Title: ANTENNA BOX FOR EXAMPLE TV-RECEPTION AND A METHOD FOR PRODUCING SAID ANTENNA BOX

Abstract: The present invention relates to an antenna box (1) for example TV-reception comprising: a number of dipole elements (2), a cover (3) functioning as a radome, means (4, 6, 10) for mounting the box (1) to a wall or similar, a balun (7), a back plane (6) and a reflector (5). The antenna box (1) is further distinguished in that the reflector (5) constitutes the inside of the back plane (6), that the dipole elements (2) are attached to the inside surface of said cover (3), that the box (1) comprises means for pivoting said antenna box (1) when the box is mounted to a wall or similar, and that the back plane (6) and the cover (3) essentially functions as the supporting structure of the antenna box. The present invention also relates to a method for producing an antenna box (1).
Antenna box for example TV-reception and a method for producing said antenna box.

TECHNICAL FIELD

The present invention relates to an antenna box for example TV-reception and a method for producing said antenna box. The antenna box for example a TV-reception comprises; a number of dipole elements, a cover functioning as a radome, means for mounting the box to a wall or similar, and a reflector.

STATE OF THE ART

TV-reception is today done by some basic means;
- Ground based TV-distribution from broadcasting antennas, UHF, VHF frequency bands.
- Cable TV, like 'Comhem' etc.
- TV distribution over satellite 14/12 GHz.
- TV over internet/broadband, being likely to become more important in the years to come.

The product application concerns antennas for reception of ground based Television distribution, now being done in the VHF (47-68 and 174-230 MHz) and in the UHF (470-854 MHz) frequency bands. Normally dipole antennas of different kinds are used, which are the antennas that are of interest. The gain achieved and needed in these applications are in the interval of 10-14 dBi. This is normally sufficient for a small house with a small number of TV-sets without any need for active amplification.
Antennas in these applications are normally based on dipoles in different open skeleton type configurations, where the dipole elements are adapted to the wavelength for the used frequency.

Studying passive antennas satisfying most existing needs, there are some basic types and solutions dominating the market today. The size of the antennas and the dipole elements are given by the frequency and need of gain. The need of gain increases with the distance to the transmitter. The need of gain is normally for these antennas from 5-14 dBi.

The use as passive antennas, i.e. without signal amplification, satisfies the needs for most existing sites and locations, for a limited number of users, considering villas and small houses. For a higher number of users per antenna and longer cabling distances amplification is needed even for the high performing antennas.

The antenna structures are normally built up from aluminium wire and plate, with plastic mechanical details for mounting purposes. The antenna elements and the complete structures are not covered with any radome or weather protection, except for mounting details and the connection box with the balun. The balun is a realised on a PCB circuit board, having the function to adapt the feed of the antenna to an electrical coaxial cable connecting the antenna. The assembling of the antennas are done, normally manually using screws.

The antennas are not supplied with any special devices for the function for alignment/panning. This function is realised by loosening the antenna mount, turning the antenna around the mounting pole. This is normally a complicated procedure, due to
the common location on the roof, and since the antenna loses its mounting grip in the mounting pole, it may drop down from its position.

5 The Yagi antenna.
The classical solution for antennas in this application is the Yagi antenna.
The Yagi consists of the following main elements.
- Dipole antenna element made by aluminium wire.
- Antenna reflector, in a vertical angle reflecting signal towards the horizontal dipole.
- Directors, mounted on a beam in front of the dipole
- Balun. Adapting antenna feed to coaxial cable.
- Mount mechanics

15 The antenna and structure parts normally are made of aluminium, wire/sheet or plastics. Smaller plastic parts are used for assembling, mounting and protection functions (the balun).

20 The Yagi antennas as used and known today in these applications is mounted on a pole. The pole is mounted normally on the roof of a villa or house or in the free nature. Reason for this type of mounting, is the design and mounting position of the antennas, causing a need for open space around the mounting point/pole, normally 1 - 2 m radius in used designs. Another advantage with a high mounting position of the antenna is from a reception point of view. Normally free sight to a sending antenna is needed in order for the antenna to operate with full performance. In some mounting locations this might be achieved by going from ground plane to the roof of the house. This advantage however will however occur only
in rare special cases, in a limited number of places/sites/locations.

