HUGHES
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# 0.98 m Ka-Band Antenna Installation Guide

## *Model: AN8-098-G*

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# Contents

# Understanding safety alert messages

Safety alert messages call attention to potential safety hazards and tell you how to avoid them. These messages are identified by the signal words DANGER, WARNING, CAUTION, or NOTICE, as illustrated below. To avoid possible property damage, personal injury, or in some cases possible death, read and comply with all safety alert messages.

## Messages concerning personal injury

The signal words DANGER, WARNING, and CAUTION indicate hazards that could result in personal injury or in some cases death, as explained below. Each of these signal words indicates the severity of the potential hazard.


DANGER indicates a potentially hazardous situation which, if not avoided, *will* result in death or serious injury.


WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.


CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

## Messages concerning property damage

A NOTICE concerns property damage only.


NOTICE is used for advisory messages concerning possible property damage, product damage or malfunction, data loss, or other unwanted results—but *not* personal injury.

## Safety symbols

The generic safety alert symbol

calls attention to a potential personal injury hazard. It appears next to the DANGER, WARNING, and CAUTION signal words as part of the signal word label. Other symbols may appear next to DANGER, WARNING, or CAUTION to indicate a specific type of hazard (for example, fire or electric shock). If other hazard symbols are used in this document they are identified in this section.

### *Additional symbols*

This document uses the following hazard symbols:

Indicates a safety message that concerns a potential electric shock hazard.

Indicates a safety message that concerns a potentially hazardous situation in which you could fall.

Indicates a safety message that concerns radio frequency (RF) energy.

## Antenna installation safety

Observe the following precautions when installing the satellite antenna. This manual also includes other safety alerts, where appropriate, concerning specific installation procedures.

**WARNING**

Only Hughes certified installers may install or service Hughes antennas and their components. Installers must expressly acknowledge the Hughes requirements for Hughes installations.

**DANGER** 

If you work on a roof, tower, or other high structure, or use a ladder or scaffold to access the work site, follow these precautions to prevent personal injury or death:

- Walk only on sound roof structures.
- Make sure the antenna assembly and installation surface are structurally sound so that they can support all loads (equipment weight, ice, and wind).
- Use safety equipment (e.g., a lifeline) appropriate for the work location.
- Follow all manufacturer safety precautions for all safety and other equipment used.
- Perform as many procedures as possible on the ground.

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**DANGER** 

- To avoid electric shock, stay at least 20 ft away from power lines when there is a chance that you or the equipment you are using could accidentally come into contact with the power lines. Always look up and check for overhead lines before moving a ladder.
- If any part of the antenna or mount assembly comes in contact with a power line, call the local power company to remove it. *Do not try to remove it yourself.* If the antenna reflector contacts electric power lines, you could be killed or seriously injured.
- For pole mount installations, be sure to obtain information regarding underground utilities in the proposed location before digging.
- Call local utility companies before digging to avoid striking underground cables, pipes, or electric lines.
- Striking or cutting underground cables, pipes, or electric lines can cause personal injury or property damage.

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**WARNING**

Properly ground the antenna assembly in accordance with all local and national electrical codes.

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**CAUTION**

If the antenna or mount assembly begins to fall during the installation, *do not attempt to catch it*. Move away and let it fall.

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**⚠ WARNING**

Antennas that have been improperly installed or attached to an unstable structure are susceptible to wind damage, which can be very serious or even life threatening. The product owner and installer assume full responsibility that the installation is structurally sound to support all loads (weight, wind, and ice) and is properly sealed against leaks.

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**⚠ CAUTION** 

Observe these precautions to avoid exposure to RF radiation, a potential safety hazard:

- The antenna must be installed in a location not readily accessible to children and in a manner that prevents human exposure to potentially harmful levels of radiation.
- Antennas mounted in Puerto Rico, the continental United States, or at any site with a greater than 30° elevation angle must be installed such that the lower lip of the antenna reflector is at least 5 ft above any surface upon which a person might be expected to stand, and 3 ft 3 inches from any opening (such as a door or window) in a building or adjacent structure.
- Antennas mounted in Canada, Alaska, Hawaii, or any site with a less than 30° elevation must be installed such that the lower lip of the antenna reflector is at least 5 ft 9 inches above any surface upon which a person might be expected to stand, and 3 ft 3 inches from any opening (such as a door or window) in a building or adjacent structure.
- The antenna must be mounted such that no object that could reasonably be expected to support a person is within 6 ft 7 inches of the edges of a cylindrical space projecting outward from the antenna reflector toward the satellite.
- If the above distance requirements cannot be met, the antenna must be mounted in a controlled area inaccessible to the general public, such as a fenced enclosure or a roof.
- A fenced installation must have a locked entry, and the fenced area must be large enough to protect the general public from exposure to potentially harmful levels of radiation.
- Access to a roof installation in a commercial, industrial, or institutional environment must be limited by a door or a permanently fastened ladder that is locked to deny access to the general public.
- Once the transmitter becomes operational, maintain a safe distance – at least 3 ft.

Failure to observe these cautions could result in injury to eyes or other personal injury.

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**CAUTION** 

Observe these precautions to avoid exposure to RF radiation, a potential safety hazard:

- Do not remove the yellow caution label on the antenna system. All antennas of any type or size must carry an industry-standard and government-approved Radiation Hazard Caution label on the feed support arm
- A fenced or roof installation in a commercial, industrial, or institutional environment must carry a Radiation Hazard Caution sign on the access door, gate, or permanently mounted access ladder within plain sight of anyone approaching the antenna from the front or sides of the reflector.

Failure to observe these cautions could result in injury to eyes or other personal injury.

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**Note:** Some installations may require additional precautions. See the appropriate site preparation and mount installation guide for more information.

*Chapter 1*

# Overview

This installation guide explains how to assemble and install the Hughes Ka-band AN9-098-G 0.98 m antenna. It is written for qualified installers who are familiar with satellite antenna installation practices and are capable of properly applying the information presented.

This chapter presents an overview of the AN9-098-G antenna, a summary of the steps used to assemble and install the antenna, and supplemental information on tasks related to antenna installation.

**⚠ WARNING**

Only Hughes-certified installers may install or service Hughes antennas and their components. Installers must expressly acknowledge the Hughes requirements for Hughes installations.

## Model AN9-098-G antenna description

The Hughes model AN9-098-G antenna is designed for Ka-band applications. Each antenna station consists of an antenna assembly and a satellite modem. The satellite modem communicates with both satellite and the Network Operations Center (NOC) using the antenna and radio assembly.

The antenna is connected to the satellite modem using two intra-facility link (IFL) cables that carry the transmit and receive signals.

Figure 1 on page 12 shows the AN9-098-G antenna—with radio assembly—assembled and installed on a trimast mount.


Figure 1: Hughes model AN9-098-G 0.98 m satellite antenna

## Antenna installation summary

Table 1 lists the basic steps and related tasks for assembling and installing the antenna. Perform the procedures in the order listed. For detailed information on each task, refer to the sections and/or other documents listed.

Table 1: Satellite antenna installation summary

| | Task | For details, see... |
|---|---|---|
| 1 | Explain the installation process to the customer. | |
| 2 | Conduct a site survey with the customer to identify a suitable location for the antenna. | Select the installation site on page 24<br><br>Appropriate site preparation and mount installation guide |
| 3 | Use Onsite Accelerated Service Installation System (OASIS) app on your smart device to determine your best line of sight (LOS) before installing your antenna, then take the required pictures.<br><br>Once you have selected the best possible location, download your GPS coordinates within 15 m of the selected site to get the exact settings for the pointing values (azimuth, elevation, and tilt). | ***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001) |
| 4 | Install and apply power to the satellite modem.<br><br>**Note:** You must install the satellite modem before installing the antenna to determine the proper antenna pointing values (azimuth, elevation, and tilt). | Appropriate satellite modem installation guide |
| 5 | Connect your laptop to the satellite modem and enter site latitude and longitude (from GPS).<br><br>Your GPS device must display coordinates in a degrees/minutes/seconds format, which is commonly found on devices manufactured by Garmin, Magellan, etc. Some phone or tablet GPS apps do not offer seconds measurements. | ***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001) |
| 6 | Determine the most suitable method for mounting the antenna, then install the antenna mast.<br><br>**Note:** The antenna mast ***must*** be plumb. The antenna cannot be adjusted to correct for a mast that is not plumb. | Select the installation site on page 24<br><br>Appropriate site preparation and mount installation guide |
| 7 | Assemble the antenna (Az/El mount, feed support arm, reflector, and other parts). | Chapter 3 – Installing the antenna and radio |
| 8 | Install the radio assembly | Installing the radio assembly on page 33 |

| | Task | For details, see... |
|---|---|---|
| 9 | Install the antenna assembly on the mast. | Installing the antenna assembly onto the mast pipe on page 40 |
| 10 | Install the IFL cable between the satellite modem and the antenna. | Chapter 4 – Cabling and connections |
| 11 | Ground the antenna assembly. | Ground connections on page 46 |
| 12 | Point the antenna. | Mechanical adjustments for pointing:<br>Chapter 5 – Adjusting antenna azimuth and elevation<br><br>Pointing procedure:<br>***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001) |

Once the antenna is properly pointed, you can commission the satellite modem as instructed in the appropriate satellite modem installation guide.

## Approved cables

For a list of approved coaxial cable types for the IFL between the antenna and the satellite modem, see the Hughes FSB, ***IFL Cable, Approved List (with lengths) for Spaceway Domestic Installations*** (FSB_080202_01).

The FSB lists the maximum cable length for each approved cable type.

Because the requirements and conditions for each installation site may vary, you must use your own judgment and best practices to determine how to route and connect the IFL cable.

*Chapter 2*

# Antenna parts and recommended tools

This chapter identifies the main components and parts provided with the AN9-098-G Ka-band antenna kit. It also provides a list of required tools you will need to successfully perform the installation.

## Antenna kit components

When you receive the antenna equipment, unpack and inspect the components and hardware to ensure that all parts have been received in good condition.

**Note:** To avoid potential damage, leave all components in their protective packages until required.

**⚠ CAUTION**

Metal components may contain sharp edges. Use care when unpacking and handling antenna parts.

If any parts appear to have been damaged in transit, immediately contact the freight carrier. If any parts appear to be missing or damaged, but not as a result of handling in transit, contact your dealer or distributor.

The main components of the antenna kit are listed below. Figure 2 on page 16 shows the components.

**Note:** The radio assembly is shipped separately from the rest of the antenna and may not arrive at the same time.

- Az/El mount assembly
- Reflector bracket and polarization plate
- Antenna reflector
- Feed support arm and feed tube adapter
- Side support rods
- Radio assembly (shipped separately)


Figure 2: Antenna parts

The following sections describe and illustrate each component of the antenna kit.

## *Az/El mount assembly*

The Az/El mount assembly, shown in Figure 3, includes components that allow you to adjust the antenna elevation and azimuth—the Az/El canister, the elevation scale, and the azimuth and elevation adjustment tools. It also includes a grounding screw, used to ground the assembly to the grounding block.

The Az/El canister supports the antenna and secures it to the mast. The elevation scale is used to measure the angle of antenna elevation. The azimuth and elevation adjustment tools are used to finely adjust the azimuth and elevation of the reflector during antenna pointing. See the ***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001) for detailed instructions.

