100 according to an embodiment. The radio device 100 may e.g. comprise the functionality of a base station of a cellular communications network or of a radio head (remote radio head) for such base station. However, the radio device according to the embodiments is not limited to base stations of cellular communications networks, but may also represent a device generally usable for RF (radio frequency) communications with at least one other device.

[0021] For example, according to a further embodiment, the radio device may also be implemented in the form of an intelligent antenna device mainly comprising an antenna system and a control mechanism therefore.

[0022] According to the present embodiment, the radio device 100 comprises a mounting device 110 for mounting said radio device 100 to a support structure 200, which is presently indicated by a dashed rectangle 200 in figure 1. The support structure 200 may e.g. be a mounting pole or a lamp post or the like.

[0023] According to the present embodiment, the mounting device 110 is configured such that radio device 100 may be movably, preferably rotatably, attached to the support structure 200. This is exemplarily indicated in figure 1 by the chain dotted line A, which represents an axis of rotation provided by the mounting device 110. For example, for attaining such rotational movement, the mounting device 110 may comprise a hinge mechanism

(not shown) or the like.

[0024] Also, according to a further embodiment, it is possible that the mounting device 110 comprises an elastic member (not shown) which enables a relative movement between a portion of the mounting device 110 fixedly attached to the mounting pole 200 and the further portions of the radio device 100.

[0025] According to yet a further embodiment, the mounting device 110 may also be configured such that an axis of rotation of the radio device 100 with respect to the mounting pole 200 coincides with a longitudinal axis A' of the mounting pole 200. Such mechanism may e.g. comprise a mounting bracket (not shown) that enables to rotatably attach the configuration 100, 110 to the mounting pole 200, wherein the axis of rotation coincides with axis A'.

[0026] According to a further embodiment, a movable or rotatable attachment of the radio device 100 to the support structure may also comprise further degrees of movement such as e.g. at least one further axis of rotation. For example, according to an embodiment, in addition to the axis A of Figure 1, a radio device may also be configured such that it can rotate (preferably freely) around an axis extending horizontally in Figure 1, i.e. basically perpendicular to the axis A. This may further help to reduce a wind load on the arrangement 100, 200.

[0027] According to an embodiment, the radio device 100 may comprise an orientation sensor device 120 which is configured to provide information on a spatial orientation of said radio device 100 (or of at least one component thereof, e.g. of an antenna system 130 or the like). According to an embodiment, the sensor device 120 may e.g. comprise one or more angular sensors configured to detect an angle of rotation between the support structure 200 and the radio device 100, e.g. around the axes A or A' (and/or any further potential axes of rotation).

[0028] According to a further embodiment, the radio device 100 may comprise an antenna system 130 a beam pattern p of which is controllable, and said radio device 100 may preferably be configured to control said beam pattern p depending on a spatial orientation of said radio device 100 or on a spatial orientation of at least one component thereof (e.g. depending on the spatial orientation of the antenna system 130).

[0029] Figure 2 schematically depicts a top view of three different operational states of the radio device 100 according to figure 1. In the top region of figure 2, a wind direction is assumed to comprise a mainly negative horizontal component cf. the arrows W1. Thus, the radio device 100, which is rotatably attached as explained above with reference to figure 1, aligns with the wind direction W1, and its beam characteristic p has its main lobe also oriented in a specific direction d.

[0030] However, if the wind direction changes to W2, the radio device 100 rotates around the axis of rotation A (figure 1). In order to still maintain the direction of the main lobe of its beam pattern p coinciding with the predetermined direction d, the radio device 100, preferably dynamically (i.e. during an operation of the radio device 100), alters its beam characteristic to ensure that the main lobe of the beam pattern p still points to the negative horizontal direction of figure 2, thus aligning with the predetermined direction d.

[0031] Also depicted in figure 2 is a third operational scenario with a yet different direction of the wind vector W3, wherein again the radio device 100 detects its orientation in space with respect to e.g. the mounting pole 200 and correspondingly adapts its beam characteristics to ensure that the main lobe of the beam pattern p remains aligned with the predetermined direction d.

[0032] Figure 3 schematically depicts a simplified flow chart of a method according to an embodiment. In step 300, the radio device determines its orientation in space, and in step 310, the radio device 100 may adapt its beam characteristic p if necessary, e.g. to maintain a direction of a main lobe d as depicted by figure 2.

