



Access Radio ODU 24 GHz

User and Installation Manual

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Contents

1	General Design of Outdoor Units (ODU)	3
1.1	Application	3
1.2	Information on intended use	3
1.3	Safety instructions	4
1.3.1	Protective equipment	4
1.3.2	Voltage	4
1.3.3	Grounding	4
1.3.4	Lightning	4
1.3.5	Weight	5
1.3.6	Sources of Danger Through Microwaves	5
2	Mounting the Outdoor Units	8
2.1	General information	8
2.2	Outdoor Unit mounting restrictions	9
2.2.1	Access Station	9
2.2.2	Load capacity of ODU mounts	9
2.3	Mast mounting	10
2.3.1	Mast mounting on a flat roof	11
2.3.2	Mast mounting on a sloping roof	12
2.4	Fixing the mounts	13
2.4.1	Mount (AN00074780)	14
2.4.1.1	Mast mounting (76-114 mm mast diameter)	14
2.4.1.2	Mast mounting (115-219 mm mast diameter)	15
2.5	Mounting and alignment of Outdoor Units	16
2.5.1	Mount for ODUs	16
2.5.1.1	Azimuth alignment	16
2.5.1.2	Elevation alignment	16
2.5.1.3	Adjusting the polarization	17
2.5.1.4	Tuning the polarization	17
2.5.1.5	Mounting the ODU	17
2.5.2	Installation with remote antenna	19
2.5.3	Connecting the system cable to the ODU	21
	Labeling Outdoor Units	21
2.6	Polarization change with parabolic reflector (0.26 m, 0.3 m, 0.6 m antenna)	23

List of Figures

Figure 2-1	Obstacle-free azimuth angle	9
Figure 2-2	Obstacle-free elevation angle	9
Figure 2-3	Mast mounting on a flat roof.....	11
Figure 2-4	Mast mounting on a sloping roof	12
Figure 2-5	Mast mounting (76 -114 mm) of mount MK3	14
Figure 2-6	Mast mounting (115-219 mm) with mounting kit adapter	15
Figure 2-7	Mounting the parabolic antenna - side view	18
Figure 2-8	Mounting the parabolic antenna.....	19
Figure 2-9	Schematic drawing of setup with remote antenna	20
Figure 2-10	Sealing the plug-connector on the ODU.....	21
Figure 2-11	Potential location of Caution Label	22
Figure 2-12	Adjusting the vertical polarization	24
Figure 2-13	Adjusting the horizontal polarization.....	25

List of Tables

Table 2-1	Recommended mast size.....	10
Table 2-2	IF cable lengths.....	13

1 General Design of Outdoor Units (ODU)

1.1 Application

The present document gives an overview of the technical characteristics of AXR Outdoor Units (ODU) for the frequency range:

- 24.25 to 24.45 GHz paired with 25.05 to 25.25 GHz

In addition, it describes the installation of the Outdoor Units and the different mounts and brackets required for this purpose.

1.2 Information on intended use

The radio unit may only be operated for the purposes defined in the operating manual and within the parameters specified (such as transmit power, transmission bit rate, frequency band, modulation procedure and safety clearance from the antenna to avoid any damage to health from electro-magnetic fields etc.).

Any change in the technical features and location may lead to the operating permit becoming null and void.

Operation of the radio system is provided in many countries and is subject to the operating conditions prevailing in each country. Operation is permitted only with the approval of the authorities responsible for frequency management in your country, in agreement with the operating regulations prevailing for a fixed radio service in the frequency band (channel) intended. This permit must be obtained prior to commissioning the system.

Note **Only appropriately trained personnel may carry out installation and operation work.**

1.3 Safety instructions

Installation and maintenance work may only be carried out by personnel with the required technical qualification and experience. The installation and maintenance personnel must be aware of possible sources of danger and take the necessary measures to reduce possible risks to a minimum.

1.3.1 Protective equipment



Protect yourself and passers-by against dangers!

When installing the Outdoor Units, the service personnel must use appropriate safety equipment to prevent units or equipment (particularly the Outdoor Unit, and mounting set) from falling down, thus preventing damage to units and injury to service personnel and passers-by.

The recommended protective equipment (helmet, gloves, safety belt etc.) must be worn during the installation. Observe the national and regional regulations and requirements.

1.3.2 Voltage



CAUTION! Battery voltage!

The ODU is powered with the 48/60 V DC supply voltage via the inner conductor of the system cable.

1.3.3 Grounding



Dangerous electrical voltage!

Improper grounding can apply dangerous electrical voltages to housing parts!

1.3.4 Lightning



Lightning!

You may only install the ODUs if the mast is grounded according to regulations. Grounding must comply with the relevant regional regulations.

Mounting work must not be carried out during or directly before thunderstorms and must be stopped immediately the storm commences.

1.3.5 Weight



Danger of injury!

The described units are very heavy. Handle them carefully and wear suitable protective clothing (shoes).

1.3.6 Sources of Danger Through Microwaves



Danger due to electromagnetic radiation!

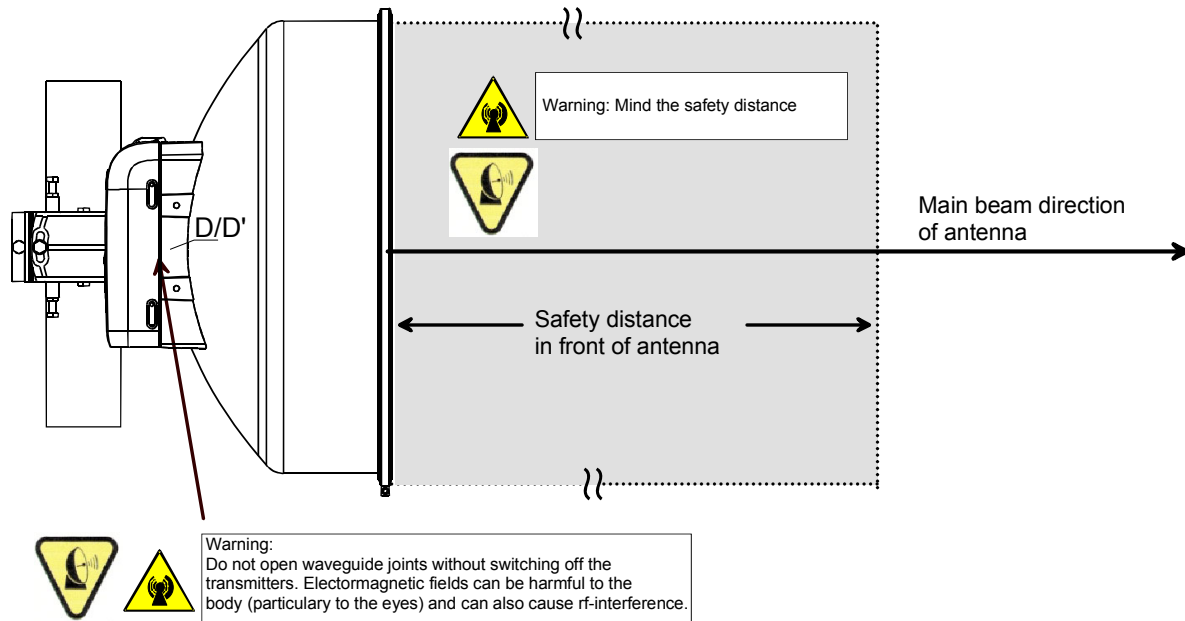
In order to avoid any hazards through electromagnetic radiation caused by microwave radio Tx power, the transmitter must be switched off before you start working at or near the antenna. If you have to work for a longer period while transmission is active, please stay only behind the antenna.

