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2. Subscriber Radio Unit Installation

2.1 Introduction

This chapter gives instructions for installation of a Subscriber Radio Unit (SRU).

Before installing the Subscriber Radio Unit, perform the following steps:

1. Refer to “SAS Installation Manual” and perform the indicated procedures.
2. Install the Base Station as explained in “BSIS Installation Manual.”
3. Verify line of sight between the BRU and the SRU.

2.2 Getting Ready for Installation

Before proceeding, remove and save all documentation. Use this manual for the installation of the Subscriber Radio Unit.

To prevent any damage to the components, carefully unpack the units on a flat, clean surface at the installation site. If a component must be unpacked at another location, carefully repack it in the original container before moving it to the installation site.

Inspect components carefully for any damage. Damaged equipment should be reported immediately to Netro and the shipping provider.

2.2.1 Subscriber Radio Component

The SRU is installed outdoors and mounted to a pole. One pole mount fixture design (Mounting Plate, Strap and related hardware) serves the 10 GHz, 26 GHz, 28 GHz, and 39 GHz SRUs.

When installing non-integral antenna units, see section 2.4 for installation requirements.

2.2.1.1 Outdoor Components for SRU with Integral Antenna

In addition to the SRU, the following parts are required for installation of the outdoor equipment for SRUs with integral antennas. (See section 2.4 for non-integral antenna.)

Pole Mount Kit

The Pole Mount adapter is used to attach the SRU Mount to a pole. A single pole mount design serves 26 GHz, 28 GHz, 39 GHz, and 10 GHz SRUs. The pole mount is available as a stand-alone assembly and is available in combination with the SRU mount (see the “Mounting Accessories” section of the Product Catalog). All bolts, nuts, and washers are A4 stainless steel, which may be purchased locally. The Pole Mount Kit includes:

- Mounting plate
- Strap
- M10 nuts, bolts, washers and anti-seize compound

SRU Mount

26 GHz, 28 GHz, and 39 GHz SRUs share the same SRU mount. See section 2.3.3 for illustrations.

A different SRU mount is required for 10 GHz SRUs. See section 2.3.6 for illustrations.

SRU Installation Kit

The installation kit includes:

- TNC male 50 Ohm connectors for LMR240
- N-Type Female 50 Ohm connector for LMR400
- 1.5m length of LMR240 cable
- Self-amalgamating weather proof tape
- Extra jam nut for the grounding lug

In addition, the 10 GHz SRU installation kit also includes:

- TNC Male to TNC Female right angle adaptor

Lightning arrestors (not part of Netro equipment or installation)

Ground wire (not part of Netro equipment or installation)

2.2.1.2 Coaxial Cable

A coaxial cable is used for the connection between the Subscriber Access System (SAS) and the Subscriber Radio Unit (SRU). Use only coaxial cable meeting the specification. An undamaged, unconnected coaxial cable should have a very high resistance between center and ground. Cables reading less than 10 MOhms should be carefully inspected for water ingress or connector corrosion. This must be verified on site prior to installation. The cable generally must pass from an indoor location of the SAS to an outdoor location of the SRU. When installing the cable, consult local regulatory authorities and follow all local building codes. When laying out the coaxial cable, **include enough cable for a service loop of at least 18 inches (0.5 m)** at the SRU. When the main cable is LMR400, remember to use a 12-inch (0.30m) length of LMR240 for the final connection to the SRU, to avoid overloading the connector due to the weight of the LMR400 cable.

The SAS and the SRU have female TNC 50 Ohm connectors. The LMR400 cable, if used, should not be connected directly to the TNC connector because of its weight. The LMR400 would be terminated with “N” connectors rather than TNC. A one-meter length of LMR240 with N on one end and TNC on the other, is recommended to connect the main LMR400 cable to the SAS or SRU, and for this reason it is included in the Installation Kit.

Ensure that the connector is dry and free of corrosion prior to connection. Even a small amount of dampness could cause corrosion, and signal problems in the cable.