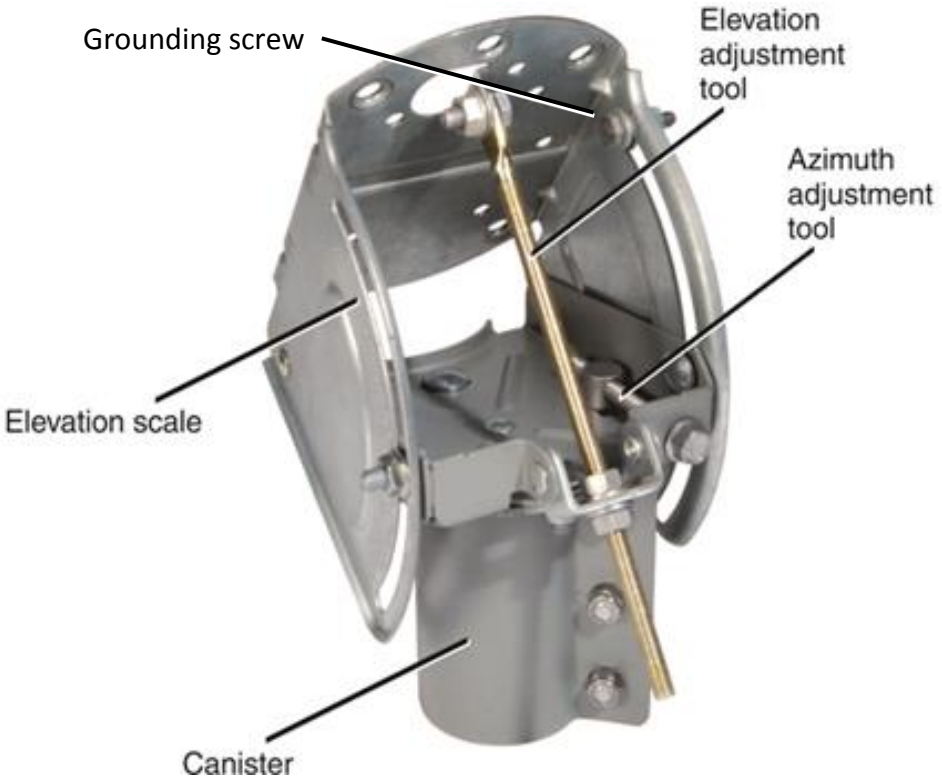


Figure 3: Az/El mount assembly

### *Reflector bracket and polarization plate*

The reflector bracket, shown in Figure 4, attaches to the Az/El mount and supports the antenna reflector. The polarization plate allows the reflector to rotate so that it can be adjusted for proper tilt. (See also Figure 8 on page 27.)

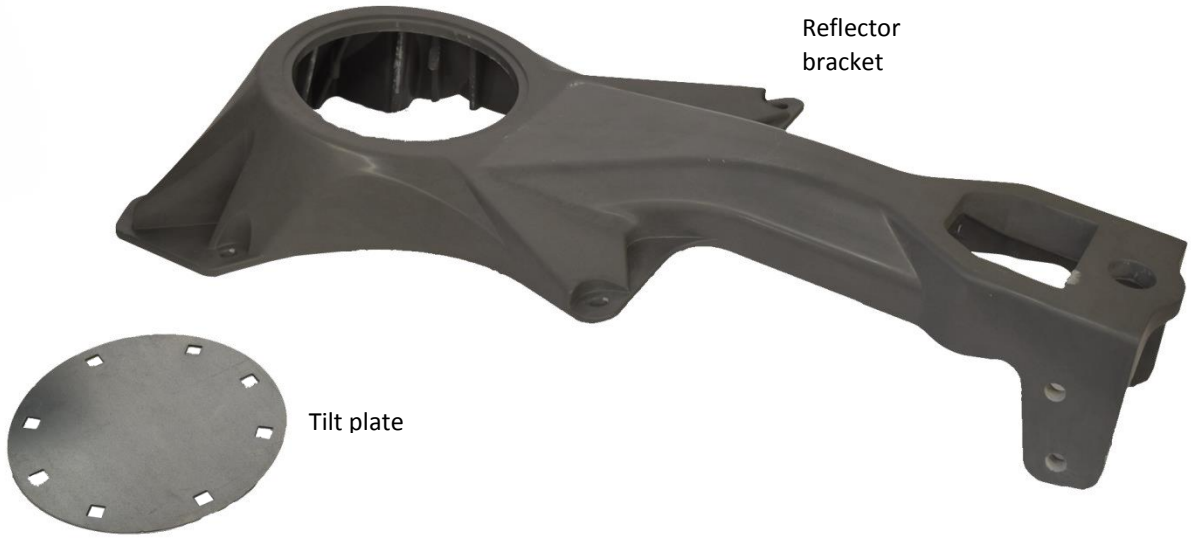


Figure 4: Reflector bracket and polarization plate

### *Antenna reflector and feed support arm*

The antenna reflector, shown in Figure 5, attaches to the reflector bracket. The feed support arm appears below the reflector. The feed support arm supports the radio assembly and feed horn.


Figure 5: Reflector and feed support arm

**NOTICE**

Handle the antenna reflector with care to avoid bending it or causing other damage.

### *Radio assembly*

The radio assembly, shown in Figure 6, consists of the radio transmitter/receiver, polarizer waveguide, and feed horn. For information about radio polarization, see Adjusting circular polarization on page 34.

**NOTICE**

The HN9x00 system has two IFL cables for transmit and receive signals.

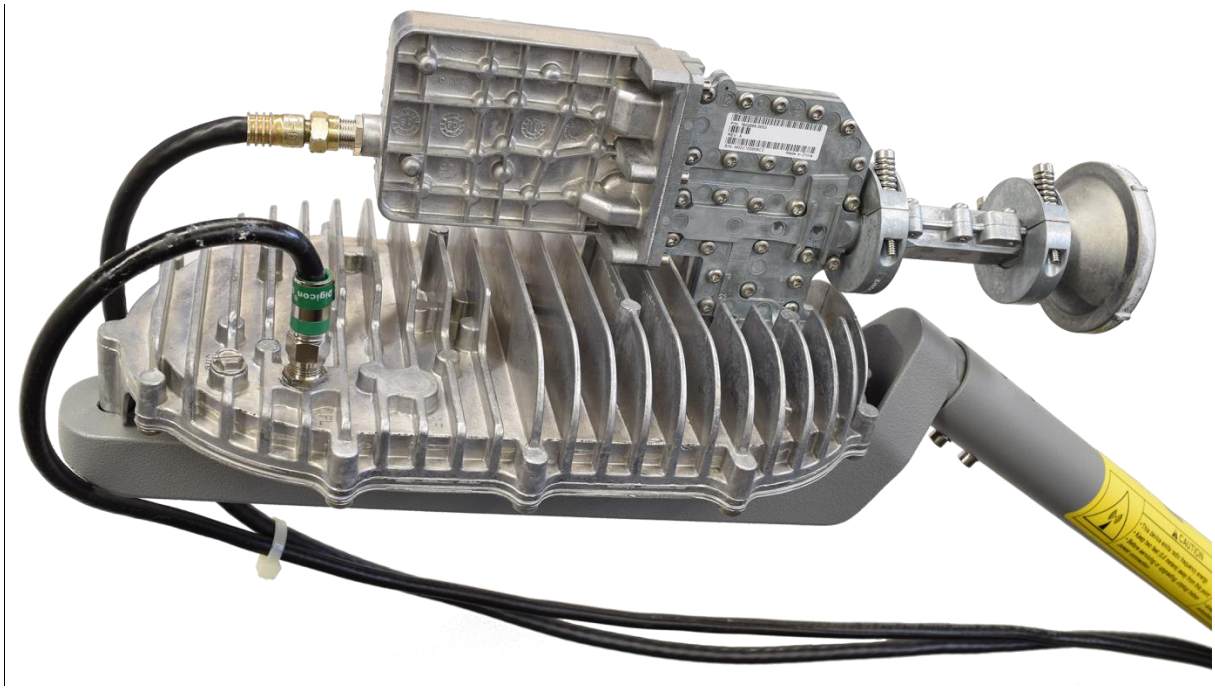

Figure 6: Radio assembly

## Small hardware parts list

Table 2 lists the small hardware parts included with the antenna kit and radio assembly.

Table 2: Small hardware parts

| Hardware parts | Quantity | Listed parts are used to attach/assemble... | Illustration showing where parts are used |
|---|---|---|---|
| $^{5}/_{16}$ inch × $^{3}/_{4}$ inch carriage bolts | 5 | Reflector bracket and polarization plate to Az/El mount assembly | Figure 8 on page 27 |
| $^{5}/_{16}$ inch hex nuts | 5 | | |
| Thread cutting screws | 6 | Antenna reflector to reflector bracket | Figure 10 on page 29 |
| $^{1}/_{4}$ inch × 2.0-inch carriage bolts | 2 | Feed support arm | Figure 11 on page 30 |
| $^{1}/_{4}$ inch flat washers | 2 | | |
| $^{1}/_{4}$ inch lock washers | 2 | | |
| $^{1}/_{4}$ inch hex nuts | 2 | | |
| $^{1}/_{4}$ inch × 1.5-inch carriage bolts | 1 | | |
| $^{1}/_{4}$ inch × 1.0-inch carriage bolts | 2 | Side support rod installation | Figure 12 on page 31 |
| $^{1}/_{4}$ inch flat washers | 2 | | |
| $^{1}/_{4}$ inch lock washers | 2 | | |
| $^{1}/_{4}$ inch hex nuts | 2 | | |
| $^{1}/_{4}$ inch × 2.0-inch hex bolts | 1 | Attaching the support arm to the reflector | Figure 13 on page 32 |
| $^{1}/_{4}$ inch flat washers | 3 | | |
| $^{1}/_{4}$ inch lock washers | 2 | | |
| $^{1}/_{4}$ inch hex nuts | 2 | | |
| $^{5}/_{16}$ inch x 1.00-inch hex bolt | 4 | Securing the feed tube adapter | Figure 13 on page 32 |
| $^{5}/_{16}$ inch flat washers | 4 | | |
| $^{5}/_{16}$ inch lock washers | 4 | | |
| M4-0.7 x 10 pan head screw | 1 | Securing the radio | Figure 14 on page 33 |

# Tools

Table 3 lists the tools recommended for assembling and installing the antenna.

Table 3: Required tools

| Tools | Details |
|---|---|
| Socket wrench, $^{1}/_{2}$ inch (with 3 inch extension) | For $^{5}/_{16}$ inch bolts. |
| Open-end wrench, $^{1}/_{2}$ inch | For $^{5}/_{16}$ inch bolts. Two of the Az/El canister nuts are not accessible by socket wrench. Some nuts and bolts require a second wrench to prevent turning. |
| 2 open-end or socket wrenches, $^{7}/_{16}$ inch | For $^{1}/_{4}$ inch bolts. Some nuts and bolts require a second wrench to prevent turning. |
| Torque wrench, foot-pounds | With $^{1}/_{2}$ inch and $^{7}/_{16}$ inch sockets, capable of measuring torque to 8 ft-lb. |
| Torque wrench, open-end, inch-pounds | $^{7}/_{16}$ inch, capable of tightening to 20 inch-lb, such as the Ripley model TW 207-AH-B torque wrench, which is present to 20 inch-lb. Used to connect IFL to the radio assembly or ground block. |
| M3 Allen wrench<br>or<br>Bondhus 3 mm screwdriver | For Allen screws on polarizer assembly (for adjusting circular polarization only). |
| Phillips-head screwdriver, $^{1}/_{4}$ inch | For screw used to secure antenna reflector to reflector bracket. |
| Bubble level | Used to ensure the mast is plumb. |
| Compass | Used in determining proper antenna azimuth. |
| Dielectric grease | Used to prevent moisture contamination from occurring on coaxial cable connections. |
| Weatherproofing tape | Used to keep moisture away from cable connections. |
| Approved RG6 cable | Used for IFL between satellite modem and antenna. |
| UV-rated cable ties | Used to secure slack in cables to antenna mast. |

*Chapter 3*

# Installing the antenna and radio

This chapter explains how to assemble and install the antenna, radio assembly, and associated hardware.