[0033] According to a further embodiment, the radio device 100 comprises an electrical generator 140 (figure 1), which is configured to transform a movement of said radio device 100 or of at least one component of said radio device into electrical energy.

[0034] According to a further embodiment, said radio device comprises at least one wireless interface 150 which is configured to wirelessly exchange data with a further device (not shown). Thereby, the radio device 100 may e.g. be provided with baseband signals which are to be processed in a manner per se known in the art prior to transmitting a corresponding radio frequency signal by means of the radio device 100 or its antenna system 130.

[0035] Also, a wireless interface 150 in the sense of an electromagnetic induction interface may be used for providing the radio device 100 with electrical energy.

[0036] According to a further embodiment, the radio device 100 may comprise a battery or an accumulator or the like for at least temporarily storing electrical energy collected by means of its generator 140 and/or a wireless interface 150.

[0037] Also, the radio device 100 according to an embodiment may comprise a photovoltaic generator for collection of electrical energy from incident solar radiation or the like.

[0038] Figure 4 schematically depicts a block diagram of a radio device 100a according to a further embodiment. The radio device 100a comprises a mounting device (not shown), which enables to fixedly attach the radio device 100a or its first component 100a_1 to a support structure 200. Also, the radio device 100 is divided into at least two different components 100a_1, 100a_2 (e.g., housing components), wherein said second component 100a_2 is rotatably attached to said first component 100a_1. Thus, the second component 100a_2 may rotate around the axis A" again enabling to reduce the wind load on the support structure 200.

[0039] The embodiment 100a according to figure 4 has the specific advantage that at least some components

such as a baseband processing unit or power amplifiers or the like may e.g. be comprised within a portion of the housing that is associated with the first component 100a_1 and thus may be fixedly attached to the mounting structure 200. One or more flexible, internal cablings may be provided connecting components comprised within the first component 100a_1 to components of the radio device 100a comprised within the second, rotatable component 100a_2. For example, the antenna system 130 (figure 1) may be comprised in the second component 100a_2.

[0040] The principle according to the embodiments advantageously enables a reduction of mechanical stress imparted on a lamp post or other mounting structure 200 (figure 1) caused by a wind load W1, W2, W3 (figure 2), by minimizing said wind load. Advantageously, aspects of the embodiments enable the radio device 100, 100a to "automatically" turn into a wind load minimizing position. According to a further embodiment, to provide or enhance a relative movement between components 100, 110, 200 or 100a_2, 100a_1, further driving units such as an integrated motor or the like may be provided. This enables the radio device to actively alter its position relative to the mounting pole 200. E.g., in some embodiments, the radio device may be configured to detect critical wind conditions and to actively "rotate" around the lamp post 200 to reduce a wind load.

[0041] According to a further embodiment, smart antenna technology may be employed to keep an antenna beam pattern constant in space even if the antennas 130 themselves or the radio device 100, 100a comprising said antennas are rotated.

[0042] Also, according to a further embodiment, use of equipment rotation, or movement, in general, to produce electricity and thereby directly power the equipment 100, 100a or charge batteries is beneficial.

[0043] The radio device 100, 100a according to the embodiments may especially be used for implementing small radio cells for cellular communications networks and the like or access points, where existing mounting sites such as lamp posts and the like are likely to be used. The invention allows to use such already existing mounting structures 200, which are in principle not designed for the additional mechanical stress that results from the radio device's wind load. E.g., while such existing mounting structures 200 may not be designed to carry a comparatively bulky load such as a radio device, when using the radio device 100, 100a according to the embodiments, it may nevertheless be attached to such existing mounting poles 200, because the radio device 100, 100a according to the embodiments inherently reduces the wind load on the overall construction.

[0044] According to a further embodiment, the radio device 100, 100a may comprise a driving unit to drive a relative movement with respect to the mounting pole 200. The radio device 100, 100a may further be configured to alter its relative (rotational) position with respect to the mounting pole 200 depending on e.g. a time of day, for example to follow or avoid the sun radiation (following the sun may be beneficial if photovoltaic converters are provided for harvesting sun energy, while avoiding the sun may be indicated due to thermal reasons).

[0045] Also, according to a further embodiment, such driving unit could be used to drive said radio device 100, 100a into a predetermined preferred (rotational) position, e.g. after strong wind events where first priority was to minimize the wind load (and where the driving unit may at least temporarily be deactivated or decoupled), whereas upon reduced wind speeds a tolerable wind load caused by the radio device again attaining its predetermined position may be tolerated.