2.2.2 Grounding Recommendations

Prior to installation, determine that the proper source voltage (AC or DC) is available, properly fused, along with appropriate grounding facilities. The positive terminal of the source -48 Volts must be connected to the ground. A negative ground supply can cause power shorts.

ATTENTION

All grounding and lightning protection must meet local building codes and ordinances. Netro is not responsible for damage to equipment or collateral damage or problems resulting from improperly grounded or protected equipment.

Grounding and lightning protection must meet local building codes. The following information provides a guide to the connections available for the AirStar system and some suggestions that may be appropriate, depending on local codes.

- **Cable** - Ground the cable at building entry and use lightning arrestors at the antenna and the indoor equipment.
- **Subscriber Radio Unit (SRU)** - Ground the SRU to the rooftop lightning grid via the lug in the enclosure. Use heavy gauge wire (10AWG).

2.2.3 Lightning Protection

A **lightning arrestor is recommended** for all SRU installations (not part of the Netro equipment or installation). You should also fit suitable lightning protection to the signal cabling.

2.2.4 Mounting Specifications

Netro pole mounts support poles of 2 to 4.5 inches (50 to 114 mm) in diameter. A single pole mount design supports 26 GHz, 28 GHz, 39 GHz, and 10 GHz SRUs. Table 2-1 shows the specification of torque that must be applied on all M10 bolts in the mounting process. The Torque Specifications are listed in Newton-Meter (Torque N-M), in Feet-Pound (Torque FT-LB), and in Inch-Pound (Torque IN-LB).

Table 2-1 Torque Specifications

Screw Size	Torque N-M	Torque FT-LB	Torque IN-LB
M10	40.0	29.5	354.0

2.2.5 Wind Loading Requirements

For the pole mount, the coordinate origin is set in the centerline of the pole, located in the middle of the two bolts in Z-axis (not the base of the mounting bracket).

The Appendix in the AirStar Operations Guide contains Wind Load analysis reports for 10 GHz and 26 GHz SRUs.

2.3 Outdoor Installation of SRU with Integral Antenna

This section describes the procedures for installing the 26 GHz, 28 GHz, 39 GHz, and 10 GHz Subscriber Radio Unit (SRU) to a pole. The way you planned your network will determine the location, height, elevation angle, and azimuth direction of the SRU being installed.

The 26 GHz, 28 GHz, and 39 GHz SRU antennae are vertically polarized. The 10 GHz SRU may be installed with either vertical or horizontal polarization. To preserve the polarization, the SRU must be mounted with the same orientation as shown in the installation figures. The SRU will not function properly if its polarization is not correct, and does not match that of the BRU.

2.3.1 SRU Mounting Process

The SRU can be mounted on a pole.

When the SRU is installed onto a pole, first a pole mount (consisting of a mounting plate and a strap) is installed onto the pole. The pole mount is the same for the 26 GHz, 28 GHz, 39 GHz, and 10 GHz SRUs. The appropriate SRU mount is then affixed to the pole mount. The 26 GHz, 28 GHz, and 39 GHz SRUs use the same SRU mount. The 10 GHz SRU uses a different SRU mount. The SRU is then affixed to the SRU mount.

2.3.2 Installing the Pole Mount

Use the following procedure for installing the pole mount to a pole of the specified diameter prior to installing the SRU to the pole mount. A single pole mount design serves the 26 GHz, 28 GHz, 39 GHz SRU mount and the 10 GHz SRU mount.

1. Prior to installation on the pole, assemble the pole mount using the instructions supplied with the Pole Mounting Kit.
2. Install three M10 bolts, lock and flat washer as shown in **Error! Reference source not found.**. Leave approximately 6.3-9.5 mm (.25-. 38 in) between the flat washer and mounting plate. When using the M10 nuts, start the nut and wind it down close to its final position. Then place a drop of anti-seize compound on each bolt, making sure to cover the thread near the final nut position when the nut is tightened.
3. Orient the mounting-plate at an appropriate height and tighten it to the torque specification. (Do not over tighten it.)