**⚠ CAUTION**

Before you install the antenna, read all safety information in Understanding safety alert messages on page 5.

## General instructions for assembling the antenna

**⚠ DANGER**

If you work on a roof, tower, or other high structure, or use a ladder or scaffold to access the work site, follow these precautions to prevent personal injury or death:

- Walk only on sound roof structures.
- Ensure that the antenna assembly and installation surface are structurally sound so that they can support all loads (equipment weight, ice, and wind).
- Use safety equipment (e.g., a lifeline) appropriate for the work location.
- Follow all manufacturer safety precautions for all safety and other equipment used.
- Perform as many procedures as possible on the ground.

**⚠ DANGER** 

- To avoid electric shock, stay at least 20 ft away from power lines when there is a chance that you or the equipment you are using could accidentally come into contact with the power lines. Always look up and check for overhead lines before moving a ladder.
- If any part of the antenna or mount assembly comes in contact with a power line, call the local power company to remove it. *Do not try to remove it yourself.* If the antenna reflector contacts electric power lines, you could be killed or seriously injured.
- For pole mount installations, be sure to obtain information regarding underground utilities in the proposed location before digging.

## Assembling the antenna

Before you assemble the antenna, read these important instructions:

- Sequence of steps – When you assemble the antenna, be sure to follow the instructions in this chapter in the order they are presented.

**WARNING**

For rooftop installations, assemble the antenna on the ground and then carry the fully assembled antenna up to the roof.

- Tightening hardware – Do not fully tighten any nuts or other hardware until instructed to do so. See Table 4 for torque specifications.
- Torque – To ensure successful installation of the antenna, it is critical that you tighten all nuts and socket-head screws to the torque values shown in Table 4.

Table 4: Torque specifications

| Fastener or connector | Proper torque value |
|---|---|
| $^{5}/_{16}$ inch | 15 ft-lb |
| $^{1}/_{4}$ inch | 3 ft-lb |
| $^{11}/_{36}$ inch thread cutter | 10 ft-lb |
| M4 wrench | 19 in-lb |

## Select the installation site

Before selecting an antenna installation site, check OASIS or the installation reference sheet to see if there is a customer preference for the installation site. Work with the customer to see if a line of sight (LOS) is available at their preferred site. Also, refer to the appropriate antenna site preparation and mount installation guide that discusses the factors you should consider when selecting an installation site.

The first and most important consideration when choosing a prospective site is whether the site can provide an acceptable LOS to the satellite. Choose a site where the antenna will be able to receive the strongest signal available. A clear, unobstructed view of the southern sky is necessary for proper transmission. Also, consider obstructions that may occur in the future, such as construction in the area or the growth of trees.

Also, consider potential grounding sources when choosing a location. For guidance on grounding, see the documents listed in Ground connections on page 46.

A local building permit may be required before installing the antenna. It is the property owner's responsibility to obtain necessary permits and comply with local building codes.

# Install the satellite modem

**Note:** You must install the satellite modem before installing the antenna to determine the proper antenna pointing values (azimuth, elevation, and tilt).

For installation instructions, refer to the appropriate installation guide for the satellite modem you are installing.

# Determining the pointing values and polarization setting

## *Pointing values*

Once the satellite modem is fully powered up, connect your smart device through a wireless router and set the pointing parameters by accessing the satellite modem System Control Center through your mobile browser (which can be launched from within the OASIS app). If you need further guidance, consult the ***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001).

Alternatively, connect the satellite modem to your laptop using an Ethernet cable, and then use your global positioning system (GPS) receiver to calculate the exact latitude and longitude of the antenna site. Follow the instructions in the ***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001) to enter the latitude and longitude information to determine the initial antenna azimuth, elevation, and tilt values. Record these values and keep them handy for reference as you install and point the antenna.

## *Polarization setting*

At the satellite modem System Control Center, enter the installation parameters as described in the ***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001) to obtain the required polarization setting (either left-hand circular polarization [LHCP] or right-hand circular polarization [RHCP]). Make a note of the required setting for reference when you install the radio.

# Install the antenna mount

Before installing the antenna, you must first install a suitable antenna mount. If the system requires a pole mount installation, be sure to obtain information about any underground utilities in the proposed location. Have the appropriate utility company mark the location of any underground telephone wires, storm drains, and so on. Also, because soils vary widely in composition and load capacity, it may be necessary to consult a professional engineer to determine the appropriate foundation design.

If you are using the QUIKRETE fast-setting concrete mixture to set the pole mount, it will take about 4 hours for the concrete to cure to the point where you can safely install the antenna. See the appropriate antenna site preparation and mount installation guide for more information about using QUIKRETE.

Mounts installed with a standard concrete mix need at least 24 hours to cure before you can install an antenna on the mount. Be sure to plan and schedule the installation accordingly.

**Note:** Ensure the pole remains plumb as the concrete cures. You can accomplish this by bracing the pole. Figure 7 shows an example of how to do this.

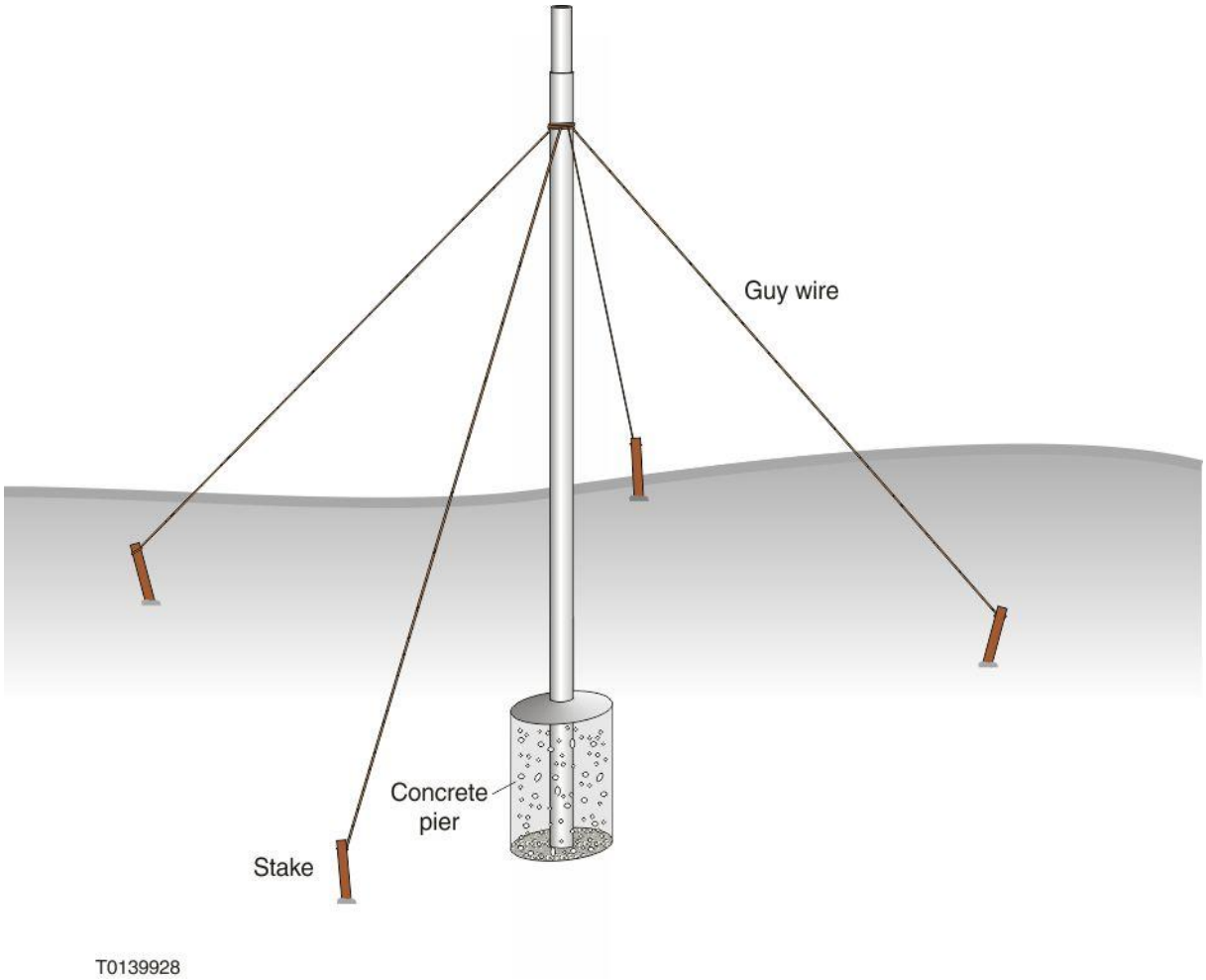


Figure 7: Pole mount kept plumb with guy wires

**Note:** The antenna mast *must* have an outside diameter of $2^{3}/_{8}$ inches.

For complete information regarding antenna mount installation, including various mounting methods, refer to the appropriate antenna site preparation and mount installation guide.

Refer to the installation reference sheet for any customer-requested guidelines concerning the mount installation. When you arrive at the site, only use the installation method/location requested in the work order if LOS proves it to be the best method/location.

If the installation reference sheet does not specify a method, you must use one of the methods documented in the appropriate antenna site preparation and mount installation guide. Most installations in commercial, industrial, or institutional environments use a non-penetrating roof mount.

## Installing the reflector bracket and polarization plate

Attach the polarization plate and reflector bracket to the Az/El mount, as shown in Figure 8.

1. Place the reflector bracket against the face of the Az/El mount. Make sure that the Az/El mount fits inside the lip of the reflector support. Then place the polarization plate over the round opening in the reflector bracket.
2. Rotate the polarization plate so that the five holes line up with the corresponding holes in the Az/El mount.

