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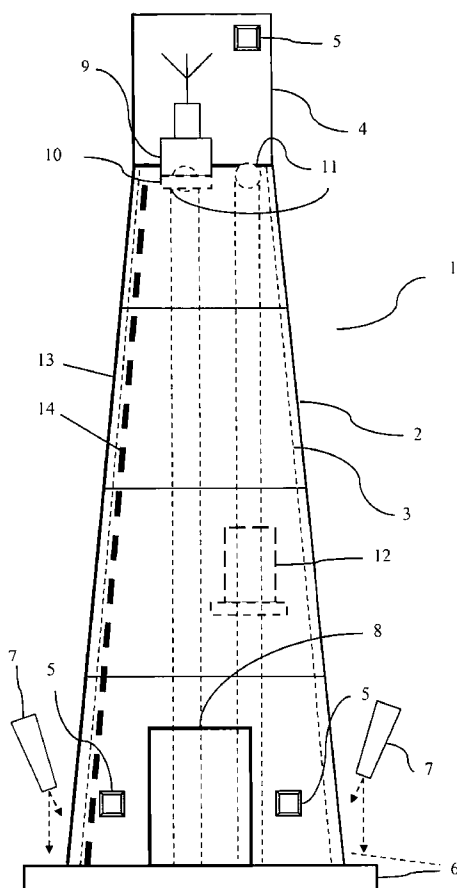
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(54) Title: TUBULAR TELECOM TOWER



(57) Abstract: The present invention aims to provide a hollow antenna tower structure for use in a wireless communications network. The tower comprises tubular tower sections made of concrete, and having a generally hollowed cross section. A movable base station unit, having at least one antenna and at least one micro wave link, is being disposed inside the tubular tower. The whole base station unit is movable up and down inside the tower by the aid of an elevator system. The tower further comprises at least one entrance into the tower and a climbing facility and/or a second elevator system, inside the tower, giving access to the base station unit.

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- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- *of inventorship (Rule 4.17(iv))*

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Tubular telecom tower

TECHNICAL FIELD

The present invention generally relates to telecom towers, and in particular, to a tubular antenna tower structure for use in a wireless communications system.

BACKGROUND

Prevailing technology for telecom towers/masts, whether self supported or guyed, are lattice steel constructions. These masts are often galvanized using hot dip galvanization, where the steel structure is coated with a layer of Zinc. Steel towers are usually manufactured for a design life between 30-50 years. Coated structures are sensible to mechanical wear, and lattice steel towers are no exception. Towers get surface damages during transportation and installation, and such damages need to be mended when the tower is installed. Since hot dip is not an option when the tower is installed, painting/spraying with cold galvanization is a method used. Damages to a protective Zink layer can not be avoided during transportation and installation and corrosion will start at damaged areas. Corrosion is what sets design life for all steel structures, and regardless of Zink cotes, certain maintenance is required to stop corrosion during a construction life time.

Many new types of masts are under development. Patent documents WO02/41444 A1, US2003/0142034 A1 and US5995063 A, are some of the documents that describe a hollow/tubular antenna mast having an inside and an outside part.

Patent document, WO02/41444 A1, describes a communications mast assembly comprising a mast extending from submergible equipment housing. The housing may house air-conditioning equipment, which is located in the access room of the housing. The arrangement is being further such that the mast

provides ventilation ducts in the form of inlet and outlet passages for atmospheric air circulation.

Patent document, US2003/0142034 A1, describes a telecommunications mast installation comprising a hollow mast supporting a telecommunications antenna and a foundation structure supporting the mast. According to the invention the foundation structure is in the form of an enclosed chamber situated at least partially and preferably fully, underground. The chamber defines an internal space which is accessible to personnel and which accommodates electronic equipment associated with operation of the antenna.

Patent document, US5995063 A, describes an antenna structure comprising a hollow antenna mast having an inside and an outside, a specially designed movable module disposed inside said hollow antenna mast and lifting means. The movable module has at least one antenna, at least one RF module and at least one RF transmission means connected to the at least one antenna and the at least one RF module. The lifting means permit the raising and lowering of the movable module inside the hollow antenna mast between a lower position and an upper position.

Other types of telecom towers/masts exist and are referred to as Monopoles, which basically are steel, aluminium or concrete poles on which a telecommunication system is attached on an external surface part.

Some of the problems with existing solutions and constructions are that they, in a general public view, are perceived as an unwelcome part of a landscape view. Existing tower structures are in many cases expensive to produce, expensive and difficult to perform service on and they require separate equipment facilities such as shelters or outdoor protected equipment. In some solutions the telecom

equipment is attached to the tower and is consequently exposed to weather variations.

SUMMARY

5 Hollow telecom towers made from concrete represent a new sort of thinking. None of the mentioned prior art documents describe concrete hollow structures where an inside of a tower is utilized as shelter, air pump, temperature equalizer, and elevator shaft for a whole antenna radio base station (RBS) all in the same construction.

10 An embodiment of the present invention is therefore to introduce a new antenna tower structure for use in a wireless communications network, wherein the tower is less expensive to produce and perform service on without interrupting radio transmission as long as possible.

15 It is an object of the present invention to introduce a new antenna tower structure having a considerably longer life cycle, better characteristics and with a more environment friendly manufacturing process.

It is another object of the present invention to introduce a
20 new antenna tower structure where all telecom equipment is fully integrating inside an exterior surface. By such a construction geometry, and the fact that telecom equipment is totally enclosed within boundaries of construction, the antenna tower structure can thus function in a similar way
25 as a Faradays cage with regard to protecting the equipment from lightning strikes and electro magnetic pulses (EMPs).

It is yet another object of the present invention to provide a hollow antenna tower structure for use in a wireless communications network. The tower comprises tubular tower
30 sections made of concrete, and having a hollowed cross section. The tower further comprises an arrangement for moving a whole antenna radio base station along the

elongation of the inside part of the antenna tower structure. The tower further comprises at least one entrance into the tower giving access for service of the antenna radio base station.

5 It is yet another object of the present invention to provide a method of manufacturing one or more sections of a radio base station antenna tower structure for use in a wireless communications network. The method is characterised by a first step of casting the antenna tower structure sections
10 into tubular tower sections having a hollowed cross section. A second step is to arrange at least one antenna tower structure section with an entrance into the antenna tower structure. A third step is to arrange the antenna tower structure sections for a mechanism for moving at least a
15 whole antenna radio base station inside the antenna tower structure. A fourth step is to arrange the antenna tower structure sections for inclusion of a service access system.

Yet another object of the present invention is to provide a wireless communications system comprising one or more
20 antenna tower structures, wherein each structure is equipped with at least one antenna Radio Base Station serving as an access point for user equipments. The wireless communications system is characterised by the antenna tower structures being cast and divided into tubular tower
25 sections having a hollowed cross section. The sections further comprise an arrangement for moving a whole antenna radio base station along the elongation of the antenna tower structure. The antenna radio base station is being disposed inside the tubular tower. Additionally, each antenna tower
30 structure has at least one entrance into the antenna tower structure giving access for service of the antenna Radio Base station.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates an antenna tower structure according to an embodiment of the present invention.