From the discussion above there are some obvious disadvantages with this type of antenna.
- The antenna consists of many parts making it comparatively expensive to produce.
- The type of mounting requires need for additional mounting pole/mechanics
- The mounting position, normally on a roof, makes mounting and adjusting complicated.
- The antennas do not comprise any suitable easy handled panning function.
- The antennas are not protected for weather meaning long term degradation.
- The antennas attract birds being a suitable resting place, meaning spread of dirt etc.
- The visual aspect on an attractive looking villa is an obvious disadvantage.

The grid antenna.
The grid antenna is a quite new type of antenna used in these applications, being built up from the following parts.
- Dipole antenna elements made by aluminium wire or sheet.
- Feed to the antenna elements.
- Balun, adapting antenna feed to coaxial cable.
- Flat net/grid reflector behind the antenna elements.
- Mounting mechanics holding the antenna elements in front of the reflector.
- Pole mounting mechanics.
Vital parts are made of aluminium (wire/sheet/tube) or plastics. Some minor mounting mechanics is made by polymer material.

This antenna is built up from normally two or four dipoles mounted vertically over one another connected centrally by the feed to the balun in middle of the antenna.

The mounting concept on a pole is the same as for the Yagi antenna. The disadvantages here of interest are about the same as for the Yagi antenna, with some differences. One advantage with this type of antenna compared to the Yagi antenna is that, even though it requires a lot of free space around it, it requires less free space than the Yagi antenna.

For panning antennas of Yagi and grid type, the fastening grip is loosened and the antenna is turned around the pole. This has the obvious disadvantage that the antenna has a tendency to slip down on the pole during the pivoting process. Panning becomes a complicated process.

The mounting mechanics must be very rigid and stiff, since they are mounted around a pole, basically in one point with close located screws, and the loads results in a big momentum coming from mechanics at long distances from the fixation point.

From a market point of view the purchase of all needed antenna mechanics becomes more expensive and complicated.

Also the mounting process becomes much more complicated.

- First the stiff, heavy and expensive base structure mechanics for the vertical tube is mounted to its base,
being a wall on the roof, like the chimney or similar. Big screws of a dimension 6 x 20 mm may be needed. Rigid walls are necessary, preferably brick or concrete, making drilling and plugging needed.

- At least three big stiff screws are normally used and needed, since in the centre of forces from weight, vibration and wind on and from antenna applies from long distance, 1-3 meters resulting in a big momentum on the mounting structure fixation point.

- Thereafter the vertical tube is mounted to the base mechanics. At least one big screw is needed. Normally at least of size M8.

- Premounting is normally needed for Yagi-Antennas taking them out from the transport box. Otherwise the transport dimensions becomes to big. Also for Gitter antennas some level of premounting is needed, due to the need of bringing down the transport dimensions.

- Finally the antenna is mounted, fixing its mount mechanics and fixing the screws to the antenna pole mounting.

Having prepared for panning, studying signal level, the antenna mounting screws are loosened again. For normal private installers, not having a signal level meter available, an additional person is needed studying the TV-image or the signal level in the digital TV-Box.

From logistic point of view there are obvious disadvantages with the above mentioned antennas. The antenna has a considerable weight of typically 2 kg. Even if some antenna parts of mechanics are dismounted and fitted into a box, the box becomes quite big, typically 85 x 50 x 15 cm. Moreover the additional
mounting mechanics is needed with considerable weight and awkward dimensions. The base structure and metal pole with lengths between 1.5 and 3 meters adding to typically 10 kg or more.

From a logistic viewpoint these designs are unfavourable, needing to administer, handle, transport, stock and sell three big major parts; the antenna box, the long tube being awkward to handle, and the tube/wall mounting structure which spread out in three dimensions being awkward to handle.

There is also a negative visual aspect having an antenna on the roof.

Another disadvantage is personal security with the free sharp antenna elements in the air in the described existing design.

Small, low performance antennas.
There are small antennas available, often with a small antenna element, often realised on circuit boards. These normally have very poor antenna performance, needing active amplification to be possible to use in normal/needings conditions.