   **Note:** The polarization plate contains additional holes that will not line up with holes in the Az/El mount.

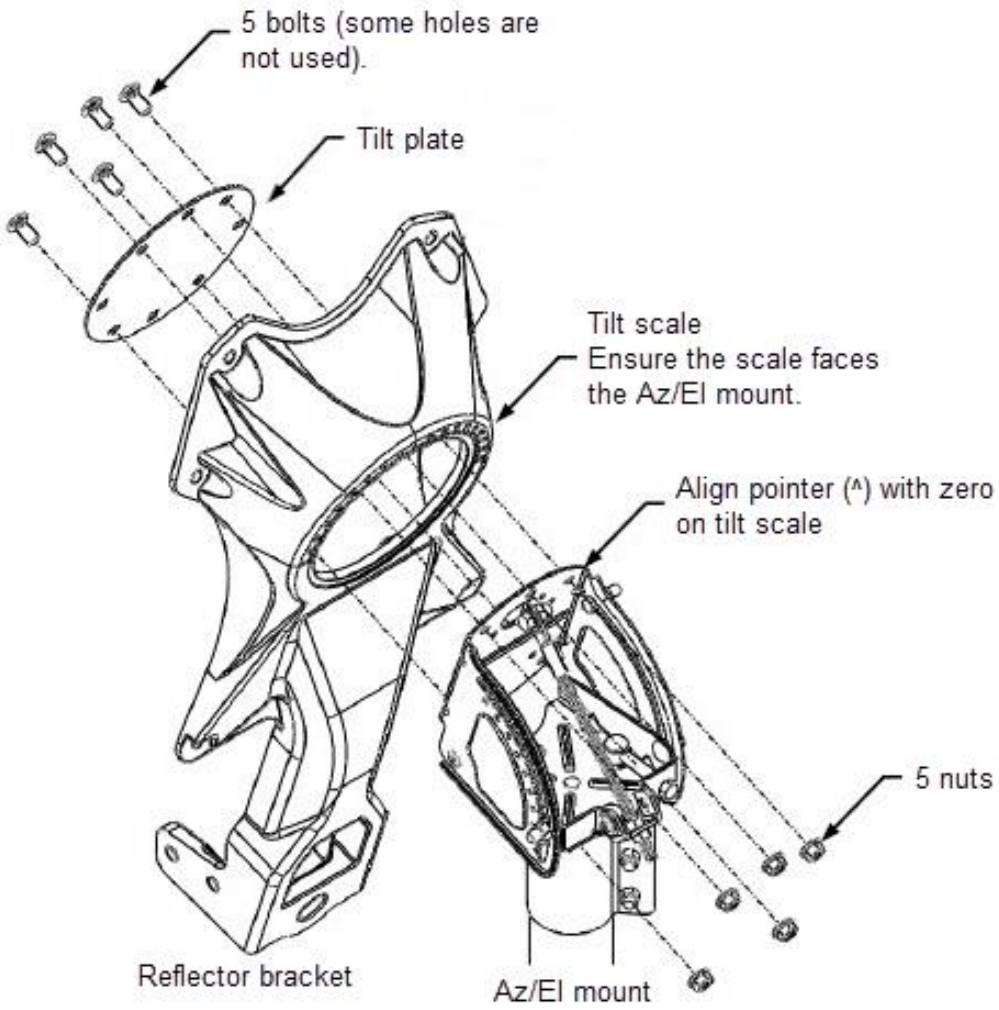


Figure 8: Attaching the reflector bracket and polarization plate

3. Insert five carriage bolts through the polarization plate and into the corresponding holes in the Az/El mount.

4. From the opposite side of the reflector bracket, place a hex nut on each bolt and tighten them lightly, only until snug. The reflector bracket should rotate freely between the Az/El mount and the polarization plate.

   When the reflector bracket is correctly attached to the Az/El mount, you can see the tilt scale numbers above the tilt pointer, as shown in Figure 9. In the figure, the tilt is set to **0**.

   The Az/El tilt scale can place the tilt or rotation of the antenna to either a positive or negative position, based on coordinates, and must be set on each installation according to specifications.

5. Using the tilt value you obtained from the satellite modem, as described in Determining the pointing values and polarization setting on page 25, set the scale to the proper reading and lock down the five bolts.

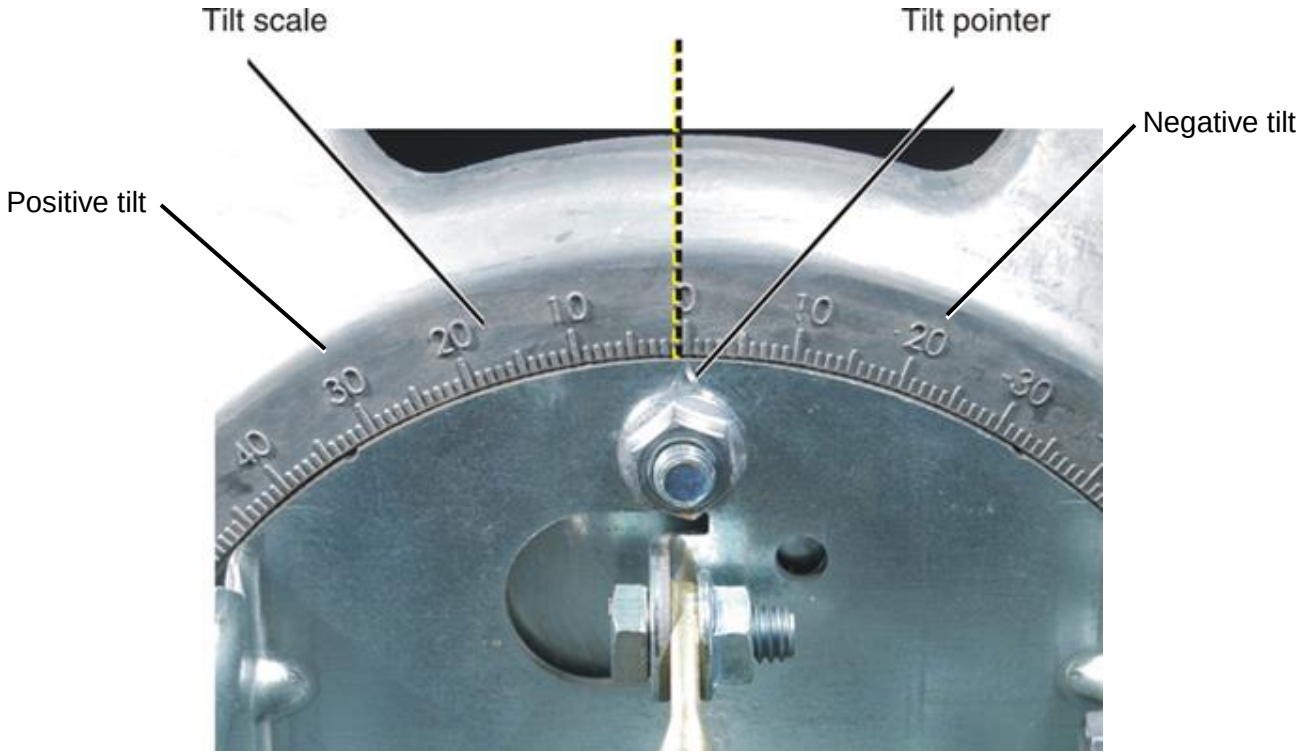


Figure 9: Tilt scale and pointer

## Installing the antenna reflector

Follow the steps below to attach the antenna reflector to the reflector bracket.

**NOTICE**

While attaching the reflector bracket, do not place the reflector face down on a hard surface. The weight of the reflector bracket and any additional pressure during assembly could bend the reflector.

1. Line up the holes on the reflector with the holes on the reflector support, as shown in Figure 10.
2. Insert six thread-cutting screws ($^{11}/_{32}$-14 × 1.13 inch) into the holes in the reflector bracket and through the corresponding holes in the reflector, as shown in Figure 10.

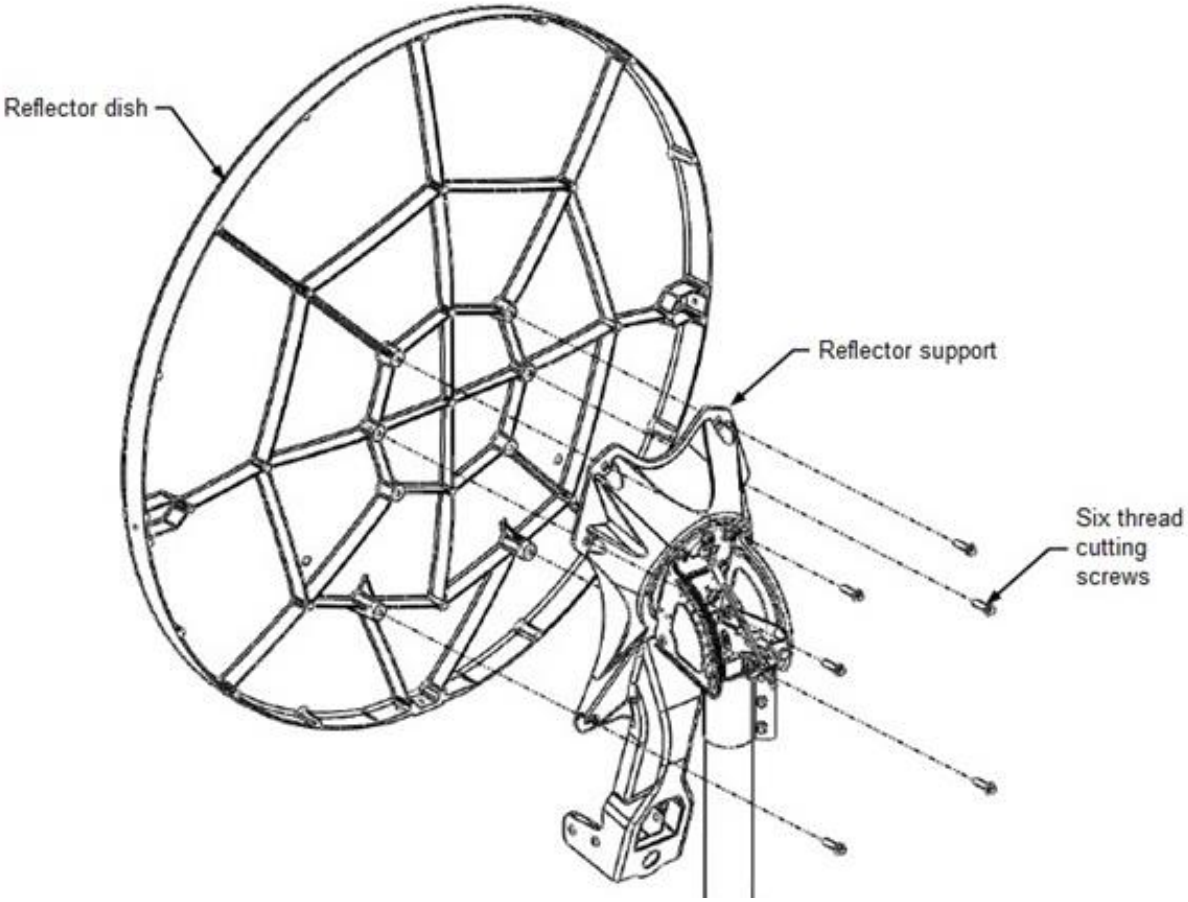


Figure 10: Attaching the antenna reflector

3. Tighten the screws using a $^{5}/_{16}$ inch wrench.

## Installing the feed support arm

To assemble the feed support arm (Figure 11):