Figure 2 illustrates a tower structure base section sketch according to an embodiment of the present invention.

5 Figure 3 is a Block diagram illustrating a foundation geometry top view according to an embodiment of the present invention.

Figure 4 illustrates a tower structure top section sketch according to an embodiment of the present invention.

10 Figure 5 illustrates some examples of antenna tower structures according to embodiments of the present invention.

Figure 6 is a flow chart illustrating a method according to an embodiment of the present invention.

15 Figure 7 is a block diagram illustrating a system according to an embodiment of the present invention.

DETAILED DESCRIPTION

Benefits of creating a tower, as described by the present invention, in concrete are uncountable. Problems with
20 corrosion, cables and feeders out in the open, radio transmission interruption during service or reparation etc., are to be avoided by the present invention.

US patent document, US5995063 A, mentions that parts of RBS equipment could be placed at a top section of an antenna
25 tower, in order not to use long feeders with substantial damping and power losses as a consequence. This technique is related to as "main remote unit" and is used mostly for small site RBSs. The "main remote unit" concept relates to moving parts of a RBS to a location nearer the top of a
30 tower or mast. This way some feeder loss is avoided, among

other benefits. However, a principle of placing the whole RBS in a top section of an antenna tower and giving availability for at place maintenance, no requirement for outdoor equipment and structural strength benefits in combination, is not even closely to the above discussion. These three needs in combination have made it impossible, in prior art systems, to place Macro equipment at the top section of the antenna tower structure. On place service/maintenance is becoming a big need for operators when radio down time costs is to be minimized.

According to an embodiment of the present invention an antenna tower structure (ATS) is manufactured from reinforced concrete. A type of concrete/mix is chosen in such a way that it is possible to guarantee a design life of > 100 years without maintenance. The concrete antenna tower structure is not sensible to scratches and surface damages in a same way as coated steel structure. Preferably, the tower will not be painted, colors come from pigmented concrete.

These are some benefits discovered when manufacturing and developing ATSS made of concrete:

1. Thermally slow

An RBS has requirements for surrounding temperature usually within approximately +5 degrees to +45 degrees Celsius. This will cause a problem in hotter climates with very high temperatures daytime. However, temperatures nighttime, even in hotter climates, goes down many degrees. A conventional, thermally fast, construction such as telecom shelters is using active cooling such as air conditioners to cool equipment. Active cooling consumes a lot of power and is therefore the no. 1 operational expenditure (OPEX), the on-going costs for running a product, for an operator of a network. Concrete is a thermally slow material. The ATS

intends to utilize this in leveraging of temperature during 24 h in hot climates. At night time the ATS will cool down as a consequence of lower outdoor temperature. Lower outdoor temperature, "Stack effect", will not alone be able to cool
5 the ATS and mechanical forced/controlled ventilation may be required. Daytime when temperature again raises the mass in a cooled ATS will manage to cut a peak temperature and is therefore capable of maintaining a cooler indoor climate.

2. Local production

10 Steel lattice towers and other kinds of towers require factory manufacturing. Precise cutting of steel, welding environment and hot dip galvanization all require factory indoor facilities. Steel lattice towers are often manufactured remotely from a site establishment and are
15 often exported between countries and continents.

According to an embodiment of the present invention the ATS is cast in concrete. Concrete is a mix of cement, aggregates and water. As long as ingredients are available it can be mixed any where. The ATS will be made of sections and every
20 section will require a mould. The mould is made of steel and sets the exact measurements for the cast elements. The moulds can be reused thousands of times. Since the manufacturing process is quite simple, providing the mould is adequately made, the ATS can be produced in temporary
25 established field factories. Thereby cutting a major part of the costs and adding considerably simplicity to the manufacturing process, as well as being more environment friendly at the same time.

3. Cost reduction

30 Cost criteria are already discussed above. The ATS will be considerably heavier than a steel lattice tower but the cost per ton will be considerably lower and in total material cost for the ATS will be approximately half of an equivalent

lattice tower. With regards to production, casting of elements is a quite simple process and production costs for casting of elements are lower than for production of steel lattice towers.

5 4. Rigidity/stiffness

From a construction point of view, concrete offers benefits compared with steel structures like for example sway damping and wear out.

5. Weight/Foundation

10 Forces that act on a tower are related to wind. Design parameters are wind area, wind speed, surface factors, return period, terrain category etc. In order not to turn over when exposed to wind, towers use a foundation. A prevailing foundation technique for steel lattice towers is
15 a raft and chimney construction made of on site cast concrete. Example concrete raft volume is approximately 35 cubic meters (m³), of course dependent on height of tower and load cases etc, but as a rule of thumb. Translated into weight it is equivalent to approximately 85 tons. A
20 preferred ATS has a typical calculated weight of approximately 30 tons (13 cubic meters concrete). The ATS has a majority of its weight close to ground, which makes it a very stable construction with regards to overturning. Total weight above ground of the ATS means that the need for
25 a foundation decreases, or is made differently. The foundation for the ATS will be made by expandable steel piles sometimes in combination with soil anchors. This is a quick and less costly method than on site cast foundation.

6. Free shaping

30 Concrete can be shaped into any form and/or color. Exact replicas can be made in thousands from the same mould. This

is an intention with the ATS, to create different and unique shapes. Lattice steel does not have this freedom.

7. Environment

Production of steel is energy consuming. According to
5 statistics of Embodied Energy Coefficients developed at
Victoria University, Wellington NZ, galvanized virgin steel
has a coefficient of 34.8 MJ/Kg. Pre-cast concrete typically
require 2.0 MJ/Kg. The ATS body consists of reinforced pre-
cast concrete. According to index steel rebar has a
10 coefficient of 8.9 MJ/Kg which is one component in the tower
tube. Calculated for a preferred tower tube is ~200 kg
reinforcement per cubic meter of concrete. This implies 1780
MJ for the rebar in every cubic meter of concrete. Example
tower tube consumes approximately 13 cubic meters concrete.
15 Concrete has a specific weight of approximately 2500 kilo
gram / cubic meter. This implies 2×2500 MJ per cubic meter
of concrete. In total a preferred example of a tower will
have a coefficient of $13 \times (1780 + 5000)$ MJ = 88,140 MJ. A
steel lattice tower (40 meters) has an approximate weight of
20 9.000 kg. 9000×34.8 MJ = 313,200 MJ.

Thus, the ATS of the example consumes about 25 % of the
energy required to produce an equivalent lattice tower.

Summing up, the ATS of the present invention is considered
to have many benefits compared to prior art towers/masts
25 created from other materials than concrete.