These antennas typically have gain figures below 5 dBi, and are not considered to be of interest for deeper considerations and comparisons with the high performance fixed antennas here discussed. Applications are indoor use close to transmitter, mounting on boats & caravans.
SUMMARY OF THE INVENTION
The present invention attacks the above mentioned disadvantages with prior-art antennas.

One object of the present invention is thus to provide an antenna box for TV-reception that is esthetic, cheap and simple to produce, and that also is easy to mount for the end user and that also has performance characteristics of the same order as the prior art antennas.

The present invention is essentially characterized in that the reflector constitutes the inside of the back plane, that the dipole elements are attached to the inside surface of said cover, that the box comprises means for pivoting said antenna box when the box is mounted to a wall or similar, and that the back plane and the cover essentially functions as the supporting structure of the antenna box.

Another object of the invention is to provide a method for producing the antenna according to the invention. This method is described in the independent method claim.

Disadvantages of the prior art are also solved by an antenna box for e.g. TV-reception according to the invention comprising; a number of dipole elements, a cover functioning as a radome, means for mounting the box to a wall or similar, a balun, a back plane and a reflector. The box is preferably mounted to the wall or similar by fixing a mounting bar of the box to the wall using screws or similar. The reflector constitutes the inside of the back plane and the back plane and the cover essentially functions as the supporting structure of the antenna box. On one side of the
box mounting means is provided around which the box is arranged to pivot. Preferably the main part of the box is pivotally attached to the mounting bar via a screw or similar that can be loosened whereby the box can be pivoted and thereafter the screw can be tightened such that the box can be fixed in a desired position. On the other side of the box, the box is provided with retaining means for further fixing the box in the desired position.

The box design allows for fixing with screws at distance which makes forces in mechanics much lower and lighter and smaller overall design can be achieved.

The transport box for the invention including all mounting mechanics will now only have dimensions of about 47 x 40 x 14 cm, and the weight will be around 2 kg. No premounting is needed. Further embodiments of the present invention are described in the accompanying claims.

The invention will now be further described using preferred embodiments and with reference to accompanying drawings.

DESCRIPTION OF THE DRAWINGS
Fig. 1 shows an exploded view of an antenna box according to a preferred embodiment of the present invention.

Fig. 2 shows a radome assembly with radome cover, dipole elements and balun, according to a preferred embodiment of the present invention.

Fig. 3 shows a front and a back view of a back plane assembly with back plane, reflector, mounting bars and a mounting bracket.
Fig. 4 shows an antenna box according to the present invention mounted to a wall.

Fig. 5 shows an antenna box according to the present invention mounted to a wall by using further retaining means.

DETAILED DESCRIPTION

Fig. 1 shows an exploded view of an antenna box 1 according to preferred embodiment of the present invention. The antenna box 1 comprises a number of dipole elements 2, a cover 3 functioning as a radome, a mounting bracket 4 for mounting the box to a wall or similar, a reflector grid 5, a back plane 6, a balun 7, a cable 8, a contact 9, and a mounting bar 10. The dipole antenna elements 2 are thus included in a closed box structure, which is a new design for antennas for the above discussed antenna applications.

Housing different kinds of electric equipment in a box design is in itself widely used for housing different kinds of electric equipment. It has however not, to our knowledge, been used earlier for these kind of antennas, i.e. high performance dipole configurations for TV-reception.

Covers/hoods for other antennas are used since many years, and they are normally made of some type of plastic material. Covers protecting antennas, making the electromagnetic fields to pass satisfactory are called radomes. These are normally put around the antenna structure being mounted to the base mounting structure of the antenna.

Mechanical structures are often cheaper to realise with plastics.
Box design is a very effective design to optimise material use and cost with regard to functions required, i.e. mechanical performance, handling and stiffness. Extruded plastics give a lot of freedom in realisation of functions into one single unit.

Bigger freedom in design is achieved using plastics as outer carrying structure. Metal such as aluminum is primarily used for realisation of electrical functions, in the amount needed for electrical performance optimisation with regard to costs etc.