1. Insert a $^{1}/_{4}$-20 x 1.5 inch carriage bolt into the pocket of the feed tube adapter.

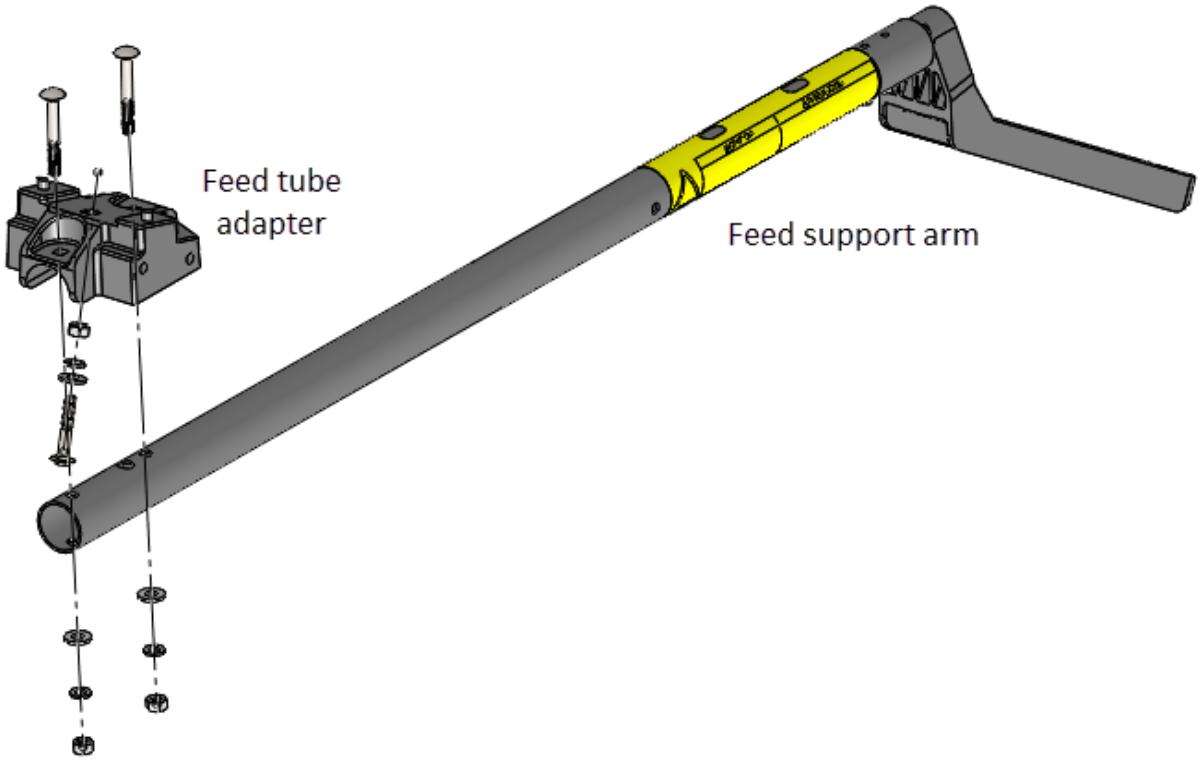


Figure 11: Assembling the feed support arm

2. Place the feed tube adapter onto the feed support arm and secure it in place with two $^{1}/_{4}$-20 x 2 inch carriage bolts.
3. Fasten each of the two carriage bolts in place with a $^{1}/_{4}$ inch flat washer, a lock washer, and a hex nut. Fasten snugly.

To install the feed support arm (Figure 12):

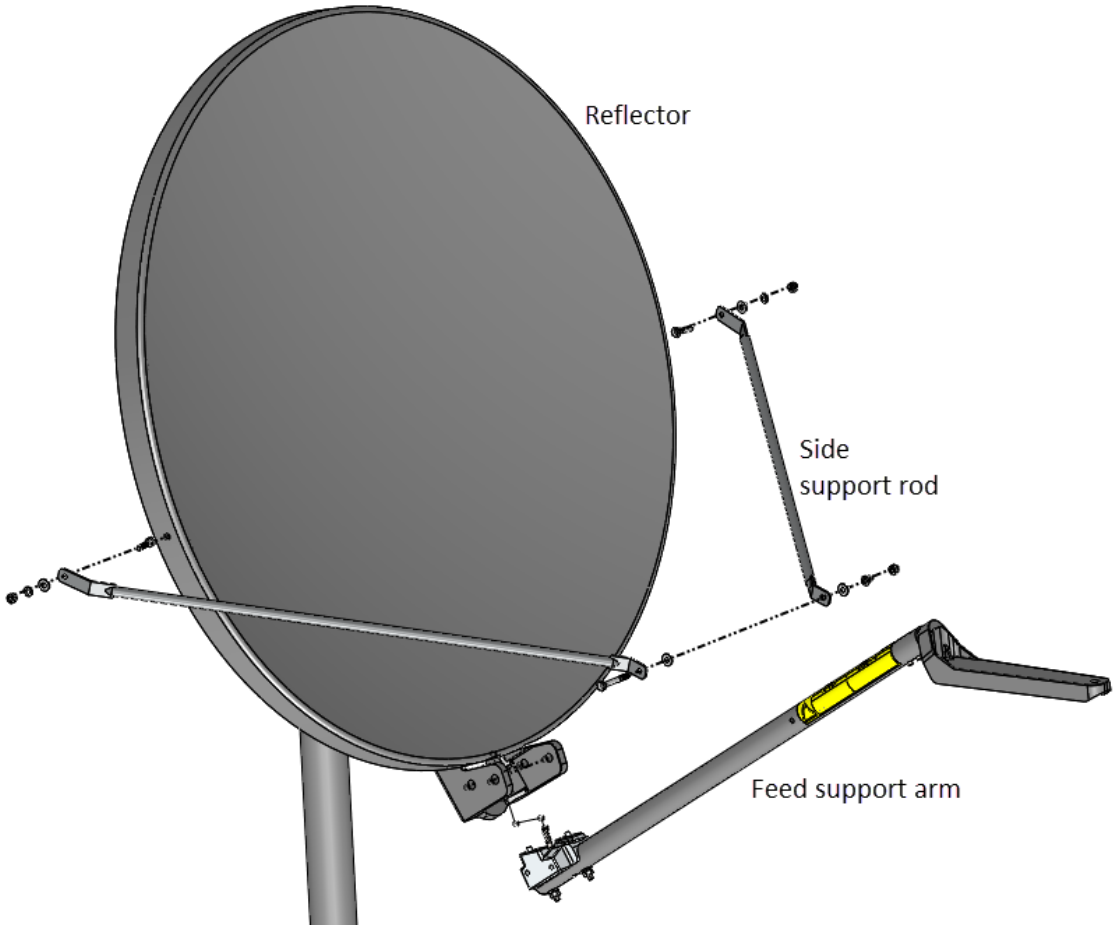


Figure 12: Side support rod and feed support arm installation

1. Attach the side rods to the reflector dish using two $^1/_4$-20 x 1 inch carriage bolts. Loosely secure both bolts with a $^1/_4$ inch flat washer, a lock washer, and a hex nut. You should still be able to rotate the side rods.
2. Loosely attach the feed support arm to the side rods using a single $^1/_4$ x 2 inch hex bolt and two $^1/_4$ inch flat washers, a lock washer, and a hex nut. The washers must be placed on both sides of the feed support arm, as shown in Figure 12.
3. Swing the feed support assembly upward and use a $^1/_4$ inch flat washer, lock washer, and hex nut to secure it to the reflector. See Figure 13 on page 32.

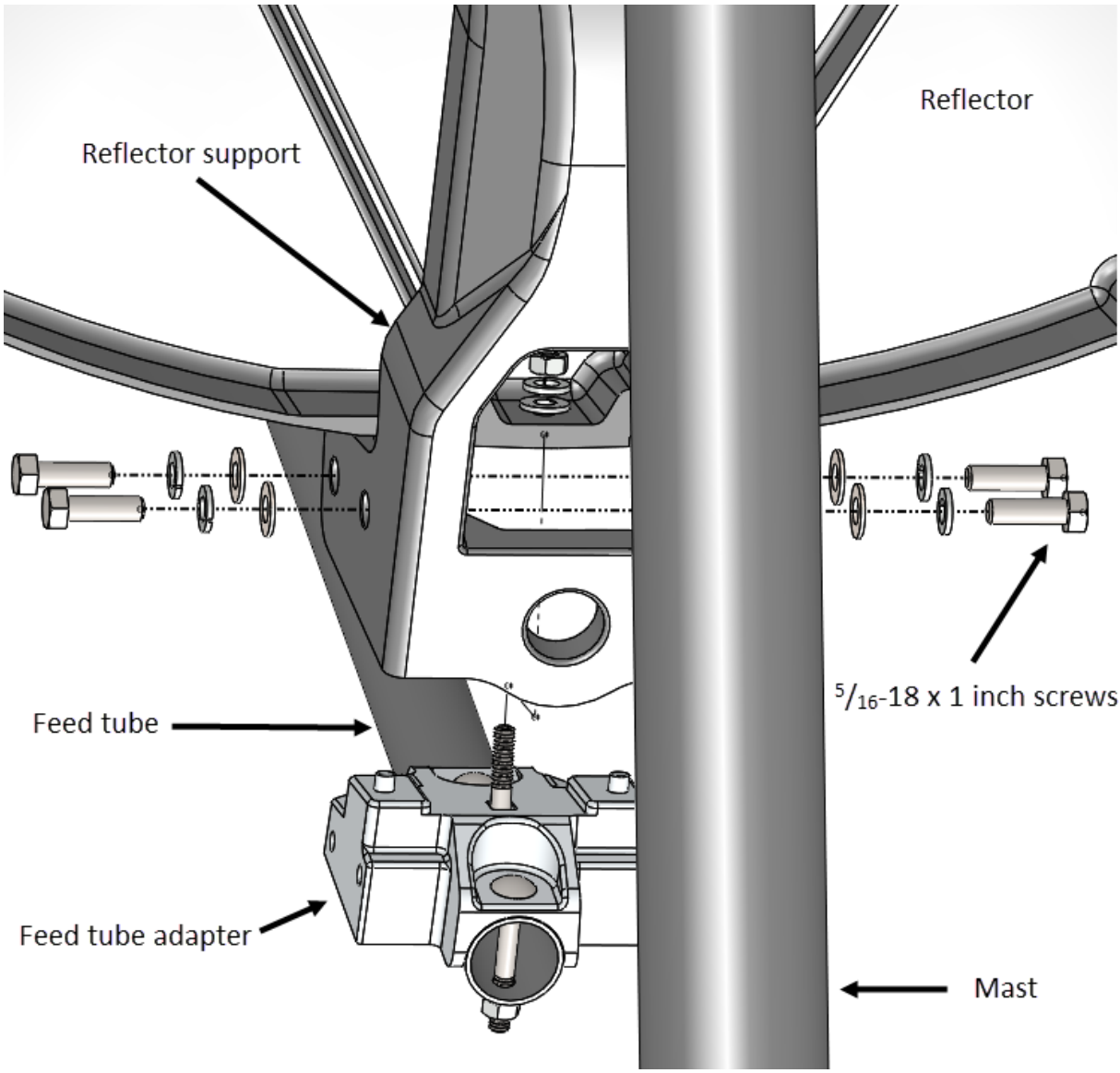


Figure 13: Securing the feed tube adapter

4. Attach the reflector support to the feed tube adapter using four $^{5}/_{16}$-18 x 1 inch screws, four $^{5}/_{16}$ inch flat washers, and four $^{5}/_{16}$ inch lock washers. See Figure 13.
5. Tighten all screws on the assembly until snug.

## Installing the radio assembly

To mount the radio assembly to the feed support arm:

**Note:** Never mark the radio housing or feed horn. Marks cannot be removed and will result in the unit being scrapped if it is returned to Hughes.

1. As shown in Figure 14, position the radio assembly above the adapter bracket so that the waveguide end of the radio is nearest to the reflector.
2. Lower the radio onto the adapter bracket and insert one $^{5}/_{16}$ inch × 2 inch bolt, with $^{5}/_{16}$ inch flat washer and lock washer, up through the feed support arm and adapter bracket, into each of the two threaded sockets in the radio transmitter.

   **Note:** If you lose a screw that holds the radio on the feed arm, use a replacement screw of the same size. Have spare nuts, bolts, or screws on hand in case you lose those provided in the kit.