2.3.3 Installing a 26 GHz, 28 GHz, or 39 GHz SRU to a Pole

Install the 26GHz, 28 GHz, or the 39 GHz SRU mount, shown in Figure 2-1, onto the mounting plate as follows:

1. Align the three bolt clearance holes of the SRU mount with the three M10 bolts started on the Mounting Plate.
2. Place the SRU mount flush against the Mounting Plate.
3. Slide the SRU mount down so the three M10 bolts slide into the bolt slots.
4. Tighten the three M10 bolts to the torque spec.

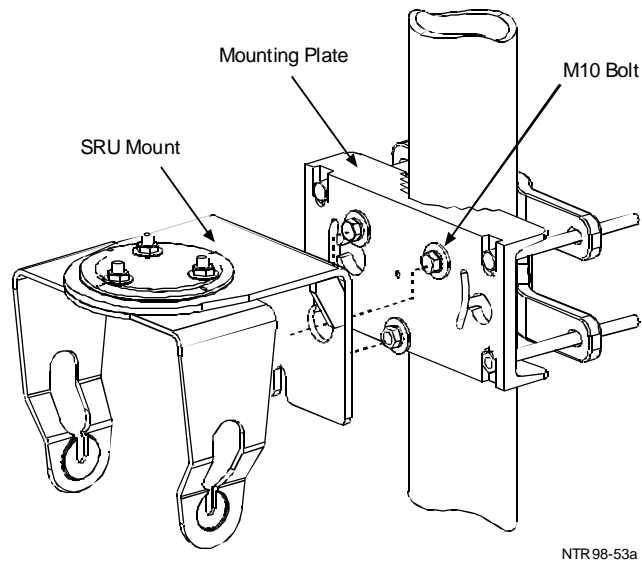


Figure 2-1 Installing 26 GHz, 28 GHz, 39 GHz SRU Mount

5. Install the SRU into the Yoke as follows:
 - a) Position the SRU as shown in Figure 2-2
 - b) Slide the SRU into the mounting Yoke, as shown in **Error! Reference source not found.**. The elevation stud with the nut washer attached should drop into the slots on the mounting yoke.
 - c) Tighten the bolts to eliminate most freeplay, but not so tightly that you can't move the SRU in both directions (elevation and azimuth).

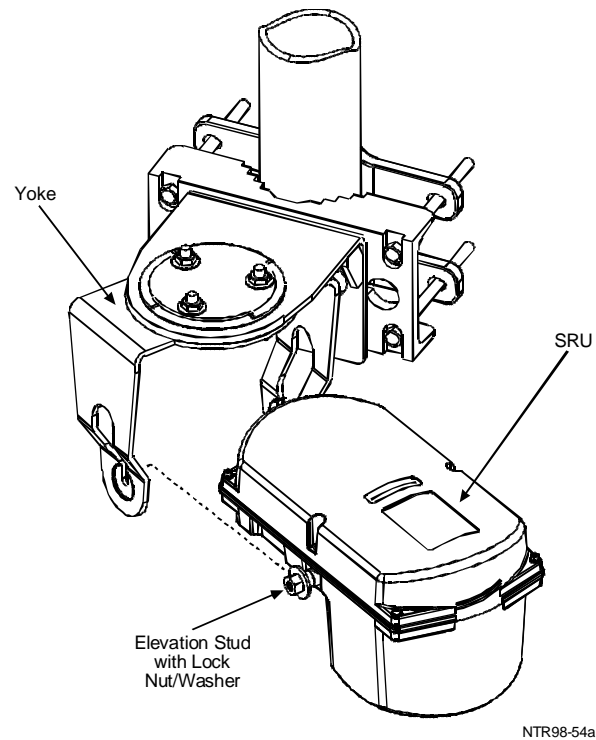


Figure 2-2 Installing 26GHz, 28 GHz, or 39 GHz SRU into Yoke

6. Once the SRU is inside the yoke (as shown in **Error! Reference source not found.**) rotate it so that the antenna is at the top (as shown in Figure 2-3).