Implementing the box design makes it possible to add additional and new features, functions and improvements in the realisation of these antennas:
- Antenna function elements become protected from handling defects and weather degradation.
- Antenna element is mounted/integrated in the cover, which also acts as a radome. This allows for a lot of advantages as described below.
- A faster and cheaper assembling process becomes possible, due to its design in two separate units;
  - One radome assembly unit, with antenna elements, balun, cable and connector, and
  - One back plane assembly unit, with reflector and mounting mechanics.

These two units are suitable for fast and automated assembly procedures and snaps fast and easy into one another.
- There are no metallic parts between the antenna elements and the reflector. This improves the performance of the antenna, creating a well defined homogenous dielectric volume of only air, between antenna and reflector. In the grid antenna there are metallic mounting mechanics between the antenna elements and the reflector. Also for the Yagi antenna there are non desired metallic parts
used for the assembling of the antenna creating undesired and unpredictable reflections distorting the performance.

- Better transport, storing, handling conditions, since the box according to the invention has a more convenient shape.
- Highly effective processes for manufacturing of base mechanical structure, cover & mounting backplane becomes available; Extrusion of plastic material etc.
- No additional pole mechanics and fixations are needed.
- The overall supporting structure is made of the plastic box design instead of a metallic framework structure, making it more effective from material use and cost point of view.
- Less parts are needed for total function.
- No extra housing for the balun is needed, since the balun is satisfactorily protected by the antenna cover.

- Location with mounting on the wall is much easier than mounting on a pole, e.g. on the roof. Also functional control, replacement and service become easier for wall mount position. Due to the mechanical design outline of existing antennas for TV-reception it is not possible to mount these on a wall.

- The mounting of an antenna becomes much easier. The mounting bracket 4 in the antenna box 1 according to the invention needs merely to be secured to a wall using two screws. Then, the antenna can be hanged with a one hand grip/movement. Thereby a clear advantage over the complicated method of mounting the antenna on a pole is achieved. Mounting on the roof is of course also possible with this new design, e.g. if the altitude is needed to achieve a free open sight line to the transmitter. The antenna box can then for instance easily be mounted on a chimney, and of course is mounting on a pole for the need of a higher position still possible.
In only very rare cases the few gained vertical meters going from upper wall mount to chimney mount will make the needed difference in reception signal. Since the loss in reception signal is insignificant the wall mount have many advantages;

- Panning becomes much easier.
- The antenna can easily be panned into a proper direction and be tightened with a screw with a one hand grip.
- With the antenna element design of the present invention, having an antenna lobe that is wide enough in the vertical direction, no elevation panning is needed.
- Freedom in position. The antenna can be placed on any position on at least two walls of a house giving free line of sight access to the transmitter.
- The cover material is chosen allowing the box to be painted and thereby giving it the same colour as the surrounding wall. This lessens the visibility of the antenna making it far more esthetic than e.g. Yagi antennas and grid antennas.
- The antenna box 1 according to the invention can i.e. be made with either two or four elements, where two is considered to be enough for most locations. Four antenna elements would approximately give about 13 dBi antenna gain, and two antenna elements would approximately give about 10-11 dBi gain. The advantages of the box design are however more obvious for the smaller two element design.

The antenna elements 2 are according to the present invention preferably made of bent steel or aluminum.

Fig. 2 shows an attached radome assembly with radome cover 3, dipole elements 2 and balun 7, according to a preferred embodiment of the present invention. The cover hood 3, i.e. the radome,
functions as a mounting base for the antenna elements 2 and therefore no additional mechanical parts is needed for the attachment of the dipole elements. Thereby the antenna box is practically cleared from any signal disturbing parts. The only additional parts inside the box 1 are the balun 7, the coaxial cable 8 and the contact 9, resulting in an antenna with excellent properties.

By mounting the antenna elements 2 in the radome cover 3, the antenna elements also gets a good protected fixation giving a guaranteed shape of the antenna elements. In present solutions the unprotected antennas elements often becomes defected in the handling and mounting process.