3. Tighten both bolts to secure the radio to the feed support arm.

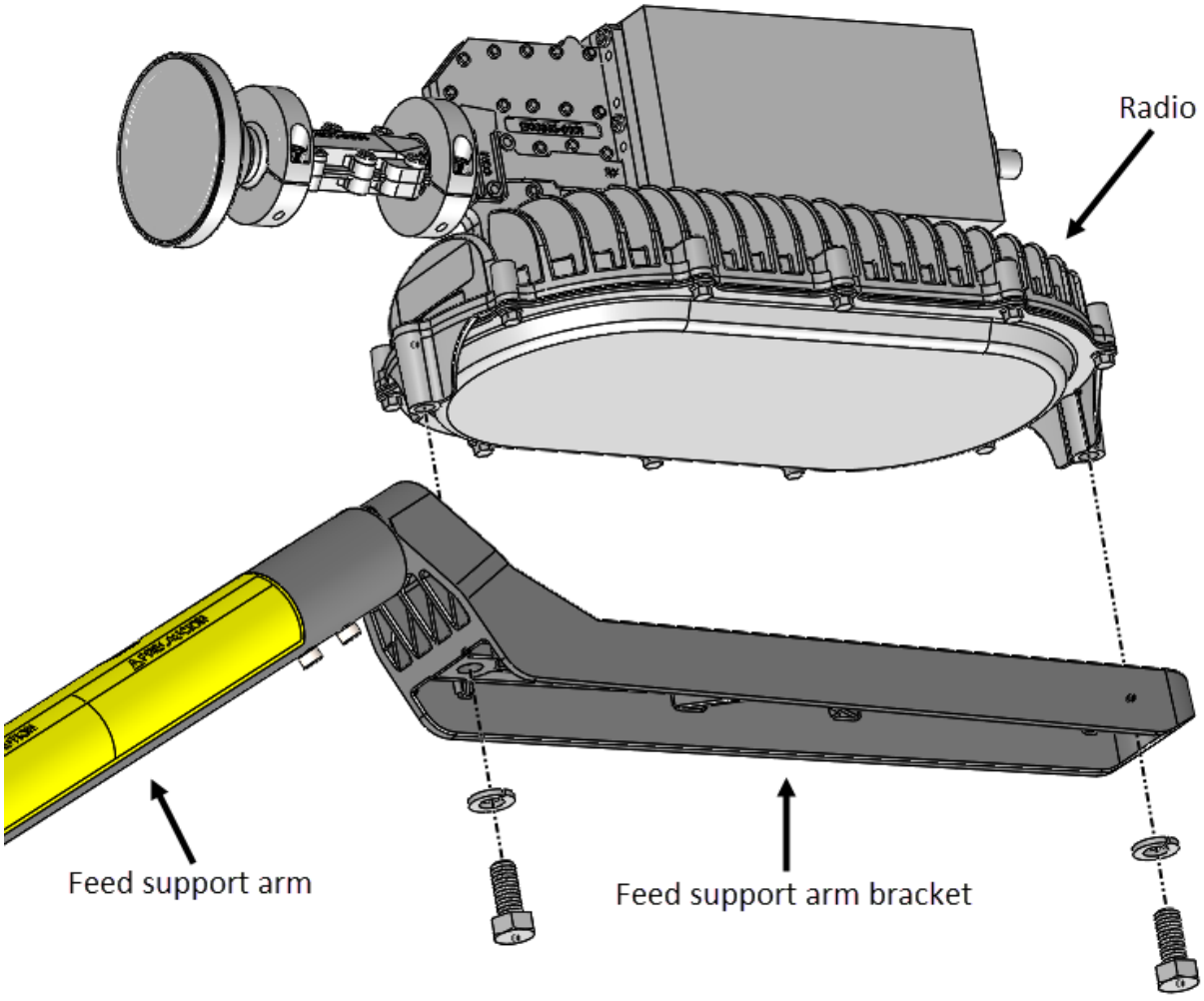


Figure 14: Attaching the radio assembly

### *Adjusting circular polarization*

It may be necessary for you to reposition the polarizer waveguide on the radio assembly to set the proper polarization between the radio transmitter and the antenna reflector. There is no default factory setting for transmit polarization; therefore, the radio may be shipped with either setting.

To check the polarizer setting and make adjustments (if necessary):

1. Check the installation reference sheet to determine whether the installation calls for left-hand circular polarization (LHCP) or right-hand circular polarization (RHCP).
2. Refer to Figure 15 and check the position of the polarizer waveguide on the radio.
   - If the marker aligns with the L, the polarizer is set for LHCP.
   - If the marker aligns with the R, the polarizer is set for RHCP.

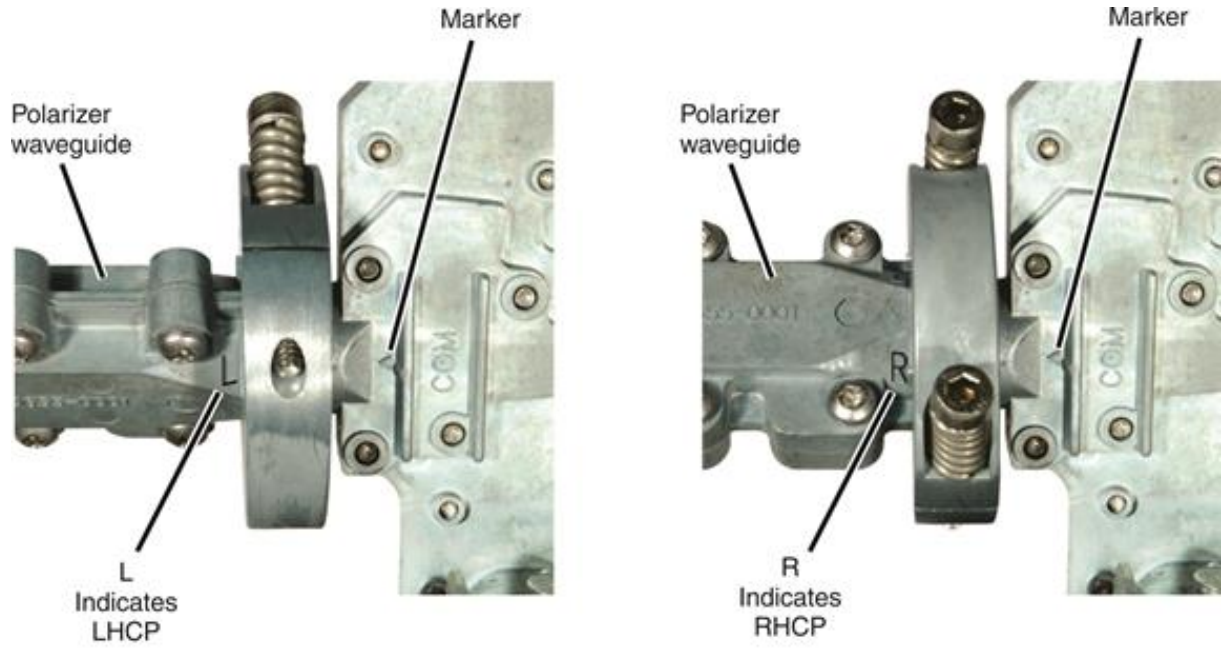


Figure 15: Determining the polarization setting

3. If the polarizer is not set in accordance with the installation reference sheet, you must reposition it.

To reposition the polarizer:

1. Remove the two-piece clamp that secures the polarizer to the transmit/receive integrated assembly (TRIA) by loosening and removing the two hex socket (Allen) screws that hold it together.
2. Separate the polarizer from the TRIA and reposition it so that the marker on the TRIA aligns with **L** for LHCP or **R** for RHCP, as shown in Figure 16 on page 35.

   **Note:** Be careful not to dislodge the O-ring in the polarizer waveguide.

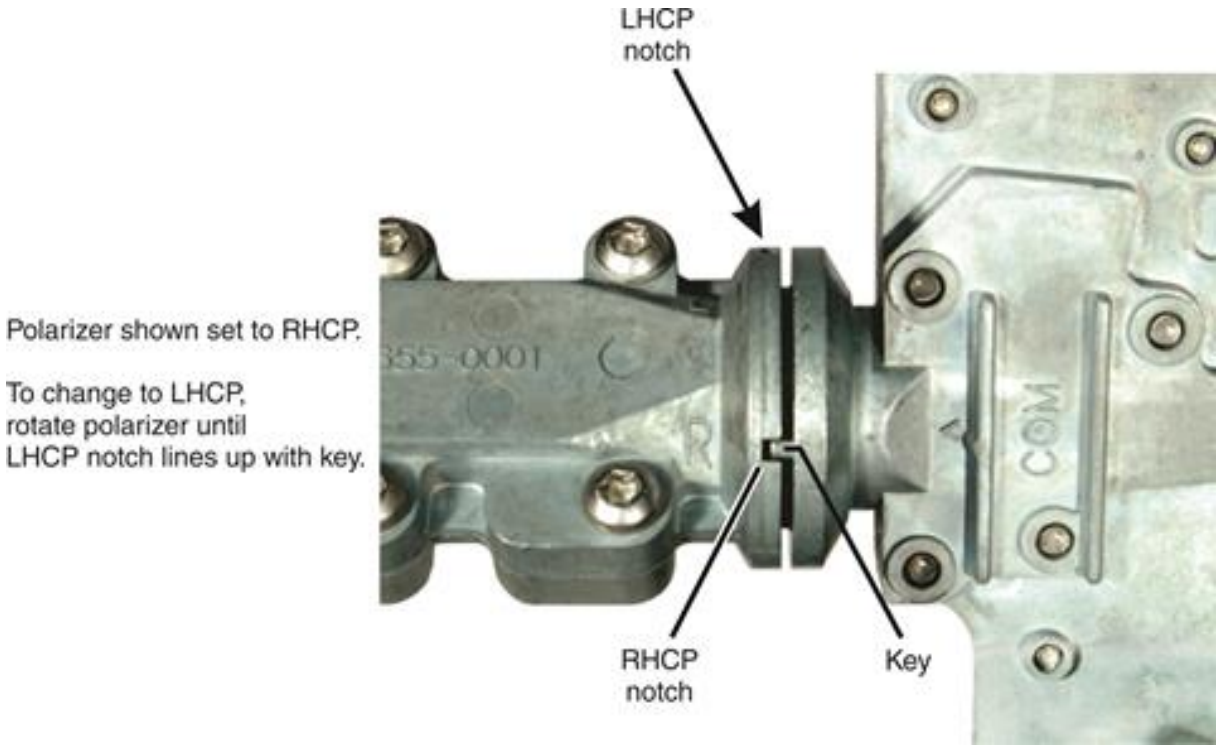


Figure 16: Adjusting circular polarization (clamp removed)

3. After making the adjustment, reseat the waveguide with the TRIA and reassemble the clamp as follows:
   a. Position the lower half of the clamp (with threaded holes) against the polarizer TRIA interface, as shown in Figure 17 on page 36.

      **Important:** To fit into place correctly, the flat face of the clamp half must align with the polarizer seam.

   b. Position the upper half of the clamp (with unthreaded holes) against the half already in place.
   c. Start each spring-loaded Allen screw by hand, being careful not to cross thread them.

      **Note:** Because the screws are long, they can easily be cross threaded if they are misaligned. If the screw does not turn easily when first inserted, back it out and start again.

   d. Use a $^{7}/_{64}$ inch Allen wrench—do not use a power driver—to alternately tighten the two spring-loaded screws. Tighten the screws until you hear a click, signifying that they are fully tightened.