Possible hazards

Potential health hazards can occur due to exposure to electromagnetic fields if the prescribed safety distances to the antenna are not observed in the main beam direction and if the waveguide interfaces are opened while the Outdoor Unit is on.

Protection measures

- If possible, switch the transmitter off before you disassemble the device or waveguide interfaces.
- Do not look into open waveguide joints. Do not stand directly in front of transmit antennas.
- Mind the prescribed safety distances in front of the antennas (specified below).
- If the safety distances cannot be maintained, the power supply to the antenna must be reduced or the transmitter switched off.



Permissible limiting values

In DIN VDE 0848 "Safety in Electromagnetic Fields", a distinction is made between two exposure areas.

LIMITING VALUES	AVERAGE POWER FLOW DENSITY	
Exposure Area 1	50 W/m ²	See also 47 CFR 1.1310 Table 1.A
Exposure Area 2	10 W/m ²	See also 47 CFR 1.1310 Table 1.B See also Official Gazette of the European Communities (1999/519/EC)

Exposure Area 1 includes:

- Controlled areas, e.g. operating areas and areas that can be monitored by the operator.
- Generally accessible areas where, on account of the method of system operation or the time spent by persons in these areas, it may be assured that exposure will occur for short periods of time only (up to 6 hours per day).

Exposure Area 2 includes:

- Residential districts or areas where sports and recreational facilities are located;

- General areas where long-term exposure (more than 6 hours per day) is expected.

A sign or other safety precautions, at the access to the antenna system (e.g. skylight), is not required if it can be assured that unauthorized persons cannot approach within the safety distance in front of the antennas.

If this cannot be assured, a suitable sign (No unauthorized entry!) must be located at the access to the antennas.

In addition, the safety precautions stipulated by the site proprietor for access and presence in the area of transmitter systems shall be observed.

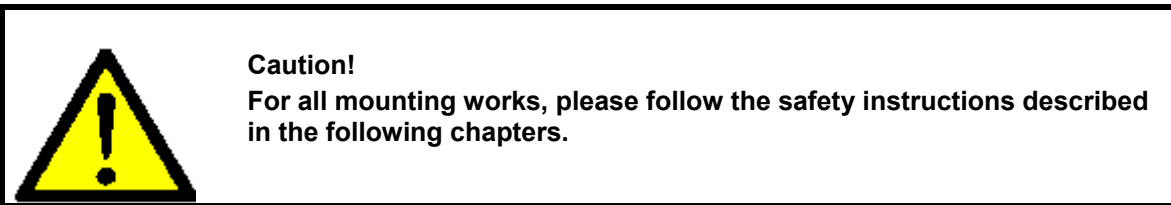
Safety distances in the area in front of antennas

The evaluation in accordance with the "OET Bulletin 65" (F.C.C.) and with the "Safety Code 6" (Industry Canada) is performed in separate documents, which can be provided on request.

Safety distances are not required according to these evaluations.

2 Mounting the Outdoor Units

2.1 General information



Note Please note that you should not install the Outdoor Unit and then leave it for long periods of time without a power supply. This can lead to inner corrosion and defects. It is therefore recommended to coordinate the installation and commissioning process so that the unit is not left without power supply for more than ten days.

The Outdoor Units can be mounted either to a mast or wall. The mounting type required is defined during the planning stage.

Please note the following instructions:

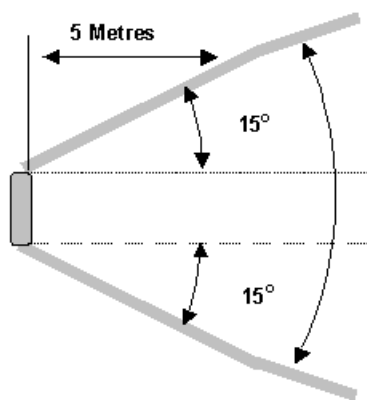
- The Outdoor Units must be connected to a suitable lightning protection grounding such as the existing lightning protection system.
- Please note that it is not permitted to ground the Outdoor Units to mains sockets in the building.
- If you mount the ODU to a mast, it should not be positioned at its top, but about 50 to 100 cm below the top of the mast (lightning protection).
- Carefully mount the Outdoor Unit in the correct position.
- If you mount several Outdoor Units close to each other, e.g. for adjacent sectors in the Base Station, a spacing of at least 10 cm must be provided between the individual units in order to avoid interference.
- Make sure that there are no obstacles, such as cables, walls, masts etc. blocking the "free zone" in front of the Outdoor Unit. If you fear that this might be possible, please contact the Marconi Network Planning Group. Describe your situation and ask for advice before you continue. Figure 2-1 and Figure 2-2 show the area which must be kept free in the elevation and azimuth angle.
- Note the maximum load capacity and the operating conditions as indicated in the technical characteristics.

2.2 Outdoor Unit mounting restrictions

When choosing the mounting site, note the restrictions described in the following chapters.

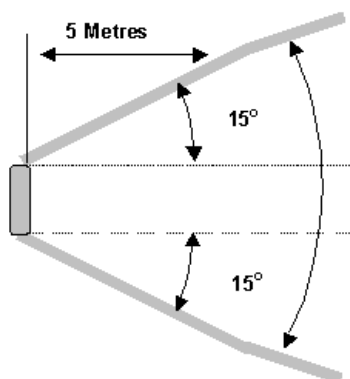
2.2.1 Access Station

The areas shown in Figure 2-1 and Figure 2-2 must be kept free from obstacles such as trees, buildings or cables laid in front of the antenna.



This drawing shows the free zone required in the azimuth angle for all Terminal ODUs, measured from the ODU edges.

Figure 2-1 Obstacle-free azimuth angle



This drawing shows the free zone required in the elevation angle for all Terminal ODUs, measured from the ODU edges.

Figure 2-2 Obstacle-free elevation angle

2.2.2 Load capacity of ODU mounts

If the Outdoor Unit is installed using the recommended settings, the maximum wind loads specified in the technical characteristics will be applicable.

2.3 Mast mounting

Mast mounting primarily depends on the specific ODU installation. The Outdoor Unit can either be mounted to an existing mast or to a mast to be newly erected.

The procurement of the mast is normally within the responsibility of the customer. The following instructions must be observed:

- The mast position is usually defined during the site inspection in the planning process. When selecting the site, note the mounting restrictions shown in Figure 2-1 and Figure 2-2.
- Make sure that all metallic parts of the mast construction are grounded by means of a connection to the building lightning protection system.
In each individual case, please observe the national and regional regulations!
- Fix the Outdoor Unit to the mast so that its top is below the top of the mast. This considerably reduces the risk that the Outdoor Unit will be struck by lightning.
- Make the mast as short and stiff as possible to minimize the sway of the Outdoor Unit in case of strong wind.
Table 2-1 shows the different mast sizes which can be used for unsupported Outdoor Unit masts under normal operating conditions. These are only guidelines. Always select the stiffest possible pole. However, it is recommended to use unsupported masts only up to the heights indicated in the following table.