[0046] According to a further embodiment, the radio device 100, 100a may comprise a weather sensor, particularly wind sensor (not shown), for determining wind conditions and the like. In this embodiment, the radio device 100, 100a may be configured to control its operation according to so determined weather conditions and/or wind conditions. For example, if a wind speed is determined to exceed a predetermined threshold, the radio device 100 may deactivate or decouple any driving unit to enable the radio device (or a rotatably/movably attached component thereof) to rotate/move freely under influence of the wind in order to minimize wind load. For example, if a wind speed is determined to be lower than a predetermined threshold, such measures are not required, and the radio device 100, 100a may e.g. use its optional driving unit to set a specific (not necessarily constant) position, e.g. following the sun or a predetermined number of terminals to be served or the like.

[0047] The description and drawings merely illustrate the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the invention and are included within its spirit and scope. Furthermore, all examples recited herein are principally intended expressly to be only for pedagogical purposes to aid the reader in understanding the principles of the invention and the concepts contributed by the inventor(s) to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass equivalents thereof.

[0048] It should be appreciated by those skilled in the art that any block diagrams herein represent conceptual views of illustrative circuitry embodying the principles of the invention. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

Claims

1. Radio device (100), particularly for a base station of a cellular communications network, wherein said radio device (100) comprises a mounting device (110) for mounting said radio device (100) to a support structure (200), wherein said mounting device (110) is configured such that said radio device (100) may be movably, preferably rotatably, attached to said support structure (200).

2. Radio device (100a), particularly for a base station of a cellular communications network, wherein said radio device (100a) comprises a first component (100a_1) and a second component (100a_2), wherein said second component (100a_2) is rotatably attached to said first component (100a_1).

3. Radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100; 100a) comprises an orientation sensor device (120) configured to provide information on a spatial orientation of said radio device (100; 100a).

4. Radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100; 100a) comprises an antenna system (130) a beam pattern (p) of which is controllable, and wherein said radio device (100; 100a) is preferably configured to control said beam pattern depending on a spatial orientation of said radio device (100; 100a).

5. Radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100; 100a) comprises an electrical generator (140) configured to transform a movement of said radio device (100) or of at least one component (100a_2) of said radio device (100a) into electrical energy.

6. Radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100; 100a) comprises at least one wireless interface (150) for wirelessly exchanging data and/or electrical energy with a further device.

7. Support structure (200), particularly lamp post or mounting pole, comprising at least one radio device (100) according to one of the preceding claims.

8. Method of operating a radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100) comprises a mounting device (110) for mounting said radio device (100) to a support structure (200), wherein said mounting device (110) is configured such that said radio device (100) may be movably, preferably rotatably, attached to said support structure (200), wherein said radio device (100; 100a) determines information on a spatial orientation of said radio device (100; 100a) and operates depending on said information on a spatial orientation of said radio device (100; 100a).

9. Method according to claim 8, wherein said radio device (100; 100a) comprises an antenna system (130) a beam pattern (p) of which is controllable, and wherein said radio device (100; 100a) controls said beam pattern depending on a spatial orientation of said radio device (100; 100a).

10. Method according to one of the claims 8 to 9, wherein said radio device (100; 100a) comprises an electrical generator (140), and wherein said generator (140) transforms a movement of said radio device (100) or of at least one component (100a_2) of said radio device (100a) into electrical energy.

Amended claims in accordance with Rule 137(2) EPC.

1. Radio device (100), particularly for a base station of a cellular communications network, wherein said radio device (100) comprises a mounting device (110) for mounting said radio device (100) to a support structure (200), wherein said mounting device (110) is configured such that said radio device (100) may be movably, preferably rotatably, attached to said support structure (200).

2. Radio device (100; 100a) according to claim 1, wherein said radio device (100; 100a) comprises an orientation sensor device (120) configured to provide information on a spatial orientation of said radio device (100; 100a).

3. Radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100; 100a) comprises an antenna system (130) a beam pattern (p) of which is controllable, and wherein said radio device (100; 100a) is preferably configured to control said beam pattern depending on a spatial orientation of said radio device (100; 100a).

4. Radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100; 100a) comprises an electrical generator (140) configured to transform a movement of said radio device (100) or of at least one component (100a_2) of said radio device (100a) into electrical energy.

5. Radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100; 100a) comprises at least one wireless interface (150) for wirelessly exchanging data and/or electrical energy with a further device.

6. support structure (200), particularly lamp post or mounting pole, comprising at least one radio device (100) according to one of the preceding claims.

7. Method of operating a radio device (100; 100a) according to one of the preceding claims, wherein said radio device (100) comprises a mounting device (110) for mounting said radio device (100) to a support structure (200), wherein said mounting device (110) is configured such that said radio device (100) may be movably, preferably rotatably, attached to said support structure (200), wherein said radio device (100; 100a) determines information on a spatial orientation of said radio device (100; 100a) and operates depending on said information on a spatial orientation of said radio device (100; 100a).

8. Method according to claim 7, wherein said radio device (100; 100a) comprises an antenna system (130) a beam pattern (p) of which is controllable, and wherein said radio device (100; 100a) controls said beam pattern depending on a spatial orientation of said radio device (100; 100a).

9. Method according to one of the claims 7 to 8, wherein said radio device (100; 100a) comprises an electrical generator (140), and wherein said generator (140) transforms a movement of said radio device (100) or of at least one component (100a_2) of said radio device (100a) into electrical energy.

Fig. 1

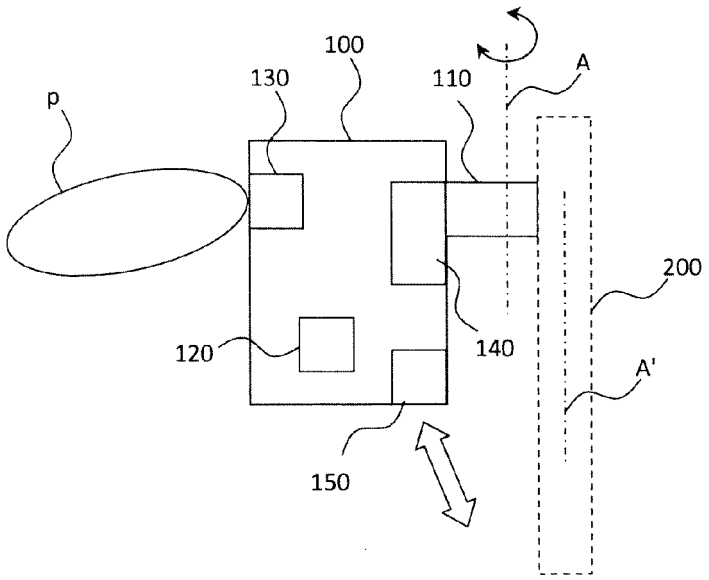


Fig. 2

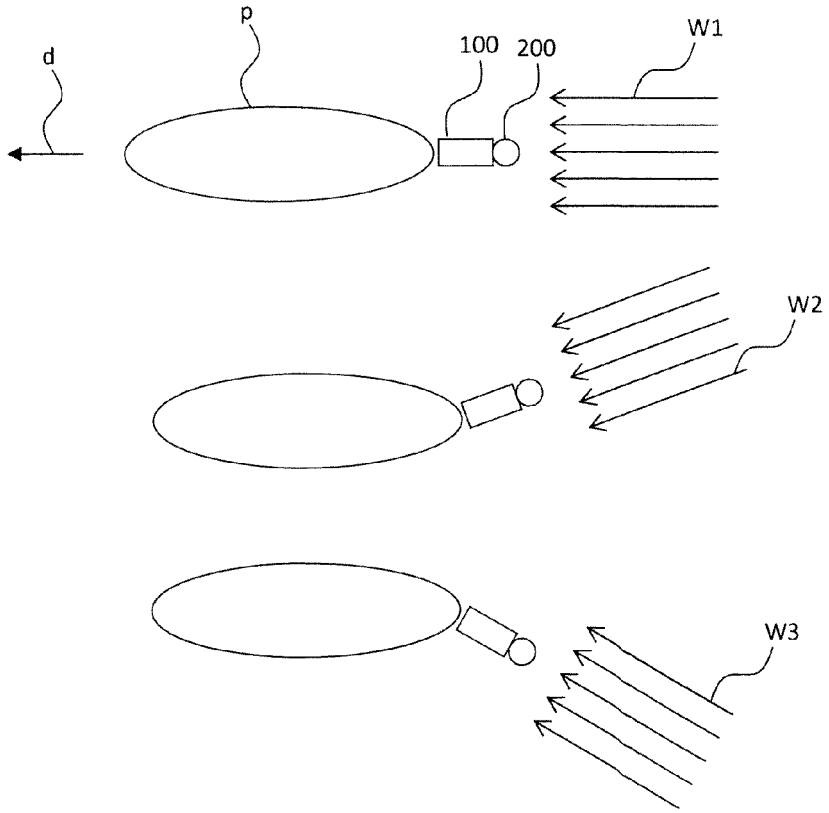


Fig. 3

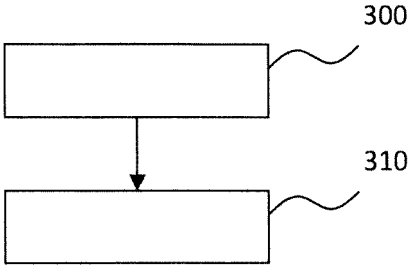
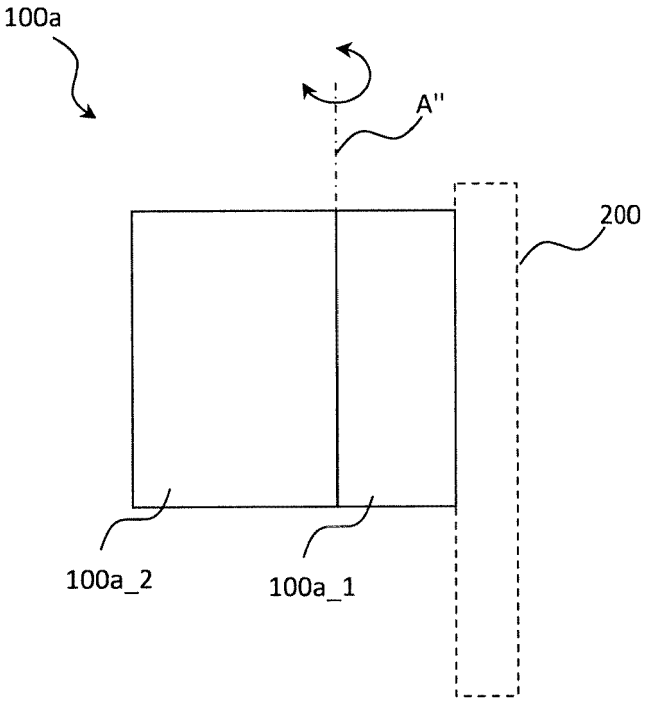


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 14 29 0123