Figure 1 shows an antenna tower structure according to an
embodiment of the present invention. The tower structure 1,
including all its sections, is a thin wall construction,
leaving the entire tower structure to be hollow from its
30 lowest part to its top. The construction, including its
lower sections, may be insulated on its inside either during
manufacturing or after assembly. The sections are attached
to each other by bolts or adhesive or a combination of both.

Other techniques to attach the sections, such as but not limited to, welding, screwing, rivet together, locking mechanism, wedging are also to be used. The tower sections have an external 2 and an internal 3 wall part. A top
5 section 4 of the tower structure 1 is made of a material protecting the inside of the antenna tower structure 1, from for example rain and snow, and at same time not significantly attenuating passage of radio signals. Such material is for example fibre composites. According to a
10 preferred embodiment the ATS 1 has a plurality of controllable ventilation openings 5 at lower parts and higher parts permitting controllable air circulation causing a cooling mechanism inside the antenna tower structure 1. A lowest ground section 6 (base section, bottom section) is
15 attached to the ground by expandable piles 7 or as a traditional raft and chimney. An entrance 8 permits access to the inside of the tower and thereby access to a climbing facility 14, an antenna radio base station (RBS) elevator 10 and to the antenna RBS 9. The elevator 10 is controlled by
20 an elevator system 11 permitting lowering and raising of the whole antenna RBS 9. Alternatively a second elevator system 11 is used for a personnel elevator 12. Preferably, the personnel elevator 12 is constructed as a cage protecting a person inside the elevator 12 from sharp edges in the inside
25 part of the ATS 1. A purpose of the climbing facility 14 and the second elevator system 11 is to give access to the antenna RBS 9 at any position of the antenna RBS 9. When the tower structure 1 is manufactured metal mesh, rebar, is included in the mould giving every section of the tower 1 an
30 integrated metal mesh structure, which after assembly and connection will give the inside of the entire tower structure a Faraday shield similar functionality, i.e. Lightning Protection Shield (LPS) 13. Example materials in the tower is for the purpose of this invention, steel
35 fibrous cement based composites i.e. concrete blended metal mesh and/or rebar. Other materials are also to be considered

able, are such as, but not limited to, metal, plastics, cement based materials, wood, glass, carbon fibre and composites of the same.

5 In a preferred alternative, the ATS 1 is constructed in one piece wherein the hollow structure, from ground level to tower top, allows telecom equipment to be hoisted up and down inside the structure in an indoor environment.

10 According to an embodiment of the invention, the preferred conical shape of the ATS will force hot air to rise from the base section 6. Since the tower is so tall there will be an over pressure at the top section 4 of the conical antenna tower structure 1 and an under pressure at the base section 6. This will make the construction into a huge "air pump", which will function as its own free cooling system simply by
15 using the laws of physics.

Many benefits are achieved by being able to have a construction permitting placing a whole antenna Radio Base Station in top of an antenna tower structure, as in the present invention. Such benefits are for example:

- 20 - installation simplicity;
- optimal radio transmission usage. Short feeders mean that a need for tower mounted amplifiers are minimized;
- possibility to manage all possible radio standards (RBS, micro wave links, radar systems etc);
- 25 - requiring only standard radio equipment for indoor environment;
- requiring only standard antenna equipment for indoor environment;

- possibility to manage a combination of different radio standards with almost no loss at all, for example by implementing multi antenna solutions;
- possibility to manage multi antenna solutions;
- 5 - possibility for multi sector solutions.

Figure 2 describes a non exclusive example of a base section 6 of the ATS 1 with geometry suitable for pile 7 foundations. According to the figure, the base section 6 is typically around 5000 mm and has a preferred shape of a circle. Typically 8-12 piles are used to attach the base section 6 to ground. Alternatively, the base section 6 is directly cast or mould into ground, by aid of a foundation part. The size and shape is not by any way limited to 5000 mm and circle shaped. Other examples of shapes are oval, square, rotating, triangular, rectangular, hexagonal, octagonal etc. The base section 6 includes one or more entrances 8, not shown in the figure, giving access to an inside part of the antenna tower structure 1. One or more controllable ventilation openings 5 at the base section part 6 permits controllable air intake for air circulation causing a cooling mechanism inside the antenna tower structure 1. The base section 6 (bottom section), which is hollow, is large enough to fit most equipment configurations in an indoor environment. The base section 6 is typically insulated, and that insulation is attached in mould and fitted while the sections are being cast. Electrical conduits are placed in the mould as well as other details. A benefit of having a hollow construction is avoidance of a separate shelter. Requirement for site fence is also avoided due to tower base natural scale protection and anti climbing geometry.

As an alternative, the base section 6 is built in separate parts which are to be put together on place.

Figure 3 illustrates an example of a foundation geometry top view according to an embodiment of the present invention. According to the figure, twelve expandable piles 7 are used to attach the base section 6 into ground. One or more
5 controllable ventilation openings 5 at a ground level permitting a controllable intake for air circulation inside the antenna tower structure 1 causing a cooling mechanism. Notice that figure 2 and figure 3 only give a description of examples of base sections used for explaining the present
10 invention.

As described above, by totally enclosing all equipment into a construction having a "Faradays cage" similar functionality, both people and equipment will be protected from lightning strikes. According to an embodiment or the
15 present invention it is possible to have a pre-constructed lightning protection system directly from factory or manufactured at place without the complexity and cost expensive procedures of prior art techniques.

Figure 4 illustrates an example of a typical construction of
20 a tower top section. The top section 4 is made of fibre glass or other material protecting the inside of the antenna tower structure, for example from rain and snow, and at the same time not significantly attenuating passage of radio signals. An antenna Radio Base Station (RBS) 9 is placed at
25 the top section 4 during operation. The antenna RBS 9 is further attached to at least one radio antenna 21 and at least one micro wave link. Metal mesh "rebar" and/or lightning protection system 13 are built in into each section of the tower antenna structure 1. Also the top
30 section 4 is typically insulated, and that insulation is attached in mould and fitted while the sections are being cast. A climbing facility 14 gives access to the antenna RBS 9 at any location of the antenna RBS inside the ATS 1. This is important when to perform maintenance on the antenna RBS
35 9, without requiring radio down time, i.e. interruption in

radio transmission. An elevator 10 is used to lower the antenna RBS 9 when/if absolutely needed. The elevator might be used by personnel as well when a minimum radio down time is considered as acceptable. Alternatively, a second
5 elevator 12 is included in purpose to be used by personnel. One or more controllable ventilation openings 5 at the top section 4 permits controllable air intake for air circulation causing a cooling mechanism inside the antenna tower structure 1. Additional mechanical cooling means, i.e.
10 air conditioning system, is most probably needed and typically placed in the base section 6 of the antenna tower structure 1.