FREE MAST HEIGHT	DIAMETER OF MAST POLE	WALL THICKNESS OF POLE	MAST DISPLACEMENT
2 m	76.1 mm	3.2 mm	0.06°
	114.3 mm	3.6 mm	0.02°
4 m	139.7 mm	6.3 mm	0.08°
	139.7 mm	10.0 mm	0.05°
6 m	168.3 mm	10.0 mm	0.11°
	219.1 mm	6.3 mm	0.10°

Table 2-1 Recommended mast size

- Make sure that the mast is installed safely. Bolt through the roof or use a straddling dowel in concrete or brick surfaces.
- Use a spirit level to verify that the mast is vertical. Use seals at the mounting points to prevent the ingress of humidity.

Note **The customer is responsible for mounting the mast. The following diagrams only represent a general guideline for mast mounting.**

2.3.1 Mast mounting on a flat roof

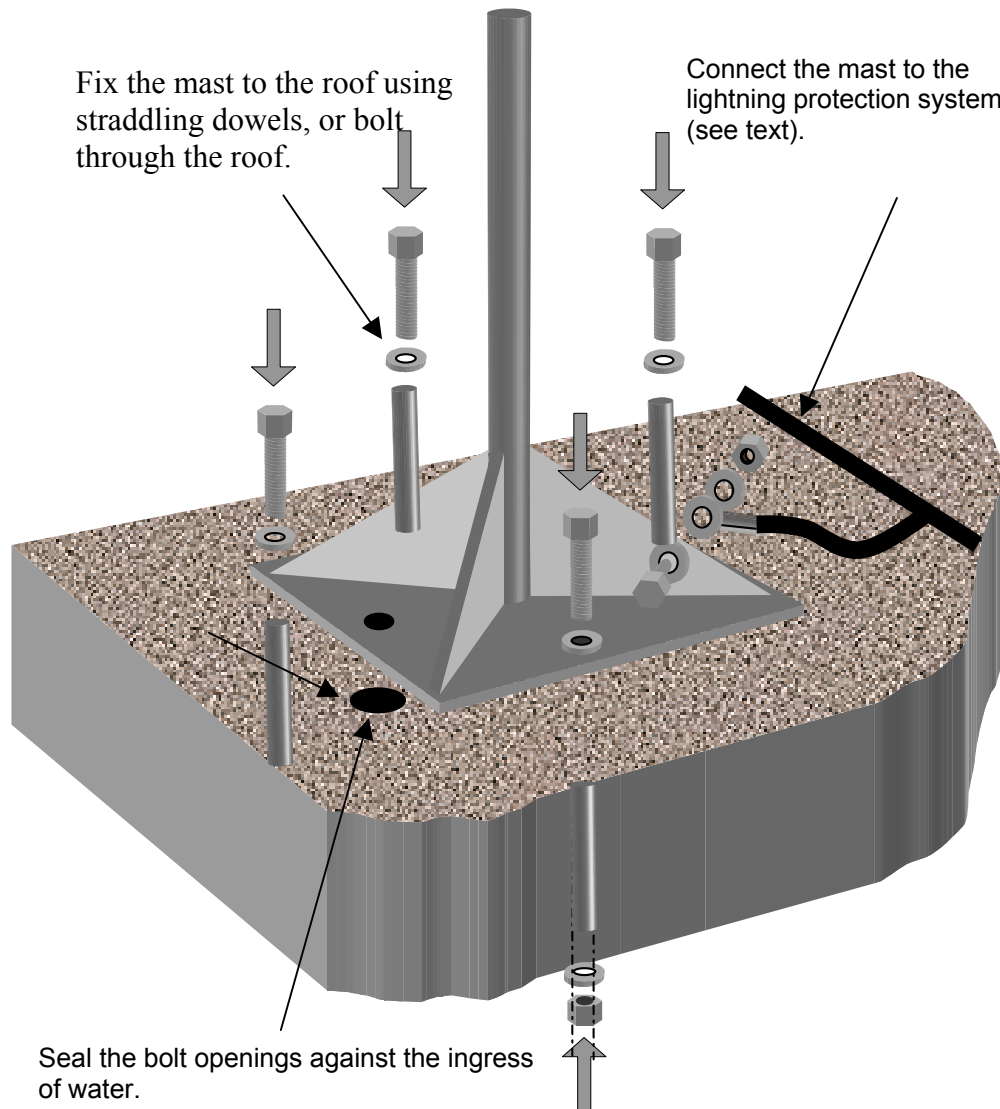


Figure 2-3 Mast mounting on a flat roof

Normally, mounting on flat roofs should cause no problems. It is important to fix the mast structure firmly to the roof, either by bolting through the roof or using suitable straddling dowels depending on the structure of the roof. Seal all bolt openings against water ingress.

Connect all metallic parts of the mast to the building lightning protection. Should such lightning protection not exist in the building, connect the mast separately to ground using a copper cable. This connection must have a ground resistance of less than 2 Ohms.

Note **When laying the ground connections, observe the local and national regulations!**