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2007/241979 A1 (YANG CHING-SHUN [US]) 18 October 2007 (2007-10-18) * abstract; figures 1,10 * * paragraphs [0002], [0008] - [0012], [0037] - [0038] * * paragraphs [0040] - [0043] - paragraph [0054]; claim 1 *	1-4,6-9	INV. H01Q1/24
X	US 2005/248496 A1 (CHEN MICHAEL [TW] ET AL) 10 November 2005 (2005-11-10) * abstract; figures 1,3,5 * * paragraphs [0006] - [0007], [0016] *	1,2	
X	WO 2008/154959 A1 (ERICSSON TELEFON AB L M [SE]; JOHANSSON MARTIN [SE]; PETERSSON SVEN OS) 24 December 2008 (2008-12-24) * abstract; figure 8 * * page 1, lines 8-18 * * page 3, lines 1-6 * * page 3, lines 25-27 * * page 6, line 10 - line 12 *	1-4,6-9	
			TECHNICAL FIELDS SEARCHED (IPC)
A	US 5 894 291 A (LEE DAVID Y [US]) 13 April 1999 (1999-04-13) * abstract; figures 1,4 * * column 3; claim 1 *	1-4,6-9	H01Q

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	29 September 2014	Almenar Muñoz, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 14 29 0123

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-4, 6-9

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 14 29 0123

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-4, 6-9

Radio device movably attached to a support structure.
Problem: how to control the beam pattern direction of a radio device.
Solution: radio device comprising a mounting device configured such that said radio device may be movably, comprising also an orientation sensor and an antenna system, and configured to control the beam pattern depending on a spatial orientation.

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2. claims: 5, 10

Electrical generator.
Problem: how to generate electrical energy.
Solution: an electrical generator is configured to transform a movement of a device into electrical energy.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 29 0123

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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29-09-2014

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82