Figure 2-3 SRU Azimuth and Elevation Adjustment

7. Follow the steps outlined in Chapter 1 to align the SRU with the BRU.

2.3.4 Installing the 10 GHz SRU Mount

Install the 10 GHz SRU mount onto the mounting plate as follows:

1. Put anti-seize compound on 25mm bolts and start them into the holes, leaving about $\frac{1}{4}$ inch space on the bolts for the 10 GHz SRU mounting.
2. Slide the 10 GHz SRU mount over (3) bolt heads, and then slide it down so the bolts are within the small part of the mounting holes.

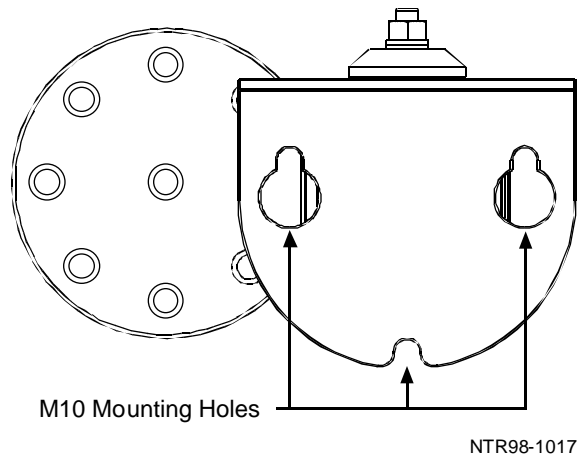


Figure 2-4 Reverse of 10 GHz SRU Mount

3. Tighten the M10 x 25mm bolts to the torque spec.

Figure 2-5 Installing the 10 GHz SRU Mount

The result should look like Figure 2-6:

Figure 2-6 10 GHz SRU Mount Installed on Pole

2.3.5 Universal Mount

The Universal mount is new in Release 2.2.2. It has been designed so as to make changes in radio apparatus easier. In case a radio breaks down, the operator can slide the radio out and replace it with another without any change in elevation or azimuth. The Universal Mount can be used with the 10GHz SRU. The Mount can be rotated 180° on the pole so that the radio can be connected in two ways. It can be connected with an elevation of 10° up and 30° down or an elevation of 30° up and 10° down. Installation Instructions are included with the mount and can also be found in the Appendix.

Figure 2-7 Universal Mount with 10GHz SRU

2.3.6 Installing the 10 GHz SRU

The 10 GHz SRU may be installed with either vertical or horizontal polarization. A label on the reverse of the SRU specifies its orientation for vertical or horizontal polarization, and the polarization is noted in the illustrations. A rotation of 180 degrees will maintain the polarization; a rotation of 90 degrees will change it. Both the 10 GHz SRU and the 10 GHz BRU must be mounted in the correct (and the same) polarization or communications will not be effective.

There are three positions that the SRU may be mounted in. Two of these result in (vertical) polarization; one is for (horizontal) polarization. To install the 10 GHz SRU to the 10 GHz SRU mount, follow these instructions.

1. Three threaded studs protrude from the back of the SRU. Choose the polarization and position you want for the SRU and insert the three studs into the corresponding holes in the SRU mount.
2. Install a nut, lock washer and flat washer on each bolt. Add a drop of anti-seize compound onto the bolt, close to the final position of the nut.
3. Tighten to the torque spec.
4. Follow the instructions in Chapter 1 to align the SRU and the BRU.

Figure 2-8 Installing the 10 GHz SRU – Reverse View

2.3.7 Latin American 10 GHz Frequency Plan

7.466 MHz Channel Spacing

Channel	Band 1 Downstream (MHz)	Band 2 Upstream (MHz)
1	10153.96667	10153.96667
2	10161.43333	10511.43333
3	10168.9	10518.9
4	10176.36667	10526.36667
5	10183.83333	10533.83333
6	10191.3	10541.3
7	10198.76667	10548.76667
8	10206.23333	10556.23333

14.933 MHz Channel Spacing

Channel	Band 1 Downstream (MHz)	Band 2 Upstream (MHz)
1	10157.7	10507.7
2	10172.63333	10522.63333
3	10187.56667	10537.56667
4	10202.5	10552.5
5	10217.43333	10567.43333
6	10232.36667	10582.36667
7	10247.3	10597.3
8	10262.23333	10612.23333