2.3.2 Mast mounting on a sloping roof

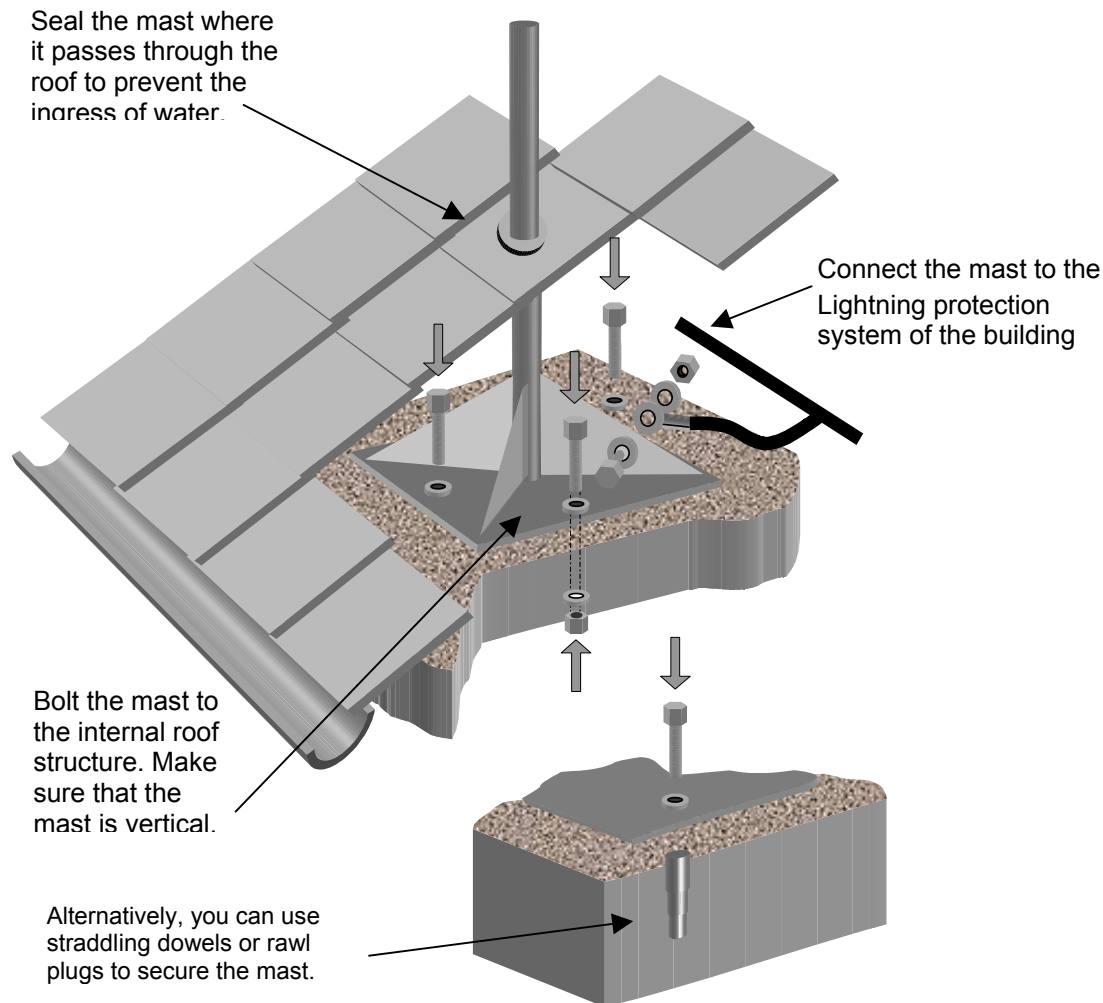


Figure 2-4 Mast mounting on a sloping roof

Normally, the roof is covered with roof tiles or a similar material which means that mounting directly on the roof surface would be impossible. You must therefore install the mast base on a supporting brace or surface beneath the roof so that the mast protrudes above the roof as shown in the diagram. Then you must seal the mast at the point it passes through the roof to make it waterproof.

Connect the metallic parts of the mast to the building lightning protection. Should such lightning protection not exist, connect the mast separately to ground using a copper cable. This connection must have a ground resistance of less than 2 Ohms.

Note **When laying the ground connections, observe the local and national regulations!**

2.4 Fixing the mounts

The followings mounts are available for ODU installation:

- Mount (AN00074780)
- Mounting kit adapter (AN00079891)

Mount (AN00074780) is provided for mounting ODUs with a parabolic antenna. It is appropriate only for mast mounting and offers a device required for antenna fine alignment.

The **mounting kit adapter** is used together with the above mount for mast diameters of 115 to 219 mm.

Mounting equipment and tools

We recommend to use the following special tools:

- 13 mm and 17 mm spanner or nut
- Spirit level with digital read-out (e.g. Marconi type DNM 60L)
- Torx screw driver

The installer should also possess the other standard tools for this type of work (see list of tools).

Before fixing the mount, always ensure that the following conditions are met:

- The line of sight in the direction of the associated Base Station must be free from obstacles (this should be indicated in the site mounting plans).
- The maximum length of the system cable between the Indoor and Outdoor Unit must not exceed the lengths specified in the table below. In addition, the cable route must be free from obstacles.

CABLE TYPE	MARCONI CODE	OUTER DIAMETER	MINIMUM BENDING RADIUS (MULTIPLE BENDS)	MAX. LENGTH
O2YS(ST)CH	AN00226089	10.2 mm	135 mm	150 m
LCF 14	AN00080254	10.0 mm	120 mm	150 m
LCF 12	AN00087586	15.8 mm	125 mm	300 m

Table 2-2 IF cable lengths

- Make sure that the wall or mast used for attaching the mount must have the required stability.

2.4.1 Mount (AN00074780)

This mount (AN0074780) is provided only for being fixed to masts with diameters between 76 and 114 mm.

For mast diameters between 115 and 219 mm, an appropriate mounting kit adapter (AN0079891) is available.

This mount is used to fix ODUs with a parabolic antenna. It offers a special device required for antenna fine alignment.

2.4.1.1 Mast mounting (76-114 mm mast diameter)

Fix the mounting strap at the required height on the mast and swivel it so that it is at 90° to the required radiation direction.

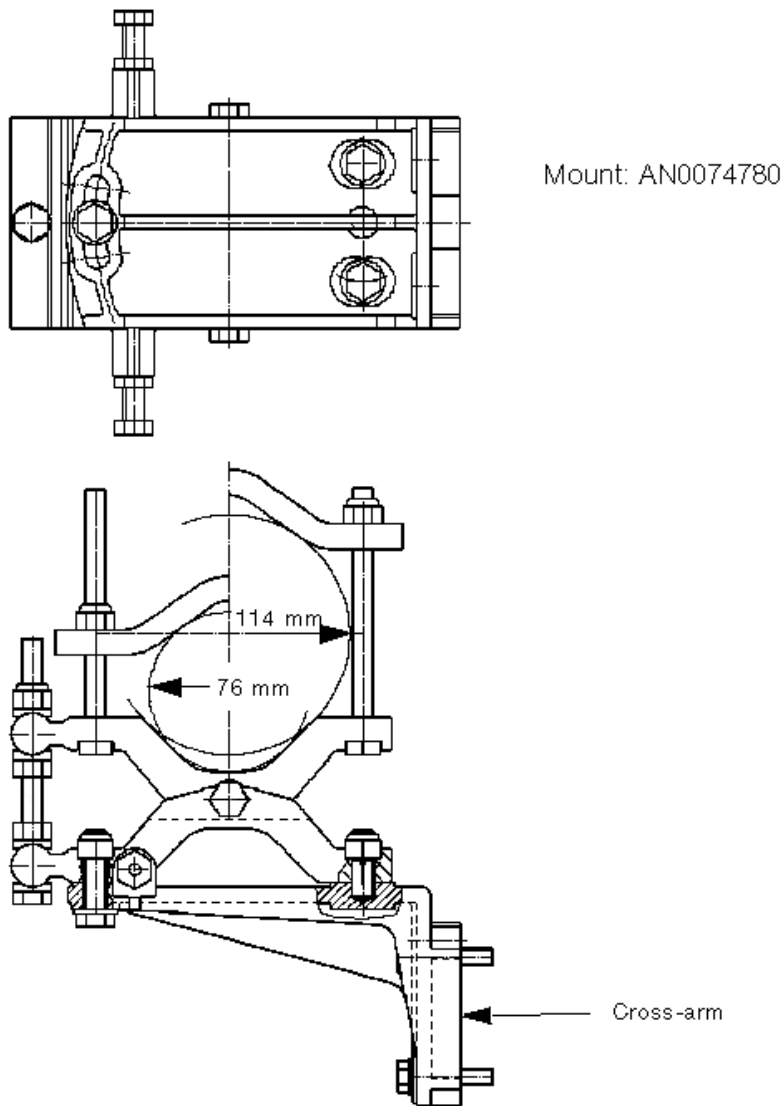


Figure 2-5 Mast mounting (76 -114 mm) of mount MK3

2.4.1.2 Mast mounting (115-219 mm mast diameter)

First attach the mounting kit adapter (AN0079891) included in the pole kit (115-219 mm) to the mast.
Then fix the mount.