Antennas designs with radome have been tested and the influence of the radome has been found to have very small or no negative effect. On the contrary, the radome can be used for positive influence on return loss choosing and adapting the design with regard to thickness and material. The hood acts as radome for the antenna element protecting the antenna and optimizing the performance through choice of design, material and dielectric constant. By fixing the antenna elements in the surface or within the radome cover, the distance between the radome and the dipole elements is constant causing the radome to have the same influence on the antenna regardless of the direction of the antenna.

The electrical reflector 5 can be made of a metallic net, acting as a grid reflector. The grid can then be fixed to the backplane by the vertical fixation bars 10, one on each end of the reflector. The bars can be snapped or screwed into the back plane 6. The reflector 5 can be optimized from cost and electrical
performance point of view with no regard to mounting stiffness supporting constraints. A reflector 5 can for example be realized with a thin layer of metallic conducting surface of the inside of the back plane, making the back plane and the reflector as one unit.

The bars 10 also constitute the mounting points to the mounting bracket 4 for the antenna. The bars are preferably made as U-bars, where the upper and lower ‘ears’ mounts to the mounting bracket. The lower fixing point can e.g. be a pin/hole configuration, designed for easy turning and low noise from e.g. vibrations. The antenna stays in place even if mounting/fixing screw is not tightened. The upper ‘ear’ allows for easy free hanging of the antenna, fixing it into proper alignment position by tightening the screw. The antenna can be fixed in either of the two bars 10, the choice is to be made depending on location/direction for line of sight access to the transmitter. The mounting bracket 4 and the bars 10 together form the function for very easy and fast wall mounting, panning and fixation, resulting in a very convenient design for these functions.

The antenna elements are preferably assembled by a high effective melting/welding process, cold high pressure deformation or hot welding, depending on material choice, steel or aluminium, where both have its advantages. In prior art designs the elements are normally screwed into the aluminium base structure, adding more components and assembling cost.

The antenna elements are according to a preferred embodiment glued or taped to the inside surface of the radome. This leads to a cheap and simple attachment of the dipole elements to the radome.
According to an alternative embodiment the antennas are snapped into the radome. An extruded plastic radome would be especially suitable for this embodiment in conjunction with producing big volumes. In this embodiment the dipole elements can easily be detached and attached from the radome.

According to another alternative embodiment, the antenna elements, as well as the balun, can also be a printed directly on the inside of the radome. This makes the manufacturing process even more effective, with fewer parts.

The antenna elements can also, in the production process, be molded into the inside of said cover. At least a part of the elements must however protrude from the cover to the inside of the box so that the elements can be in contact with the balun. This leads to a very fast manufacturing process in which the radome assembly unit as shown in Fig. 2 is complete (apart from the balun assembly 7-9) with the antenna elements 2 in essentially one step.

The cover is aimed for big series manufacturing in plastic extrusion process. The cover assembly is pre manufactured holding the antenna elements, the balun, the coaxial cable and the outer connector.

For low volume production the vacuum forming is available as a quite cost effective procedure. Then the antenna element can be effectively and fast fixed to the inside surface of the radome by an attaching tape procedure.
Both vacuum forming and extrusion of the cover allows for attractive designs and a possibility to create a more selling agreeable product.

The balun and cable assembly is made as a pre manufactured unit, and of a design that is well known in the art.

The radome assembly, consisting of the radome 3, the dipole elements 2 and the balun assembly 7-9, is preferably fixed to the back plane 6 by a very fast and easy snap function, in which elongated protrusions on the back plane snaps into elongated openings in the radome. The back plane is basically a plane sheet of plastics.

Fig. 3 shows a front and a back view of a back plane assembly with back plane 6, reflector 5, mounting bars 10 and a mounting bracket 4. The reflector 5 is for instance made as a metallic grid. This can not be done in prior art antennas since the reflector there constitutes its own structure, and/or is a part of the supporting structure, and therefore needs to be adapted to the overall design. The reflector material can be of very light weight in e.g. steel or aluminum. In the aspect of electrical performance, there is a big freedom in mechanical design and dimensions for the grid reflector.