9	10213.7	10563.7
10	10221.16667	10571.16667
11	10228.63333	10578.63333
12	10236.1	10586.1
13	10243.56667	10593.56667
14	10251.03333	10601.03333
15	10258.5	10608.5
16	10265.96667	10615.96667
17	10273.43333	10623.43333
18	10280.9	10630.9
19	10288.36667	10638.36667
20	10295.83333	10645.83333

9	10277.16667	10627.16667
10	10292.1	10642.1

NOTE: The frequencies listed above are the exact transmit/receive frequencies. Frequencies displayed by the NMS may differ by a few kHz due to rounding in NMS display calculations.

2.4 Outdoor Installation of SRU with Non-Integral Antenna

The high-performance, non-integral antenna version of the radio unit consists of a parabolic antenna, shroud and radome. The feed assembly has rectangular waveguide. Two sizes of antennae are available, 0.3 m or 0.6 m.

2.4.1 Installing the Radio Unit & Antenna

2.4.1.1 General

The following installation instructions are provided for the installation of a Non-Integral Antenna (SlimLine) radio unit with the antennas that are offered for it. Prior to installation, it is suggested that this entire procedure be read and understood. Thorough preparation is essential prior to commencing the actual installation.

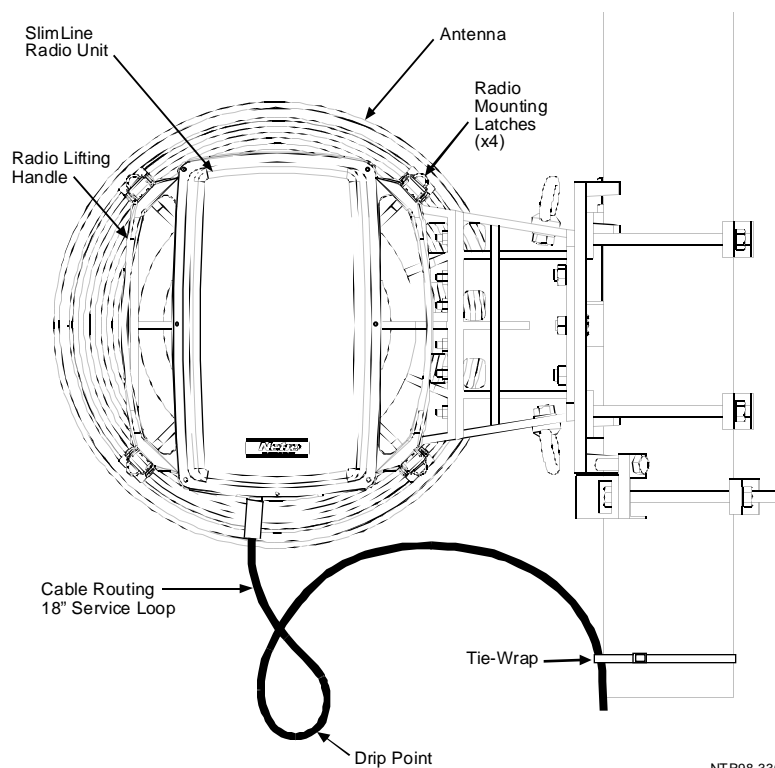


Figure 2-9 Finished SlimLine Radio Mounting: Rear View

The radio/antenna assembly is normally mounted on a pole attached to a building rooftop, wall or parapet. Shown in Figure 2-10 to **Error! Reference source not found.** are typical mountings for these environments. In each case, the mounting structure is bolted to the building using fasteners according to local building regulations. The radio/antenna assembly is then bolted to the mounting structure.

Figure 2-10 Wall Mount

Figure 2-11 Tripod Mount

When selecting a physical location, ensure that there is enough room to swing (pan) the antenna during antenna alignment and that all the adjustable hardware is accessible.