Other examples of antenna tower structures are described in Figure 5. A height of 40 000 mm is used in the examples,
15 though the tower is not by any means limited to the sizes and shapes described in the figure. Other relevant antenna tower structure heights are all between 15 to 45 meters. Typical minimum base section 6 width size is 5 meters. Different conical shapes are suggested in figure 6, but
20 other shapes are also under consideration. Sections are formed upon request and can be made to represent a signature as of an operator or to better fit into a landscape view. From a business perspective an important aspect of the present invention is to introduce a costumer specific
25 antenna tower shape(s), working as a signature for an operator. As an alternative aspect, the antenna tower structure may form part of a support for an advertising board.

Figure 6 is a flow chart illustrating steps of a method
30 according to an embodiment of the present invention. The flow charts relates to a method of manufacturing one or more sections of a radio base station antenna tower structure for use in a wireless communications network. A first step (S1) comprises casting the antenna tower structure sections into
35 tubular tower sections having a hollowed cross section. A

second step (S2) arranges at least one antenna tower structure section with entrance into the antenna tower structure. A third step (S3) arranges the antenna tower structure sections for a mechanism for moving at least a whole antenna radio base station inside the antenna tower structure. A fourth step (S4) arranges the antenna tower structure sections for inclusion of a service access system. Alternatively a following fifth step (S5) is introduced, the step of assembling sections into forming a conical shaped antenna tower structure.

According to a further embodiment of the invention the sections are cast in concrete, and arranged with a climbing facility and/or an elevator system that in combination with the at least one entrance gives access to the whole base station unit. Access is given at any position of the base station unit inside the completed antenna tower structure. Thus, the climbing facility and/or the elevator system permits the antenna radio base station, comprising at least one antenna and at least one micro wave link, to be rigidly connected both in operation and in service mode.

According to yet a further embodiment of the invention the antenna tower structure sections are made to fit together into forming a complete antenna tower having a conical shape. The sections are put together by such a procedure as but not limited to, welding, screwing, rivet together, locking mechanism or wedging. The sections are cast into any of the following shapes oval, square, rotating, triangular, rectangular, hexagonal, octagonal etc. An antenna tower structure top section is made in a form and of a material protecting the inside of the antenna tower structure, from for example rain and snow, and at the same time not significantly attenuating passage of radio signals.

Figure 7 is a block diagram illustrating a system for wireless communication in accordance to an embodiment of the

present invention. The wireless communications system 30 comprises one or more antenna tower structures 31 each equipped with at least one antenna Radio Base Station 9 serving as an access point for user equipments 32. The
5 antenna tower structures of the system are being cast and divided into tubular tower sections having a hollowed cross section. The sections are equipped with an arrangement for moving a whole antenna radio base station along the elongation of the antenna tower structure, wherein the
10 antenna radio base station is being disposed inside the tubular tower. Each antenna tower structure have at least one entrance into the antenna tower structure giving access for service of the antenna Radio Base station 9. The system 30, permits operator specific antenna tower structure
15 designs (OP1, OP2, OP3, OP4, OP5 etc).

In a further embodiment, operator specific designs makes it more simple for service personnel to identify a specific antenna tower structure among other towers, wherein
20 equipment in the tower is to be served, updated or reconfigured.

While the invention has been described with reference to specific exemplary embodiments, the description is in general only intended to illustrate the inventive concept and should not be taken as limiting the scope of the
25 invention.

It will be understood by those skilled in the art that various modifications and changes may be made to the present invention without departure from the scope thereof, which is defined by the appended claims.

30

CLAIMS

1. An antenna tower structure for use in a wireless communications network comprising one or more Radio Base Stations (RBSs), the tower being characterised by:
 - 5 - tubular tower sections having a hollowed cross section;
 - the antenna tower structure having an arrangement for moving a whole antenna radio base station along the elongation of the antenna tower structure, the antenna radio base station being disposed inside the tubular tower; and
 - 10 - at least one entrance into the antenna tower structure giving access for service of the antenna Radio Base station.
2. An antenna tower structure according to claim 1 wherein the tubular tower sections are made of concrete.
3. An antenna tower structure according to any of the
15 preceding claims wherein the at least one entrance gives access to the whole antenna radio base station at any position of the antenna radio base station inside the antenna tower structure, by aid of moving arrangement, a climbing facility and/or an elevator system.
- 20 4. An antenna tower structure according to any of the preceding claims wherein the antenna radio base station, comprising at least one antenna and at least one micro wave link, is rigidly connected both in operation and in service mode.
- 25 5. An antenna tower structure according to any of the preceding claims wherein the tower sections comprise ends that fit together into forming the conical shape.
6. An antenna tower structure according to claim 1 wherein the tower sections, having each a hollowed cross section,

belongs to any of the following shapes oval, square, rotating, triangular, rectangular, hexagonal, octagonal etc.

7. An antenna tower structure according to any of the preceding claims wherein the tower sections are to be
5 constructed in such a way permitting on field manufacturing.

8. An antenna tower structure according to any of the preceding claims wherein a top section of the antenna tower structure is made in a form and of a material protecting the inside of the antenna tower structure, from for example rain
10 and snow, and at the same time not significantly attenuating passage of radio signals.

9. An antenna tower structure according to any of the preceding claims wherein all equipment inside and the inside of the antenna tower structure are enclosed as in a Faradays cage, i.e. built in to be protected from lightning strikes.
15

10. An antenna tower structure according to claim 9 wherein the Faradays cage similar functionality is achieved by including metal mesh and/or conductors in every section of the antenna tower structure 1 and thereby achieving an
20 integrated electricity conducting structure, which after assembly functions as a Lightning Protection Shield, LPS.

11. An antenna tower structure according to any of the preceding claims wherein a bottom section part of the antenna tower structure is constructed in such form
25 permitting directly earth attachment, i.e. with expandable piles and/or anchors, without requiring additional construction work.

12. An antenna tower structure according to any of the preceding claims wherein the antenna tower structure has a
30 plurality of controllable ventilation openings at lower parts and higher parts of the antenna tower structures

permitting controllable air circulation causing a cooling mechanism inside the antenna tower structure.

13. An antenna tower structure according to any of the preceding claims wherein the tower forms part of a support
5 for an advertising board.

14. Antenna tower structure according to any of the preceding claims wherein the antenna tower structure has a typical height between 15 to 45 meters.

15. A method of manufacturing one or more sections of a
10 radio base station antenna tower structure for use in a wireless communications network, the method characterised by;

- casting the antenna tower structure sections into tubular tower sections having a hollowed cross section;
- 15 - arranging at least one antenna tower structure section with entrance into the antenna tower structure;
- arranging the antenna tower structure sections for a mechanism for moving at least a whole antenna radio base station inside the antenna tower structure; and
- 20 - arranging the antenna tower structure sections for inclusion of a service access system.

16. The method of claim 15, wherein one or more sections are cast in concrete.

17. The method of claim 15, wherein the sections are
25 additionally arranged with a climbing facility and/or an elevator system that in combination with the at least one entrance gives access to the whole base station unit at any position of the base station unit inside the completed antenna tower structure.

18. The method of claim 17 wherein the climbing facility and the elevator system permits the antenna radio base station, comprising at least one antenna and at least one micro wave link, to be rigidly connected both in operation and in
5 service mode.