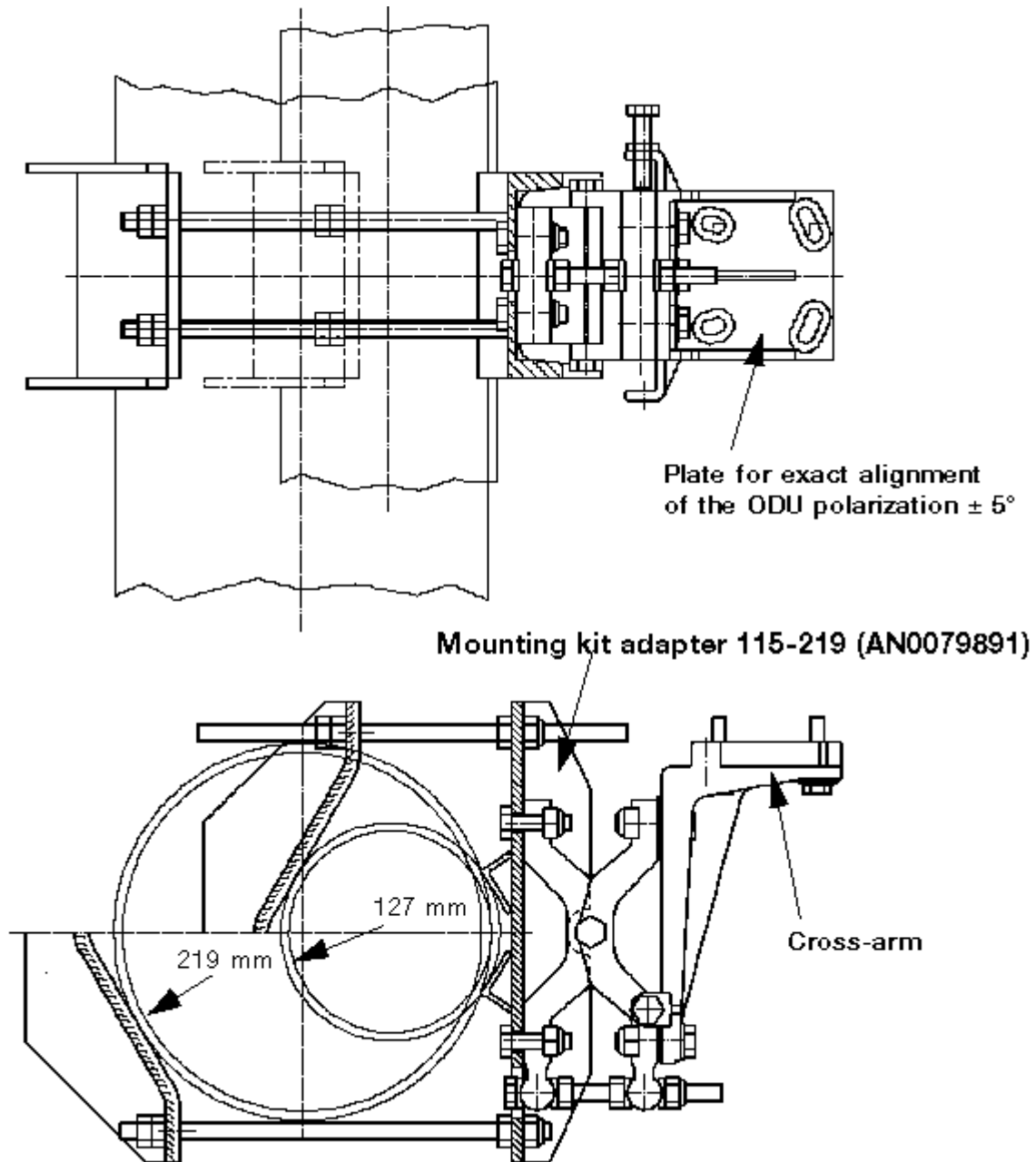


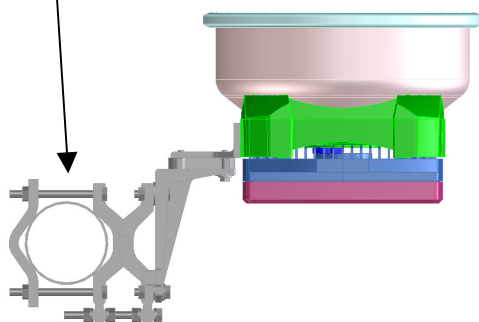
Figure 2-6 Mast mounting (115-219 mm) with mounting kit adapter

2.5 Mounting and alignment of Outdoor Units

2.5.1 Mount for ODUs

This mount (AN0074780) is used to install ODUs with a separate parabolic antenna. It is provided for masts with diameters between 76 and 114 mm. Using the additional mounting kit adapter (AN0079891), mast diameters of up to 219 mm can be implemented.

Mount
AN0074780



Reflector 0.26m with radome
Antenna 0.3m 05MBH00063AAK
Antenna 0.6m 05MBH00060AAD
Feed

This mount is equipped with setting screws for the antenna fine alignment. This special device is necessary since a parabolic antenna with its small aperture angle requires a very high alignment accuracy.

The antenna feed is pre-mounted before the antenna is delivered.

Mount the antenna onto the corresponding bracket by means of three screws **A** (see Figure 2-7 and Figure 2-8).

2.5.1.1 Azimuth alignment

Attach a theodolite to the antenna to align the latter to the Base Station. The Marconi Network Planning Group will specify the exact alignment.

Loosen locking nut **B** and adjust the position with tuning screw **C**. Each rotation of screw **C** swivels the antenna by 0.9° in the azimuth to up to a maximum of $\pm 5^\circ$. Tighten nut **B** when the antenna is correctly aligned.

2.5.1.2 Elevation alignment

Place an electronic spirit level (note length for 60 cm antenna) on the outer edges of the front of the antenna to set the correct vertical (tilt) angle. The Marconi Network Planning Group will inform you on the correct tilt angle. An angle of 0° indicates the horizontal position; a negative angle indicates a 'downwards' tilt of the antenna.

Loosen the three screws **A** on the antenna mounting bracket and locking nut **D**. Then turn setting screw **E** until the spirit level shows the correct alignment. One rotation of setting screw **E** moves the antenna by 0.5° to up to a maximum of $\pm 7.5^\circ$. Retighten locking nut **D** and make sure that the angle has not changed.

2.5.1.3 Adjusting the polarization

See Section Polarization change with parabolic reflector (0.26m, 0.3 m, 0.6 m antenna).

2.5.1.4 Tuning the polarization

Loosen screws **F**. Place the spirit level on the lower edge of the rear side of the antenna (see Figure 2-7). Turn the antenna until it is in the exact horizontal position, a rotation angle of $\pm 5^\circ$ being possible. Then retighten screws **F**. Verify that the antenna has not been displaced.

2.5.1.5 Mounting the ODU

Now screw the ODU to the antenna by means of four fixing screws (allen screw M6).