The mounting location of the radio/antenna assembly on the pole mount as well as the routing of the coaxial interface cable should be decided upon in advance.

All the mounts will accommodate a maximum pole diameter of 115mm [4.5 inches] with the supplied V-clamp bolts. The minimum pole diameter is 60mm [2.4 inches].

2.4.1.2 Tools Required

The following tools will be required to install the radio/antenna mount:

- 17mm (0.7in) combination (open and box end) wrench.
- Socket wrench, 3/8 inch (0.95cm) drive with 2-3 inch (5-7.6cm) extension and 17mm (0.7in) 6-point deep socket. An adjustable torque setting is recommended.
- Ratchet wrench, 17mm (0.7in).

2.4.1.3 Installation Instructions and Specifications

Mechanical specifications for the antennae, including adjustment ranges, weights, wind loading, and antenna mounts are included with the installation instructions shipped with each unit.

2.4.2 Pre-installation Preparation of the Antenna and Radio Assemblies

Prior to installation prepare the radio and antenna as follows:

1. Record the serial number of the antenna for future reference.
2. Determine the appropriate polarization for the radio and antenna. The radio unit (SL) can be installed with horizontal or vertical polarization (see section 2.4.3 and Figure 2-12). If the radio will be **horizontally polarized***, change the polarization of the antenna using the instructions provided in section 2.4.3.1. If the radio will be vertically polarized (which is the antenna default), proceed to step 3.
***Note:** Consult the Netro product catalog to determine availability of horizontal polarization.
3. Remove the protective cap from the antenna waveguide aperture.
4. Remove the protective cap from the radio waveguide aperture.

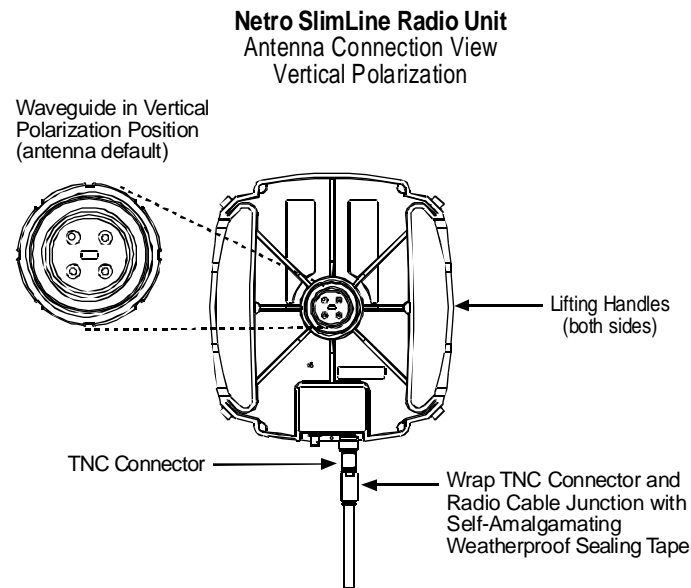
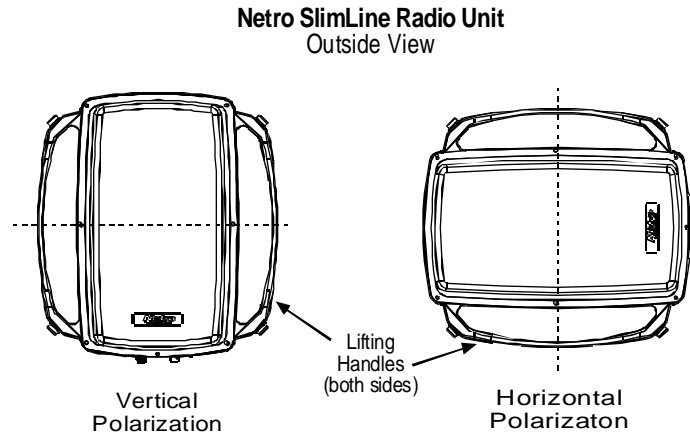
5. Black plugs cover small drain holes in the antenna reflector. Determine the orientation of the antenna on the pole then remove the plug from the hole at the bottom of the reflector.
6. If the SlimLine is horizontally polarized, connect the 90° TNC adapter supplied with the radio to the TNC connector on the radio. This adapter is required to provide the necessary clearance to route the coaxial interface cable between the radio and the mount. Orient the connector pointing downward to prevent moisture from penetrating the connector.