19. The method of any of claims 15-18 wherein the antenna tower structure sections comprise ends that fit together into forming a complete antenna tower structure having a conical shape.

10 20. The method of claim 19 wherein the sections are put together by such a procedure as but not limited to, welding, screwing, rivet together, locking mechanism or wedging.

21. The method of any of claims 15-20 wherein the antenna tower structure sections, having each a hollowed cross
15 section, are cast into any of the following shapes oval, square, rotating, triangular, rectangular, hexagonal, octagonal etc.

22. The method of any of claims 15-21 wherein the antenna tower structure sections are to be constructed in such a way
20 permitting on field manufacturing.

23. The method of any of claims 15-22 wherein a antenna tower structure top section is made in a form and of a material protecting the inside of the antenna tower structure, from for example rain and snow, and at the same
25 time not significantly attenuating passage of radio signals.

24. The method of any of claims 15-23 wherein a Faradays cage similar functionality is achieved by including metal mesh and/or conductors in every section and thereby achieving an integrated electricity conducting structure,
30 which after assembly functions as a Lightning Protection Shield, LPS.

25. The method of any of claims 15-24 wherein a bottom section part of the antenna tower structure section is constructed in such form permitting directly earth attachment, i.e. with expandable piles and/or anchors,
5 without requirement for additional construction work.

26. The method of any of claims 15-25 wherein lower and higher antenna tower structure sections comprise at least one controllable ventilation opening.

27. The method of any of claims 15-26 wherein at least one
10 section of the antenna tower structure comprises support for an advertising board.

28. The method of any of claims 15-27 wherein the sections after assembly form a conical antenna tower structure with a typical height between 15 to 45 meters.

15 29. A method of manufacturing a radio base station antenna tower structure for use in a wireless communications network, the method characterised by;

- casting a first tubular tower section having a hollowed cross section;
- 20 - casting a second top section having a hollowed conical shape with a closed upper part;
- arranging the first tubular tower section with at least one entrance;
- arranging the first tower structure section for a
25 mechanism for moving at least a whole antenna radio base station along the elongation of the first tower structure; and
- arranging the antenna tower structure sections for inclusion of a service access system.

30. A wireless communications system comprising one or more antenna tower structures each equipped with at least one antenna Radio Base Station serving as an access point for user equipments, the wireless communications system
5 characterised by the antenna tower structures being cast and divided into tubular tower sections having a hollowed cross section, having an arrangement for moving a whole antenna radio base station along the elongation of the antenna tower structure, the antenna radio base station being disposed
10 inside the tubular tower, and wherein each antenna tower structure has at least one entrance into the antenna tower structure giving access for service of the antenna Radio Base station.