      **Note:** The screws will continue to turn after they click, even though they are fully tightened.

**NOTICE**

Attach the clamp exactly as described in the previous procedure and as shown in Figure 17. Failure to do so could allow moisture to accumulate inside the TRIA and/or feed horn, causing damage to the radio.

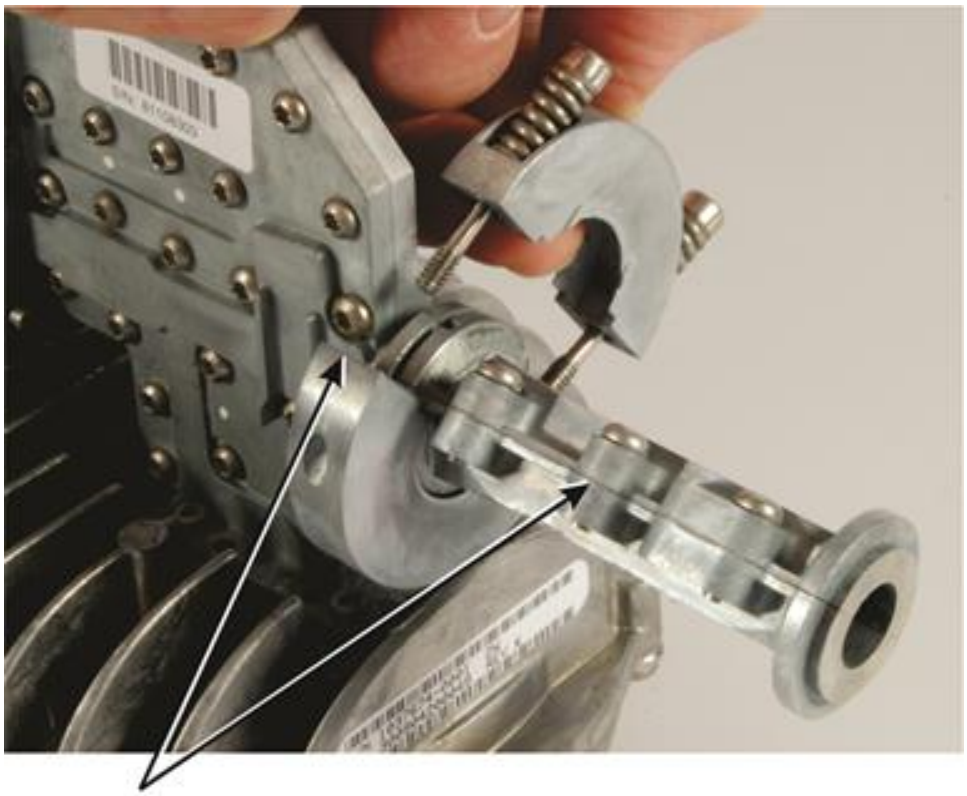


Figure 17: Securing the waveguide clamp

## Installing the feed horn

**NOTICE**

- Do not remove the protective packing material from the feed horn window until installation of the radio assembly is complete.
- Do not attempt to remove the feed horn window at any time.
- Be careful not to damage the feed horn window.
- Do not touch the plastic film that covers the window.

To attach the feed horn to the radio assembly:

1. Remove and discard the protective seal from the polarizer on the radio assembly, shown in Figure 18.

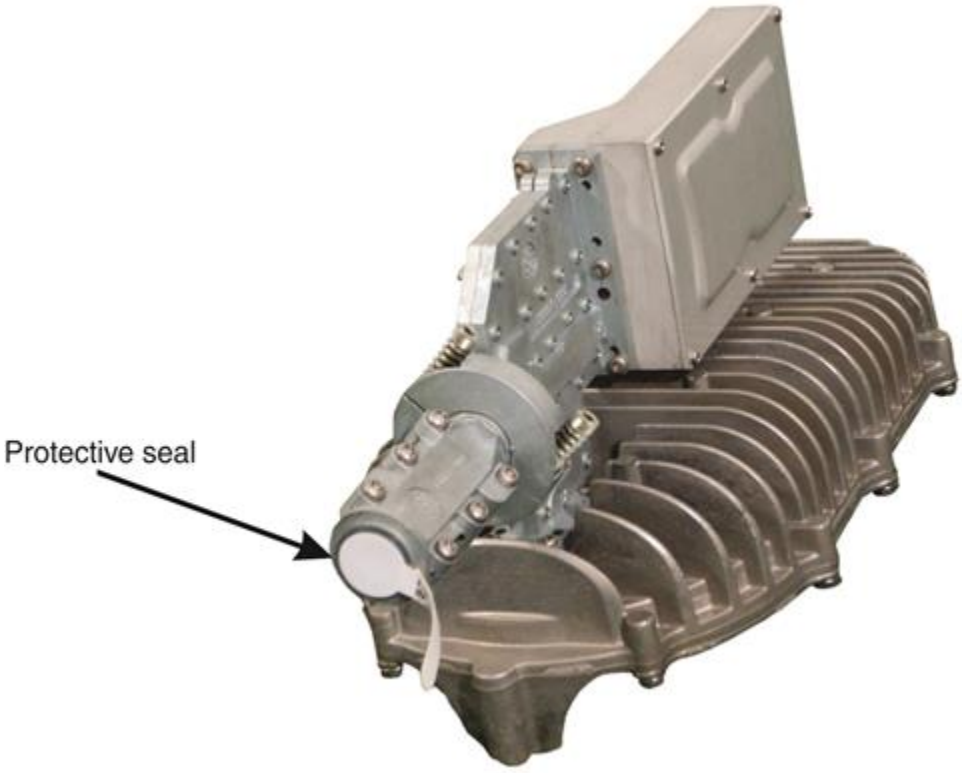


Figure 18: Remove the protective seal from the polarizer

2. If one is not already present, insert the O ring into the groove inside the stem of the feed horn, as shown in Figure 19.

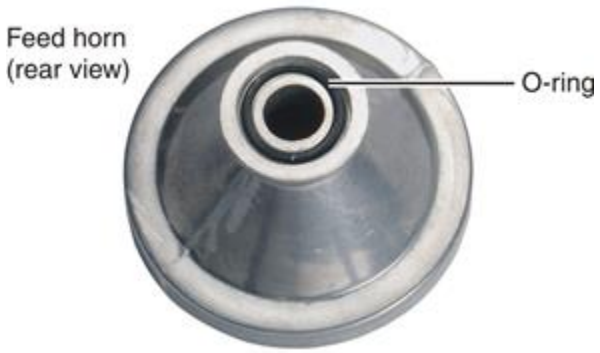


Figure 19: Insert O-ring into groove at mouth of feed horn

3. Position the feed horn against the waveguide, as shown in Figure 20.

Figure 20: Feed horn position

4. Fit the two halves of the feed horn clamp around the ridge at the point where the feed horn meets the waveguide, as shown in Figure 21 on page 39. When properly aligned, the seam formed by the two halves of the clamp will line up with the seam on the waveguide.

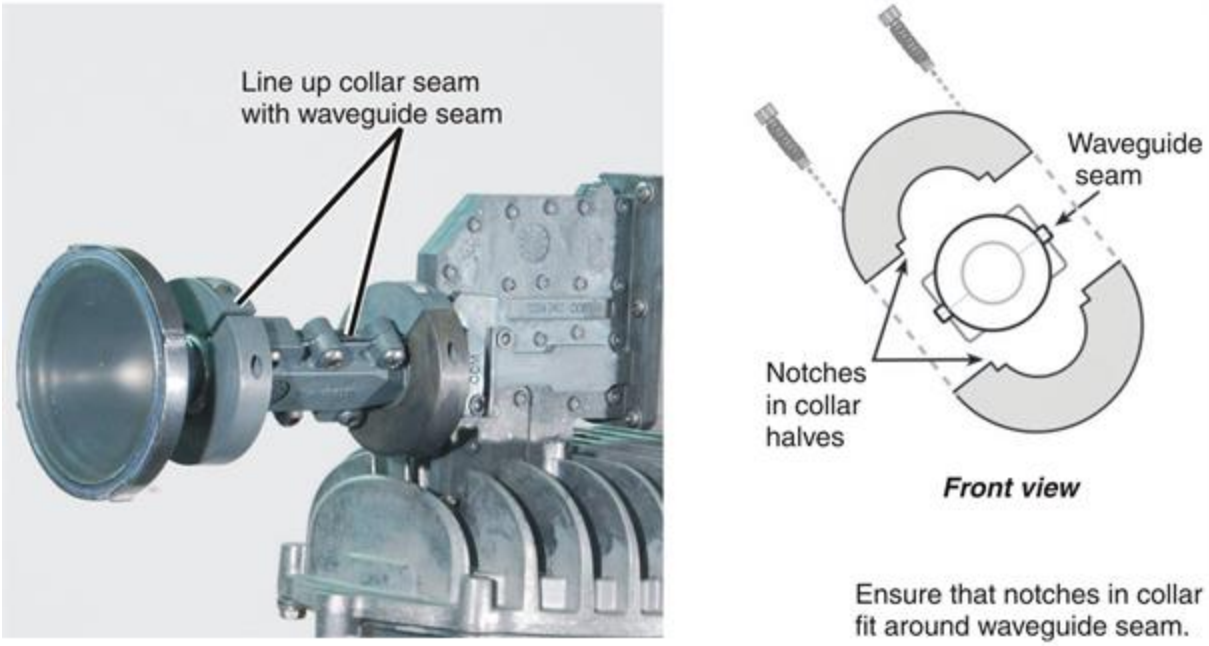


Figure 21: Attaching the feed horn clamp

**NOTICE**

You *must* assemble the collar exactly as described above and as shown in Figure 21 before tightening the hardware. Failure to do so will result in damage to the polarizer waveguide.

5. Insert the two hex socket (Allen) screws into the collar and tighten to secure the feed horn in place.
6. At this point, fully tighten any hardware that is not tight—however, leave nuts that are used for pointing adjustments slightly loose or just snug.

## Installing the antenna assembly onto the mast pipe

Follow these steps to mount the antenna assembly onto the mast:

1. Before you install the antenna assembly onto the mast pipe, use a bubble level to make sure that the mast is plumb.

   Check the mast at two perpendicular locations, as shown in Figure 22.

   **Note:** It is critical that the antenna mast is plumb. It is impossible to adjust the antenna to correct for a mast that is not plumb.