If the radio is vertically polarized, it does not require the 90° adapter.

7. Depending on the installation, it is sometimes more convenient to connect the SAS/radio unit cable to the radio unit prior to mounting.

A jumper consisting of a 1-meter length (40 inches) of LMR240 cable with TNC and N connectors is provided in the installation kit. When the main cable run uses LMR400, Netro recommends use of the LMR240 jumper to make the final connection to the radio from the SAS. (LMR400 requires N connectors. TNC will not work). LMR240 is more pliable and weighs less than LMR400. You can connect the LMR240 jumper to the radio prior to mounting the unit. Once the radio unit has been mounted, you can connect the jumper to the LMR400 cable.

8. Wrap the joint between the SAS cable and the SL connector with self-amalgamating weatherproof tape (provided in the radio unit installation kit). The tape is approximately 12.5 mm (0.5 inch) wide. Ensure that the tape over-wraps itself by approximately 6 mm (0.25 inch) and that the connectors are totally covered and thus protected from the elements. **Make sure the tape completely covers the connector and the heatsink of the cable. The tape must extend up the cable.**



NTR98-34

Figure 2-12 SlimLine Radio Waveguide Polarization

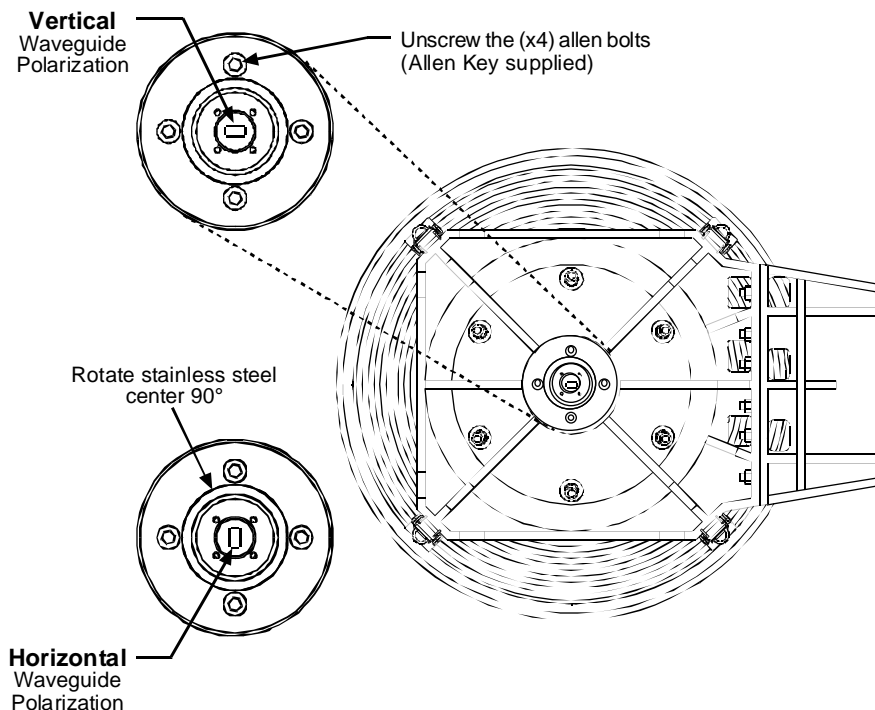
2.4.3 Installing with the Correct Polarization

The radio unit can be installed with horizontal or vertical polarization. Figure 2-12 shows the polarization with reference to the radio lifting handles and waveguide. The antenna assembly is shipped in a vertical polarization configuration.

To set the radio unit and antenna for horizontal polarization you must change the antenna's waveguide feed from its default vertical polarization to a horizontal polarization, and match the radio unit position accordingly (see Figure 2-12).