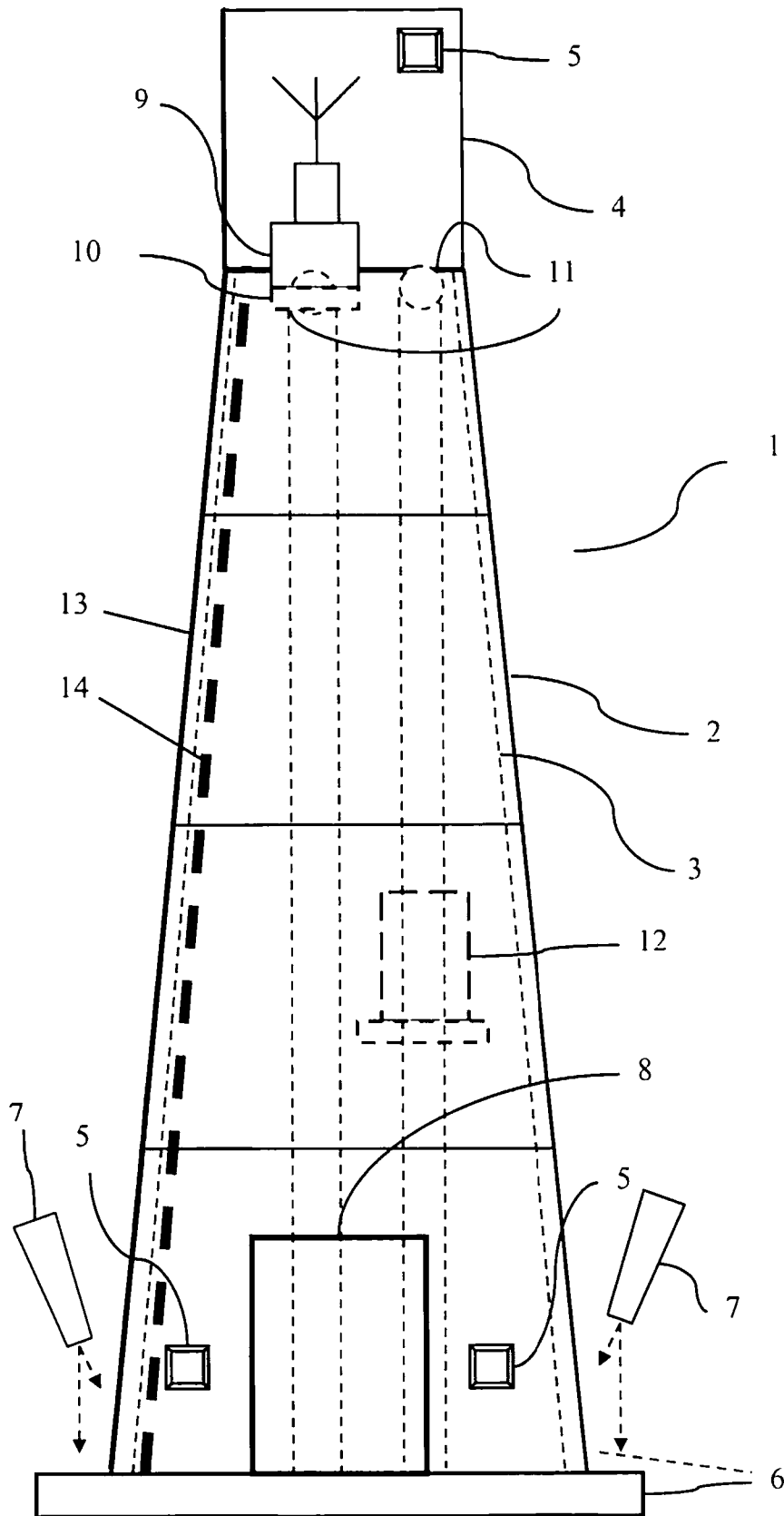


FIG. 1

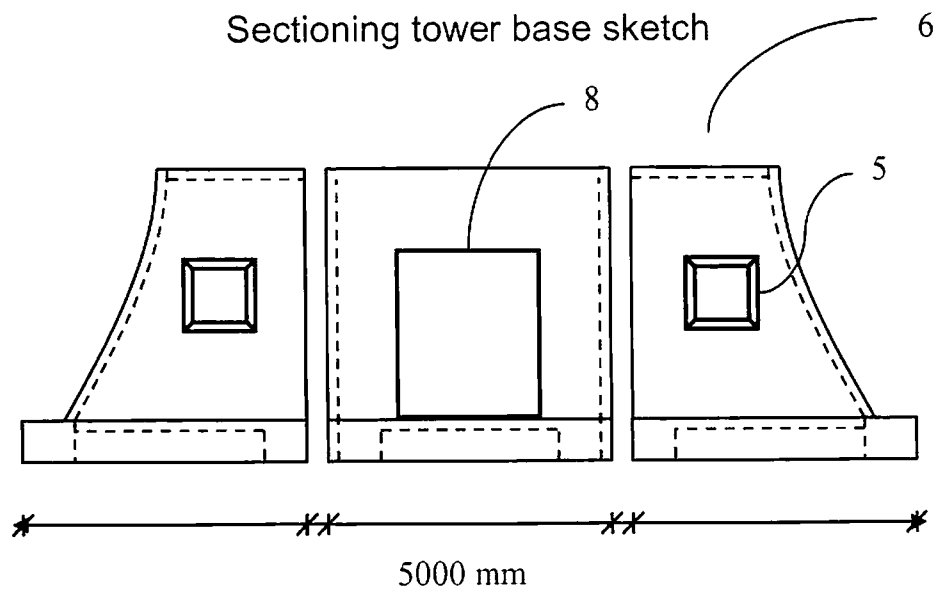


FIG. 2

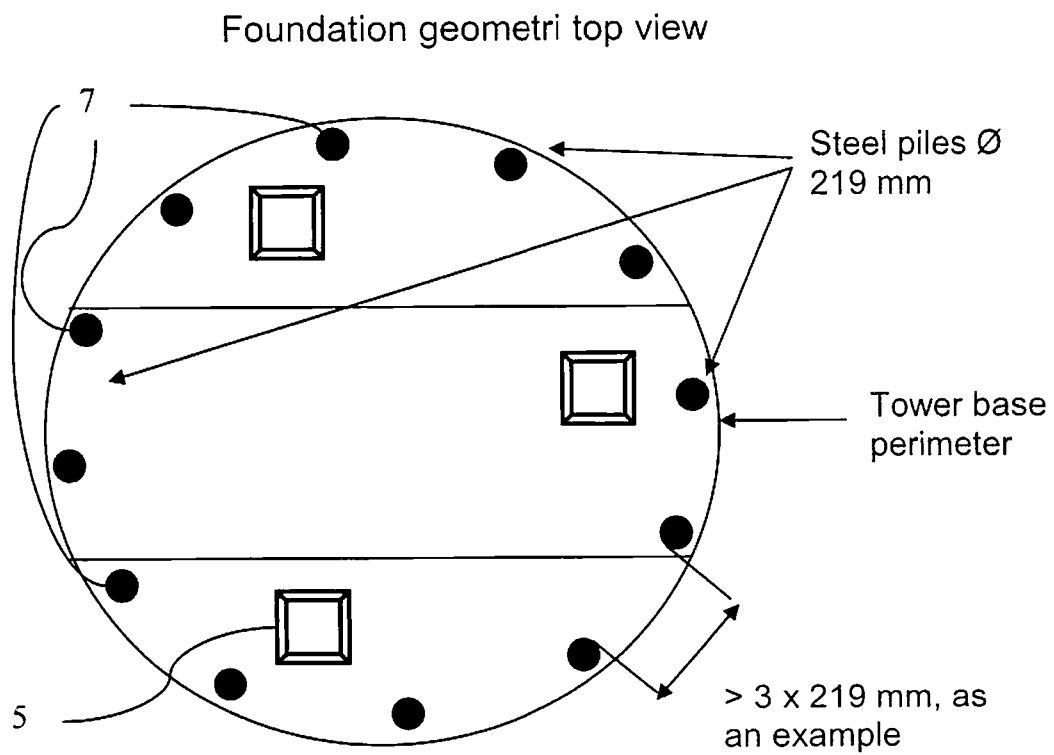


FIG 3