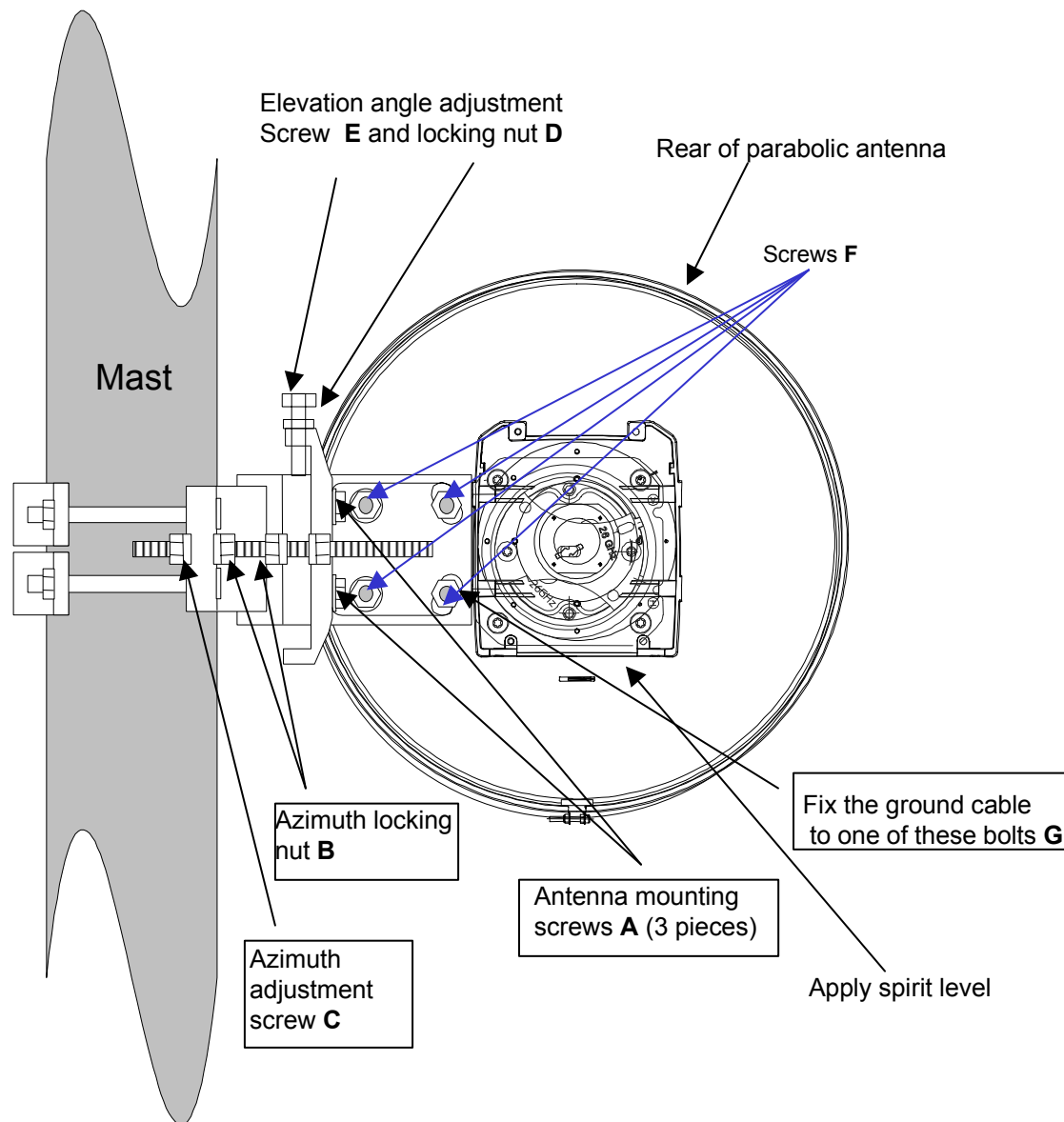


Figure 2-7 Mounting the parabolic antenna - side view

Alternative 115-219 mm mast mounting device with mounting kit adapter.

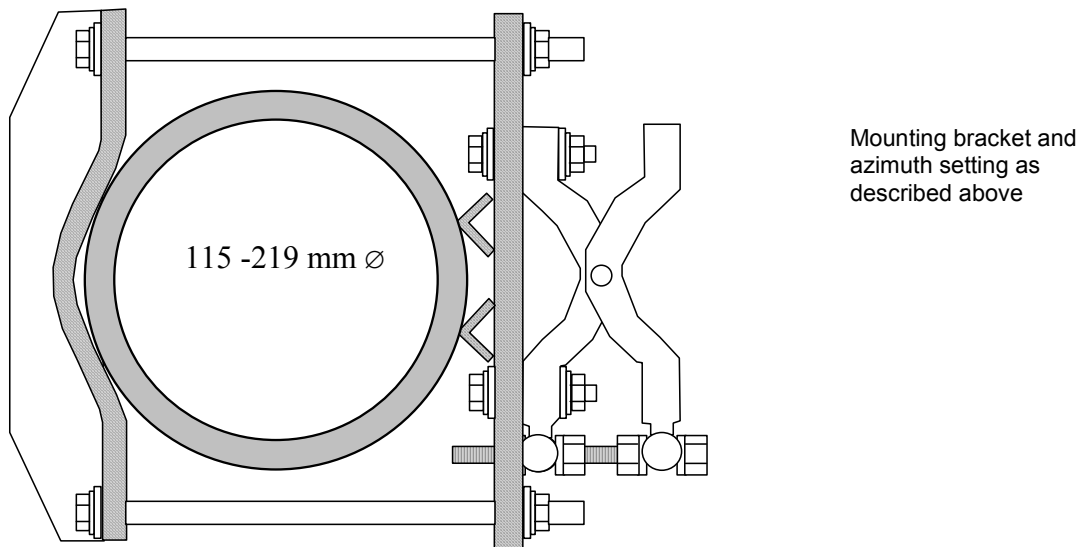


Figure 2-8 Mounting the parabolic antenna

2.5.2 Installation with remote antenna

In certain cases of application (e.g. hardly accessible antenna installation sites), it may be reasonable to install the antenna and transceiver in different places.

Recommended configuration:

- ODU for mounting with separate antenna
- ODU mount - Adapter frame ODU L (05MBH00136AAC)
- ALFORM 290 waveguides
- transition kits
- Parabolic antenna (including mount)

Optionally, you can use waveguide bends (R220 interface, 1 x H-bend, 1 x E bend) to permit smaller bending radii for waveguides.

In addition, you require the standard mounting material for waveguides (sealing rings, pressure window, mounting clamps) as well as the tools necessary for laying ALFORM waveguides.

Mounting steps:

1. Install the ODU using mount AN00074780. It permits the ODU to be mounted inside or outside the building.
2. Mount the ODU L adapter frame.
3. Mount the transition kits (note pressure window and seals).

4. Mount the parabolic antenna (see section 2.5.1) and align it as precisely as possible.
5. Attach the waveguide (normally ALFORM 290) to the transition kits and lay it according to the standard guidelines.
6. Take the terminal into operation according to instructions. If required, the fine alignment of the parabolic antenna can be facilitated by temporarily inserting a short flexible waveguide between the ALFORM waveguide and parabolic antenna.

Note **The insertion loss of the waveguide is compensated by the higher gain of the parabolic antenna (compared to standard planar antennas). Thus, there are no restrictions regarding the link range, i.e. the alignment procedure is still applicable without any modification.**
The maximum insertion loss is therefore 5.5 dB.
When using ALFORM 290 waveguides, this corresponds to a maximum waveguide length of 10 m.