2.4.3.1 Adjusting the Antenna's Waveguide Position

1. Remove the red cap from the antenna feed. Figure 2-13 shows the position of the antenna feed as shipped with vertical polarization.
2. Using the Allen key provided, remove and save the 4 Allen bolts from the antenna chassis near the center of the antenna.
3. Grasp the stainless steel antenna feed and rotate it one-quarter turn (90°). When the long sides of the rectangular waveguide are **perpendicular to the horizon**, the antenna is horizontally polarized.
4. Align the holes for the Allen bolts in the antenna chassis with the holes in the stainless steel antenna feed inside the chassis.
5. Replace the Allen bolts (removed in step 2) into each of the 4 holes. Tighten the bolts with the Allen key provided.
6. Go to section 2.4.2 step 4 to complete the pre-installation procedures.



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Figure 2-13 Non-Integral Antenna: Changing Polarization

2.4.4 Installing the Mount

The following instructions provide details on two typical installation scenarios.

2.4.4.1 Direct Assembly at Final Mounting Position

When access to the mounting pole is unobstructed and at a comfortable working height, use the following procedure:

Install the antenna pole mount as shown in the relevant installation drawing using the V-clamps and associated hardware (see Figure 2-14).

Figure 2-14 Installing the Non-Integral Antenna Pole Mount

1. Mount the antenna/bracket assembly as shown in Figure 2-15.

Figure 2-15 Attaching the Non-Integral Antenna to the Pole Mount

Lift the radio to the antenna waveguide. Attach the radio using the four (4) latches. Place the supplied safety pins through the eyelets on the latches. A lock can be placed through a latch eyelet if security is a concern.

Figure 2-16 Completed Non-Integral Antenna Mounting

2.4.4.2 Ground Level Assembly

When access to the mounting pole is at a height making it necessary to assemble all components at ground level, use the following procedure.

1. Attach the radio to the antenna/bracket assembly and to the top half of the antenna mount. Secure the four (4) latches and install the safety pins through the latch eyelets. A lock can be placed through a latch eyelet should security be a concern.
2. Attach the V-clamp and bolts to the mount according to the relevant installation drawing.
3. Attach a lifting rigging to the entire assembly. The rigging must be capable of safely lifting the entire assembly. The SL radio assembly weighs 13.2 kg [30 lb.] with the 0.30m [12 inches] antenna and 17.8 kg [40 lb.] with the 0.6m [24 inches] antenna.
4. Raise the assembly to the position where the final mounting will be performed. Attach the assembly to the pole.

2.5 Installation of Coaxial Cable

A coaxial cable connects the SAS to the SRU. The cable generally must pass from an indoor location of the SAS to an outdoor location of the SRU. When installing the cable, consult local regulatory authorities and follow all local building codes. When laying out the coaxial cable, **include enough cable for a service loop of at least 18 inches (0.5 m)** at the SRU. When the main cable is LMR400, remember to use a 12-inch (0.30m) length of LMR240 for the final connection to the SRU, to avoid overloading the connector due to the weight of the LMR400 cable.

ATTENTION

Follow local building codes *when routing coaxial cables from the inside to the outside of the site and when installing lightning arrestors.*

2.5.1 Connect SRU Coaxial Cable

Use the following procedure for connecting the coaxial cable to the SRU.

1. Install the lightning arrestors in the cable
2. **Ensure that the connectors are dry and free of corrosion.** Even a small amount of dampness could cause corrosion, and signal a weak spot. Connect the coaxial cable to the TNC connector on the SRU.
3. Wrap the connection with self-amalgamating weatherproof tape. **Make sure that the tape completely covers the connector and the heatshrink of the cable. The tape must extend up the cable.**
4. Tie wrap the cable to the pole **leaving an 18 inch (0.5 m) service loop.** Be sure the service loop has a 6" (15.24cm) drop pointing down so that water drains away from the connector. Avoid positioning any connector junction at a low point in the service loop.

WARNING

Install and connect the coaxial cable between the SAS and the SRU prior to turning on the unit.