Basic example of an antenna tower structure top

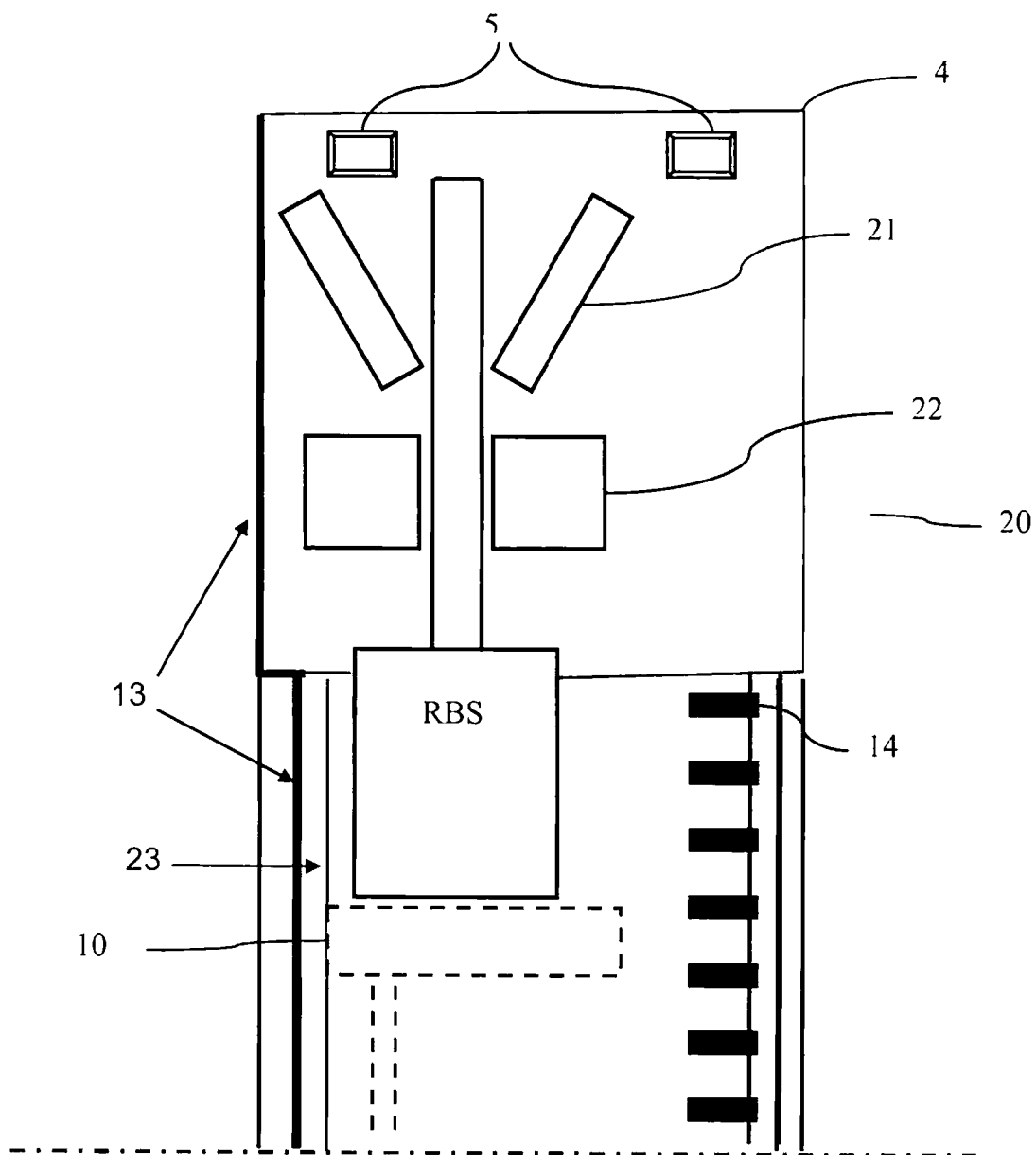
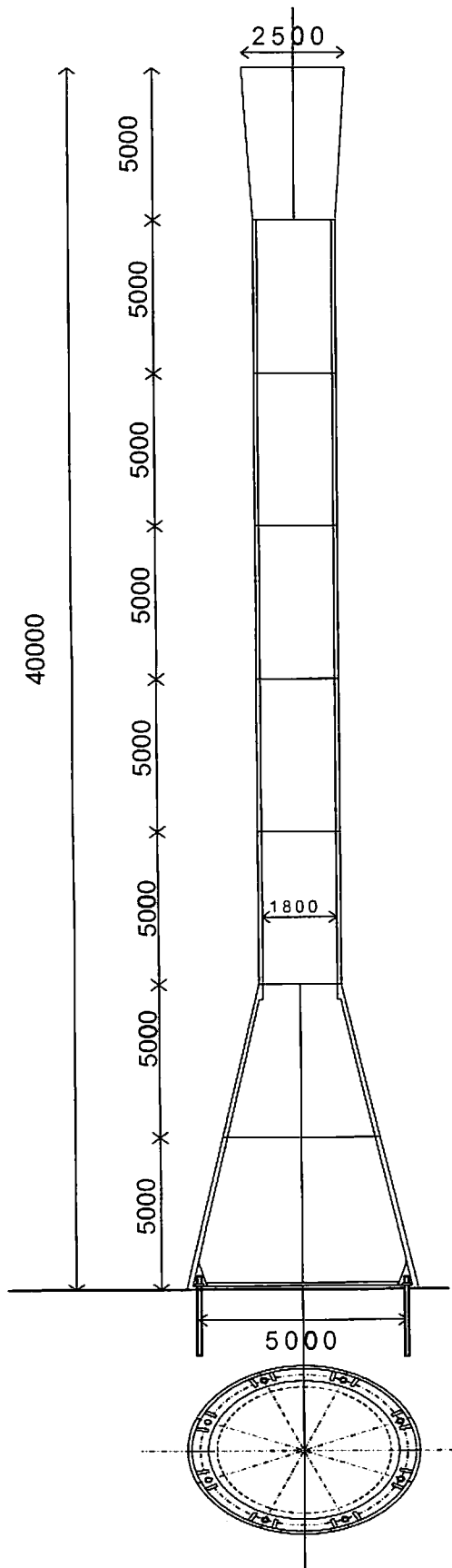
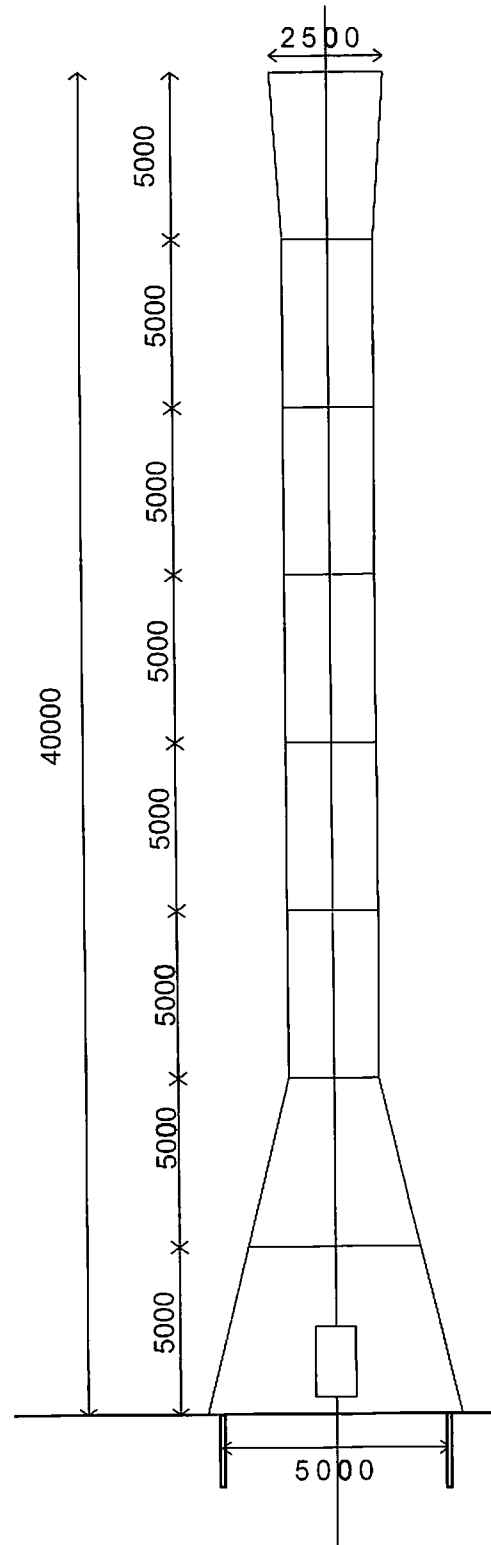