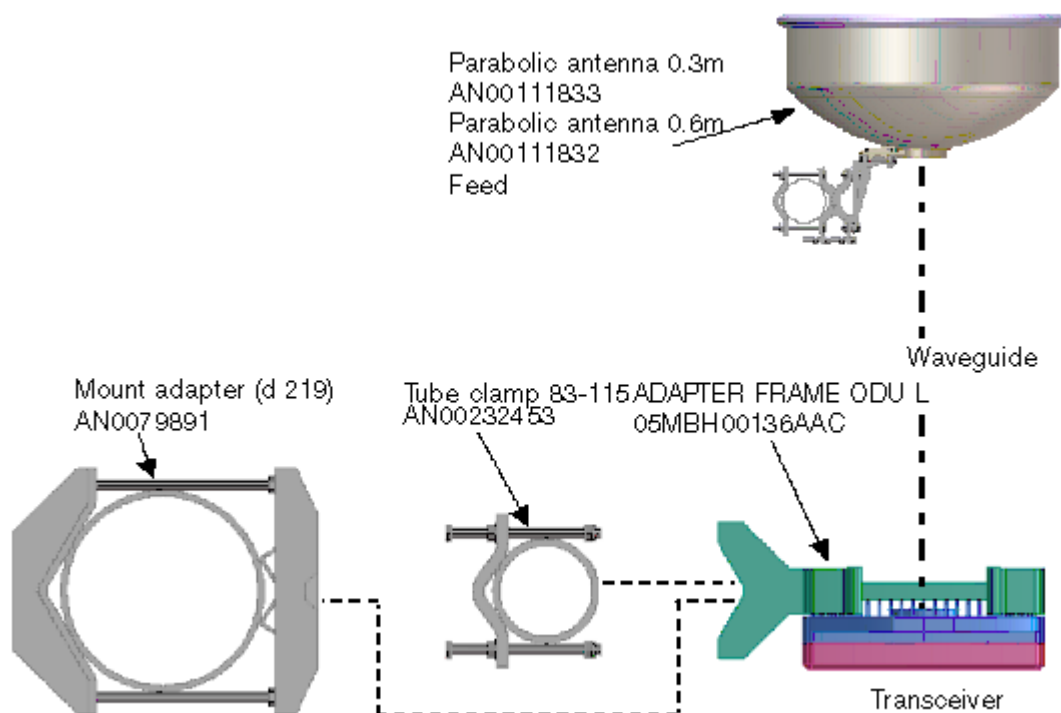


Figure 2-9 Schematic drawing of setup with remote antenna

2.5.3 Connecting the system cable to the ODU



CAUTION! Battery voltage!
The ODU is powered with the 48/60 V DC supply voltage via the inner conductor of the system cable.

1. Make sure that the mast and ODU are correctly grounded.

Note

The system cable may be connected only after the ODU has been appropriately grounded.
Always connect the system cable to the ODU first and then to the IDU.

2. Connect the IF cable and overvoltage protection - if used - to the rear of the ODU.
3. Seal the plug connector with self-vulcanizing tape as shown below.

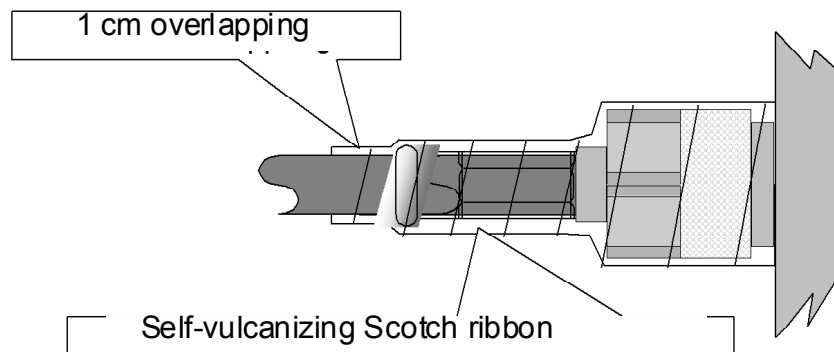


Figure 2-10 Sealing the plug-connector on the ODU

Note

Please note that the unit should not be left longer than 10 days without power supply, as this could lead to internal corrosion damage through condensation.
If the ODU must be left without power for more than 10 days, remove it from the antenna and store it in a closed room up to its final commissioning.

2.5.4 Labeling Outdoor Units

Caution Label for RF-Exposure

For all antennas having diameters larger than 1/2 ft (>15 cm), the maximum power flux density in front of the antenna is less than 10 W/m² at all distances (please refer to chapter 1.3.6).

Nevertheless, a Caution Label concerning rf-exposure has to be attached to the antenna in good visibility.

This Caution Label is delivered as adhesive label together with the ODU. After having installed the antenna and the ODU, the Caution Label shall be attached to the antenna. For long durability, please wipe clean the surface of the mounting area of the antenna with a cleaner before attaching the label. Use a cleaner designed for high-quality painted surfaces. The cleaner must be wet, non-abrasive, without strong solvents, and have a pH value between 3 and 11 (neither strongly acidic nor strongly alkaline).

Location of the label shall be chosen for good visibility at unintended approach. A possible location is shown in Figure 2-11

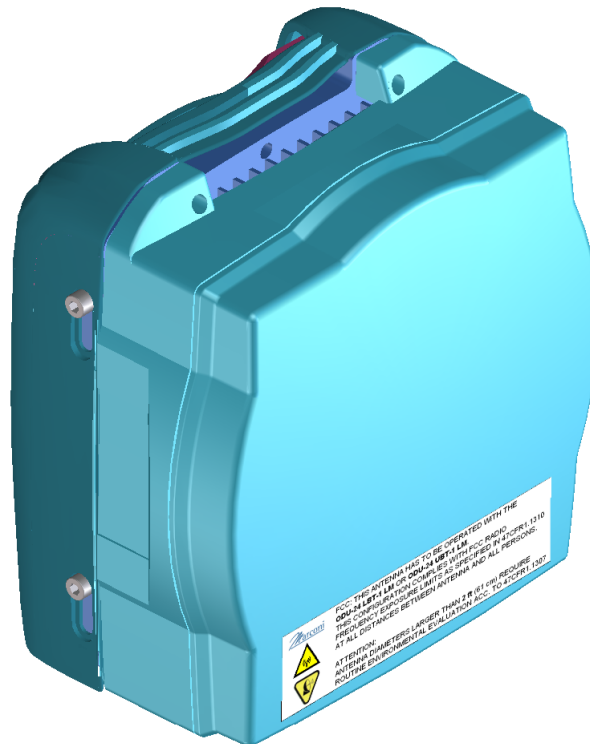


Figure 2-11 Potential location of Caution Label

Marking for local configuration

After mounting, it is recommended to label the Outdoor Units with their most important installation data. For this purpose, you should use a waterproof label.

In case of installations with more than one radio link, it is recommended to label also the indoor components with the same code, in order to facilitate the assignment between the Outdoor Unit and Indoor Unit. Due to their dimensions, it may be difficult to attach the labels on some of the units. In this case, we recommend to keep a schematic drawing of the subrack configuration labeled accordingly near the installation site.

2.6 Polarization change with parabolic reflector (0.26 m, 0.3 m, 0.6 m antenna)

A polarization change with parabolic reflectors having diameters of 0.26 m, 0.3 m and 0.6 m is possible by turning the feed by 90° and changing the mounting position of the polarization plate.

Figure 2-12 and Figure 2-13 shows the position of the polarization plate for vertical and horizontal polarization.

To change the polarization, proceed as follows:

1. Loosen the four mounting screws of the feed. Then turn the feed to the required position for a vertical or horizontal polarization.
2. Retighten the feed by means of the four mounting screws (Torque: 190 Ncm).
3. Loosen the mounting screws of the polarization plate.
4. Remove the polarization plate.
5. Remount the polarization plate in the correct position for the required polarization. The nose of the polarization plate must point to H or V.
6. Secure the polarization plate by means of its mounting screws (torque: 190 Ncm).