The back plane 6 and the reflector 5 can be produced as one unit, whereby the inner side of the, e.g. plastic, back plane has a thin layer of a metallic conducting material. Many processes are available to perform this, e.g. by gluing a thin metallic foil of for example aluminum on the plane 6, or by painting with conducting paint, or by chemical/electrical adhesion processes.
The back plane 6 can also consist of a metal, e.g. aluminum, whereby the back plane also functions as a reflector. In this way the mounting bars 10 are not necessary in order to attach the mounting bracket 4 to the rest of the assembly. The back plane 6 can instead be equipped with mounting devices for easy attachment of the mounting brackets 4. In this embodiment the antenna box merely comprises four different parts for assembly of the finished box 1 - the radome assembly 2, 3; the balun assembly 7-9; the back plane assembly 5-6 and the mounting bracket 4. This leads to extremely simple and cheap assembly and manufacturing processes.

According to the invention the radome 3 essentially has three functions: it functions as a cover for the dipole elements 2, it constitutes a part of the supporting structure, and it is a carrier of the dipole elements 2.

Availability of many different low cost materials and processes also lead to an increased flexibility in the production of the antenna compared to previous antennas.

Fig. 5 shows an antenna box according to the present invention mounted to a wall by using further retaining means. Apart from the previously mentioned mounting mechanics, this embodiment constitutes a retaining pin 11, a butterfly nut 12 and means 13 for mounting the pin 11 to the wall or similar. In this embodiment a butterfly nut 12 is also used for fixing the box 1 to the mounting bar 4. A butterfly nut 12 is especially useful since it can be tightened and loosened without using any tools besides your fingers. The retaining pin 11 could e.g. also be telescopic. The
means 13 for mounting the pin 11 to the wall may be a clip or any other mounting means.

The invention is of course not limited to the embodiments described above and to the illustrated drawings, but it can be modified within the scope of the appended claims. The antenna can be used for other apparatus for example mobile telephone base stations.
CLAIMS

1. Antenna box (1) for e.g. TV-reception comprising; a
   number of dipole elements (2), a cover (3) functioning as a
   radome, means (4,6,10) for mounting the box (1) to a wall or
   similar, a balun (7), a back plane (6) and a reflector (5),
   wherein; the reflector (5) constitutes the inside of the back
   plane (6), the dipole elements (2) are attached to the inside
   surface of said cover (3), the box (1) comprises means for
   pivoting said antenna box (1) when the box is mounted to a wall or
   similar, and the back plane (6) and the cover (3) essentially
   functions as the supporting structure of the antenna box.

2. Antenna box according to claim 1, characterized in that,
   the dipole elements (2) are attached to the inside surface,
   preferably on the side opposite the reflector (5), of said cover
   by use of glue, tape or some sort or adhesive.

3. Antenna box according to claim 1, characterized in that,
   the dipole elements (2) are attached to the inside surface,
   preferably on the side opposite the reflector (5), of said cover
   by snap-fitting.

4. Antenna box according to claim 1, characterized in that,
   the dipole elements (2) are molded or vacuum formed into the
   inside surface, preferably on the side opposite the reflector (5),
   of said cover.
5. Antenna box according to claim 1, characterized in that, the dipole elements (2) are printed on the inside surface, preferably on the side opposite the reflector (5), of said cover (3).

6. Antenna box according to any of the previous claims, characterized in that, the back plane (6) is provided with means for pivotally attaching the back plane (6) to a mounting bracket (4).

7. Antenna box according to any of the previous claims, characterized in that, the reflector (5) is attached to the back plane (6) by means of mounting bars (10) to which a mounting bracket (4) can be pivotally attached.

8. A method for producing an antenna box (1) according to claim 1, characterized in that, it comprises the steps of:
   - forming the cover (3) by extrusion, vacuum forming or molding,
   - attaching, in the previous forming step, or in a subsequent step, the dipole elements (2) to the inside surface of the cover (3),
   - connecting the balun (7) to the dipole elements (2), and
   - fitting the cover (3) to the back plane (6).

9. A method for producing an antenna box (1) according to claim 8, characterized in that, mounting the contact (9) inside the cover hood (3), i.e. the radome.