FIG. 4



Mast elevation Scale 1:200



Mast elevation Scale 1:200

FIG. 5

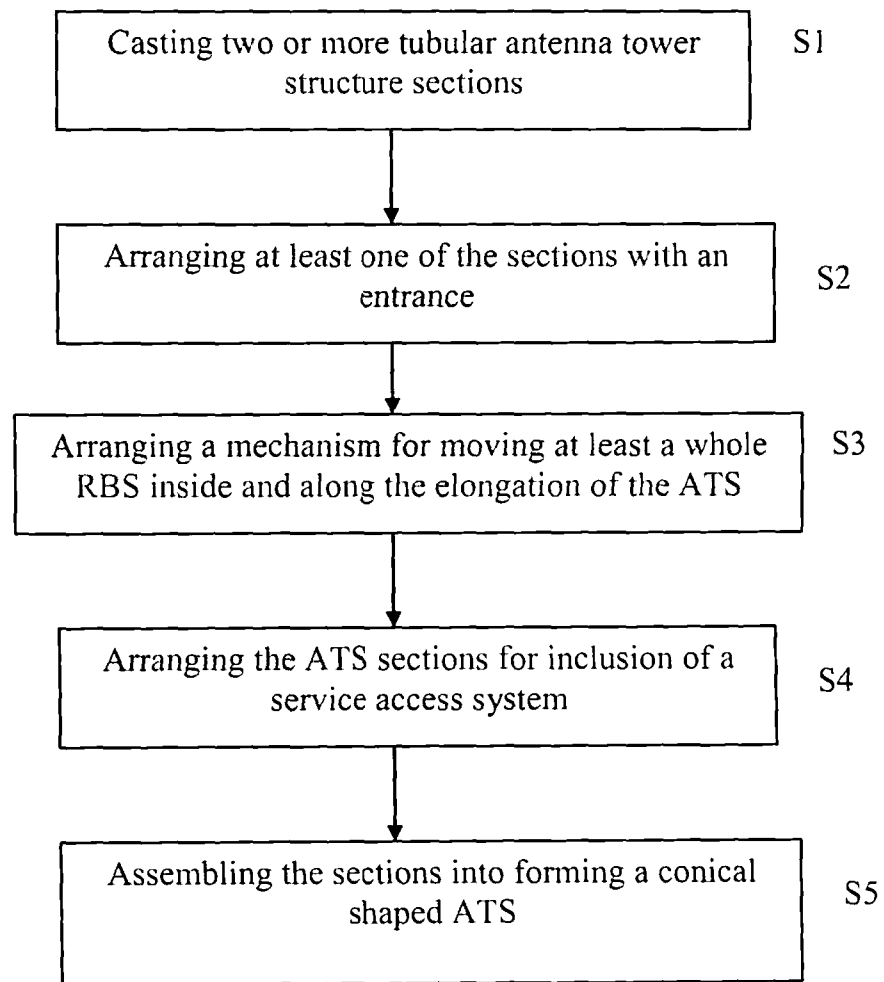


FIG. 6

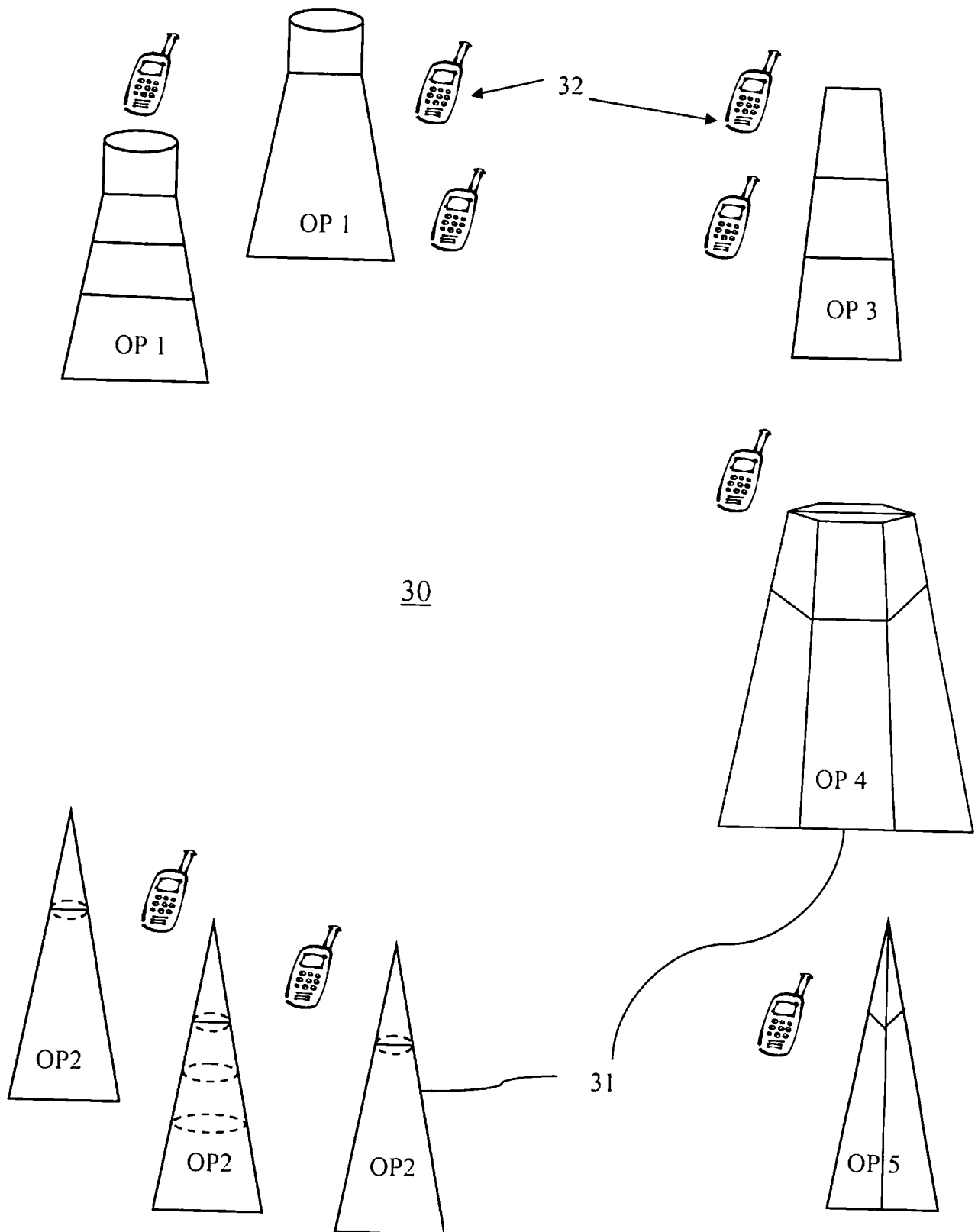


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2006/050584

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H01Q, E04H

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

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6335709 B1 (CUMMINGS, C S), 1 January 2002 (01.01.2002), figure 1, claim 1, abstract --	1-30
A	US 5969693 A (LEGG, D R), 19 October 1999 (19.10.1999), figures 1,2,4, abstract --	1-30
A	US 6131349 A (HILL, D L), 17 October 2000 (17.10.2000), abstract -- -----	1-30

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

26 January 2007

Date of mailing of the international search report

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International patent classification (IPC)**H01Q 1/12** (2006.01)**E04H 12/12** (2006.01)**Download your patent documents at www.prv.se**

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2006/050584

US	6335709	B1	01/01/2002	NONE		
US	5969693	A	19/10/1999	CA	2251422 A,C	10/05/1999
US	6131349	A	17/10/2000	US	5941036 A	24/08/1999
				AU	6662398 A	22/09/1998
				CA	2281510 A	11/09/1998
				EP	0968344 A	05/01/2000
				US	5904004 A	18/05/1999
				WO	9839537 A	11/09/1998