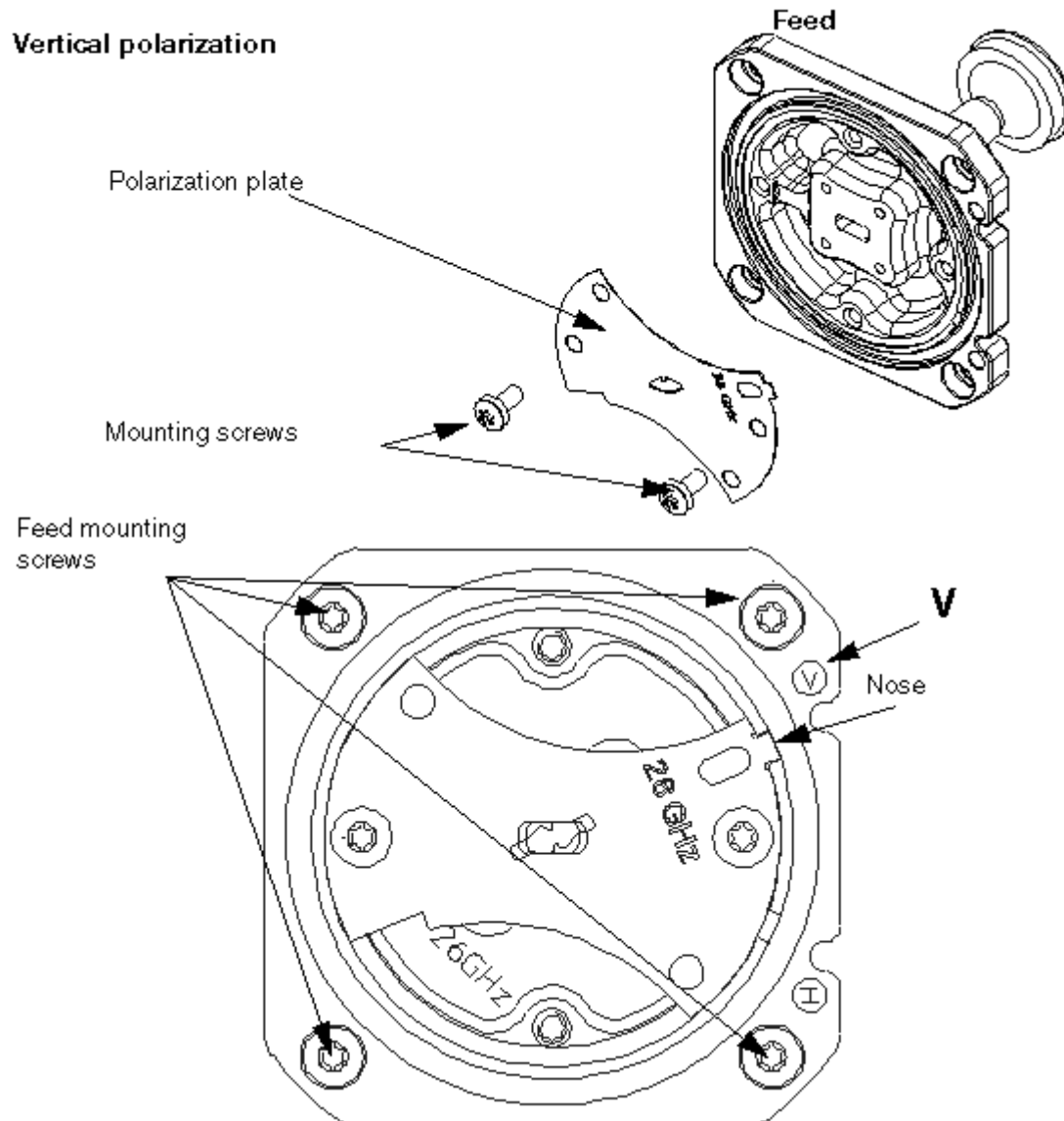


Figure 2-12 Adjusting the vertical polarization

Horizontal polarization

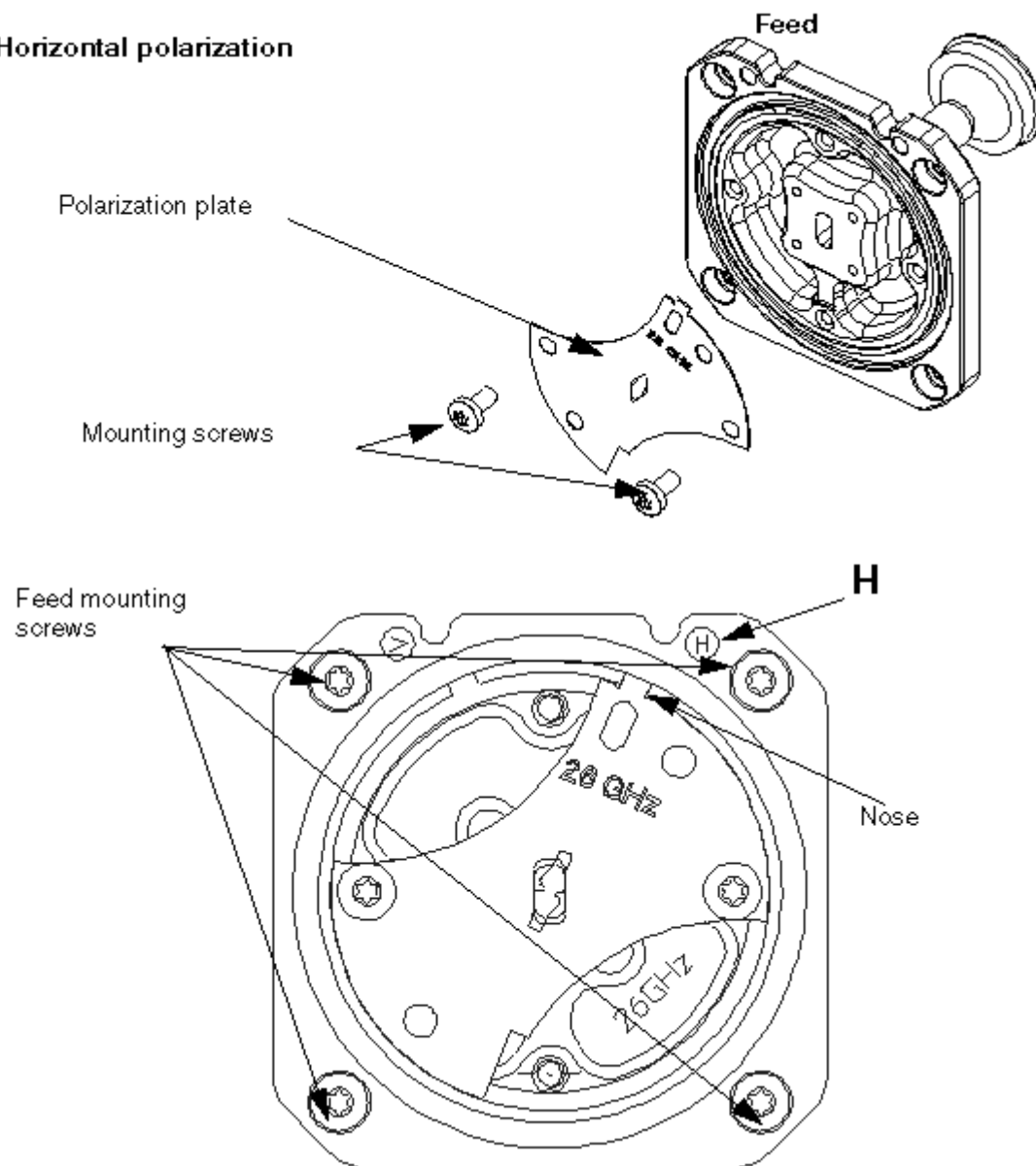


Figure 2-13 Adjusting the horizontal polarization