10. Antenna box (1) for e.g. TV-reception comprising; a number of dipole elements (2), a cover (3) functioning as a
radome, means (4, 6, 10-13) for mounting the box (1) to a wall or similar, a balun (7), a back plane (6) and a reflector (5), wherein; the reflector (5) constitutes the inside of the back plane (6), the back plane (6) and the cover (3) essentially functions as the supporting structure of the antenna box, and the box (1) on one side is provided with mounting means (4, 10) around which the box (1) is arranged to pivot, and on the other side the box (1) is provided with retaining means (11-13) for fixing the box (1) in a desired position.
1. Antenna box (1) for e.g. TV-reception comprising; a number of dipole elements (2), a cover (3) functioning as a radome, means (4,6,10) for mounting the box (1) to a wall or similar, a balun (7), a back plane (6) and a reflector (5), wherein; the reflector (5) constitutes the inside of the back plane (6), the dipole elements (2) are attached to the inside surface of said cover (3), the box (1) preferably comprises means for pivoting said antenna box (1) when the box is mounted to a wall or similar, and the back plane (6) and the cover (3) essentially functions as the supporting structure of the antenna box.

2. Antenna box according to claim 1, characterized in that, the dipole elements (2) are attached to the inside surface, preferably on the side opposite the reflector (5), of said cover by use of glue, tape or some sort or adhesive.

3. Antenna box according to claim 1, characterized in that, the dipole elements (2) are attached to the inside surface, preferably on the side opposite the reflector (5), of said cover by snap-fitting.

4. Antenna box according to claim 1, characterized in that, the dipole elements (2) are molded or vacuum formed into the inside surface, preferably on the side opposite the reflector (5), of said cover.
5. Antenna box according to claim 1, characterized in that,
the dipole elements (2) are printed on the inside surface,
preferably on the side opposite the reflector (5), of said cover (3).

6. Antenna box according to any of the previous claims,
characterized in that, the back plane (6) is provided with means
for pivotally attaching the back plane (6) to a mounting bracket (4).

7. Antenna box according to any of the previous claims,
characterized in that, the reflector (5) is attached to the back
plane (6) by means of mounting bars (10) to which a mounting
bracket (4) can be pivotally attached.

8. A method for producing an antenna box (1) according to
claim 1, characterized in that, it comprises the steps of:
- forming the cover (3) by extrusion, vacuum forming or
  molding,
- attaching, in the previous forming step, or in a
  subsequent step, the dipole elements (2) to the inside
  surface of the cover (3),
- connecting the balun (7) to the dipole elements (2),
  and
- fitting the cover (3) to the back plane (6).

9. A method for producing an antenna box (1) according to
claim 8, characterized in that, mounting the contact (9) inside
the cover hood (3), i.e. the radome.

AMENDED SHEET (ARTICLE 19)
10. Antenna box (1) for e.g. TV-reception comprising; a number of dipole elements (2), a cover (3) functioning as a radome, means (4, 6, 10-13) for mounting the box (1) to a wall or similar, a balun (7), a back plane (6) and a reflector (5), wherein; the reflector (5) constitutes the inside of the back plane (6), the back plane (6) and the cover (3) essentially functions as the supporting structure of the antenna box, and the box (1) on one side is provided with mounting means (4, 10) around which the box (1) is arranged to pivot, and on the other side the box (1) is provided with retaining means (11-13) for fixing the box (1) in a desired position.
**INTERNATIONAL SEARCH REPORT**

**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

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**

<table>
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>DE 3938512 A1 (SEI ELETTRONICA S COOP A R L), 20 November 1989 (20.11.1989), the whole document</td>
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<tr>
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<td>WO 9619844 A2 (NORTHERN TELECOM LTD), 27 June 1996 (27.06.1996), the whole document</td>
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☐ Further documents are listed in the continuation of Box C.  ☒ See patent family annex.

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**INTERNATIONAL SEARCH REPORT**

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*H01Q 19/30* (2006.01)

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<td>AU</td>
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<td></td>
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<td>US</td>
<td>5999145 A</td>
<td>07/12/1999</td>
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<td></td>
<td>GB</td>
<td>2296385 A</td>
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<td></td>
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