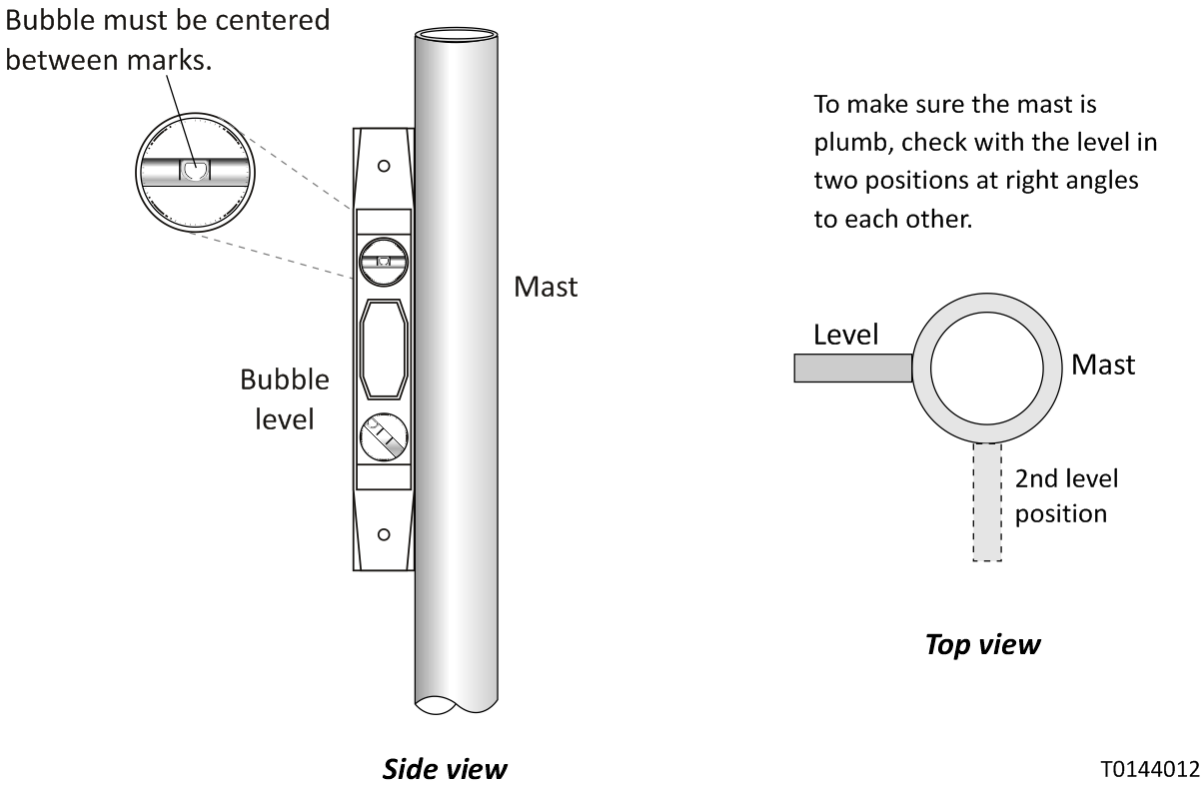


Figure 22: Making sure the mast is plumb

2. Slide the Az/El canister down onto the mast as shown in Figure 23 on page 41.
3. Tighten.

   **Note:** The outside diameter of the mast must be $2^{3}/_{8}$ inches.


**Note:** Reflector and reflector bracket are not shown.

Figure 23: Installing the Az/El mount assembly

This completes the assembly phase of the antenna installation process. Depending on its orientation, the antenna should look similar to the one shown in Figure 24.

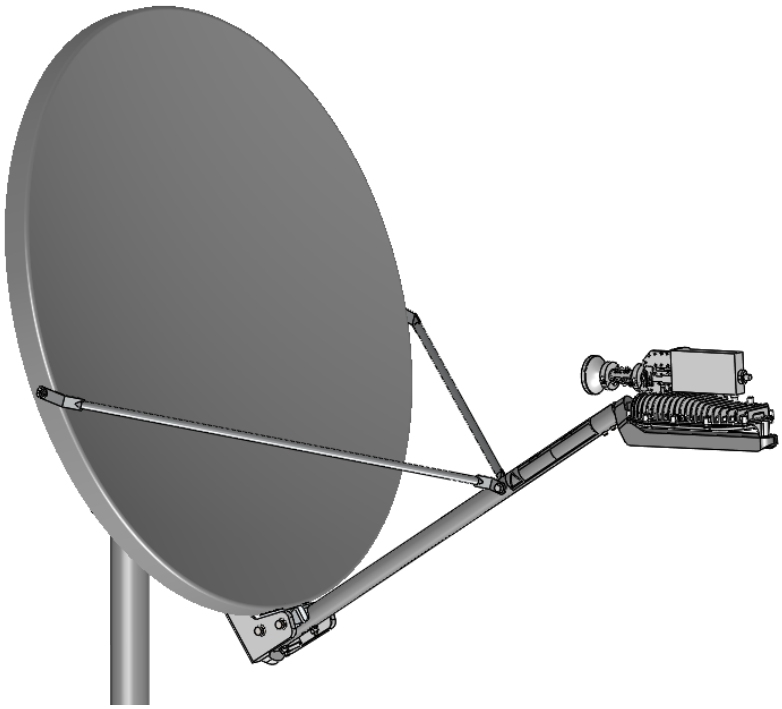

Figure 24: Assembled antenna

To proceed with the installation, you must route the IFL transmit and receive cables between the antenna and the IDU. See Chapter 4 – Cabling, connections, and grounding.

*Chapter 4*

# Cabling, connections, and grounding

This chapter illustrates where the antenna IFL connector is located, describes how to route the IFL cable at the antenna, and explains how to connect the IFL cable to the radio assembly. You must connect this cable before you can point the antenna at the satellite.

## Cabling requirements

For a list of approved coaxial cable types for the IFL cable that runs between the antenna and the satellite modem, see the Hughes FSB, ***IFL Cable, Approved List (with lengths) for Spaceway Domestic Installations*** (FSB_080202_01). The FSB lists the maximum cable length for each approved cable type for all relevant radio types.

**NOTICE**

Coaxial cables and connectors can corrode if exposed to moisture. Use only compression-type connectors, and weatherproof them with dielectric grease and weatherproofing tape.

**Note:** For connector and ground block requirements, see the Hughes FSB, ***HN Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks and Ground Block Location*** (FSB 50518_01).

## Routing the IFL cable at the antenna

1. Both IFL cables must run along the feed support arm, secured to the arm with UV-resistant cable ties, as shown in Figure 25.


Figure 25: IFL cable configuration

2. Leave an adequate coiled service loop (6 ft to 10 ft) and use UV-resistant cable ties to secure it to the mast, boom arm bracket, or Az/El mount, providing a minimum cable length of 25 ft between the radio and the satellite modem.

   **Note:**

   — Do not leave the service loop lying on roof or other mounting surface.
   — Do not block access to the azimuth and elevation adjustment nuts on the Az/El mount assembly.
   — Be sure to run a grounding wire from the Az/El plate to the ground block.

3. Coil any additional cable and secure with cable ties.

**NOTICE**

Where the IFL cable connects to the radio or to a ground block, tighten the cable connector to the torque specified in Table 4. Over-tightening the radio connector can result in damage to the radio assembly.

## Connecting the IFL cable

This section explains how to connect the IFL cable to the radio assembly at the antenna.

**NOTICE**

All outdoor F-connector threads must be coated with dielectric grease before connecting them to the radio or ground block. See Hughes FSB ***HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks and Ground Block Location*** (FSB 050518_01).

Connect the IFL cable to the radio as follows:

1. Ensure that the satellite modem is powered off and its power cord is unplugged from the outlet.
2. Apply a small amount of dielectric grease to the inside of the IFL cable connectors.
3. Connect the IFL cables to the connectors on the radio, as shown in Figure 26.
4. Tighten the cable connectors to 20 in-lb.
5. When the IFL cables are properly connected to both the radio and the satellite modem, reapply power to the satellite modem as instructed in the satellite modem installation guide.

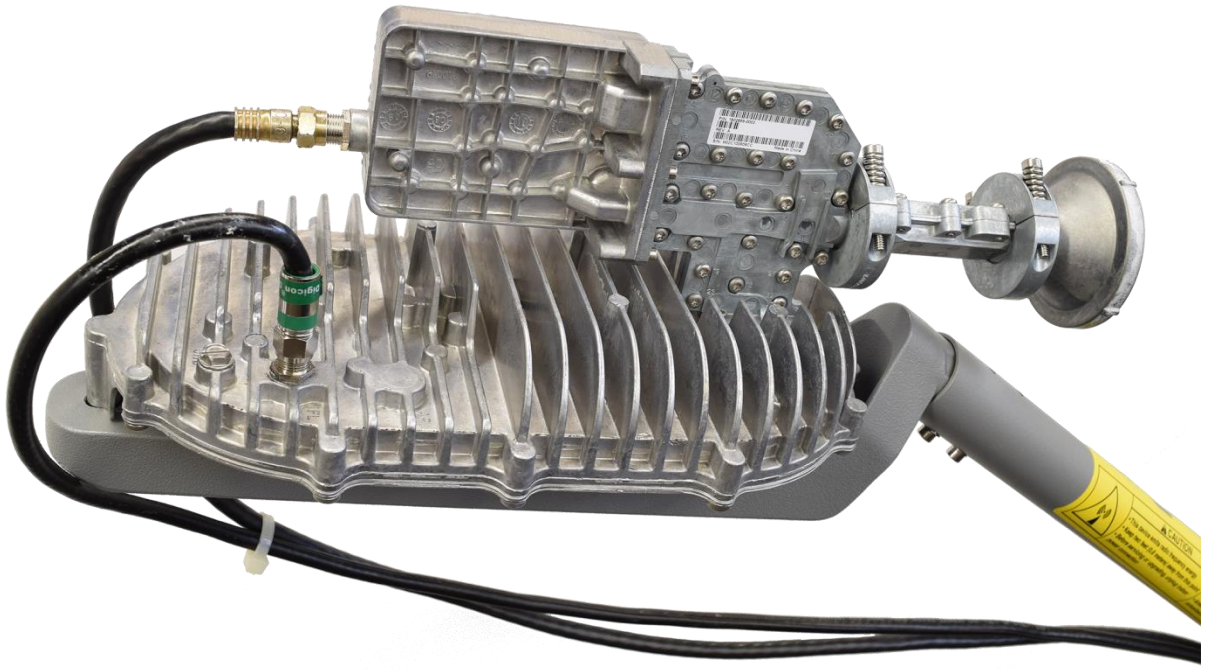

Figure 26: IFL cable connector

**NOTICE**

You must protect the radio connection with a weather boot or approved weatherproofing tape; however, because the antenna pointing procedure requires that you disconnect the IFL cable, wait until pointing is complete before weatherproofing the connection. For additional information, see Weatherproof the cable connections on page 51.

## Ground connections

**WARNING**

Properly ground the antenna assembly in accordance with all local and national electrical codes.

The antenna assembly must be grounded. For grounding information, refer to your training, best grounding practices, Hughes Field Service Bulletin (FSB) ***HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks and Ground Block Location*** (FSB 050518_01), and applicable parts of the National Electrical Code (NEC).

### *Antenna mast*

Ground the antenna mast at the Az/El mount. For specific grounding procedures, refer to the documents listed above.

### *Radio*

Although the radio contains a ground screw on its underside, use of this ground screw is optional. The radio is grounded through the shield in the coaxial cable and the ground block, and no additional grounding is necessary. For additional grounding procedures, see the documents referenced above.

## Pointing

This completes the installation. You must now point the antenna. See the ***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001) for details. For mechanical adjustments specific to this antenna, see Adjusting elevation on page 47.

*Chapter 5*

# Adjusting antenna azimuth and elevation

This chapter explains how to adjust the antenna azimuth and elevation for optimum transmission and reception. It explains mechanical adjustments only. For explanation of the pointing process for this antenna, see the ***Ka-Band Antenna Pointing Guide for Bent-Pipe Satellite Networks*** (1038764-0001). To successfully point the antenna, you must follow the procedures as described in the pointing guide.

**NOTICE**

Do not pull on the antenna reflector or feed support arm to make pointing adjustments. Doing so could cause permanent damage to the antenna. Instead, use the adjustment mechanisms and procedures described in this chapter.

## Adjusting elevation

Figure 27 illustrates how to adjust the antenna elevation by moving the antenna up and down relative to the horizon.

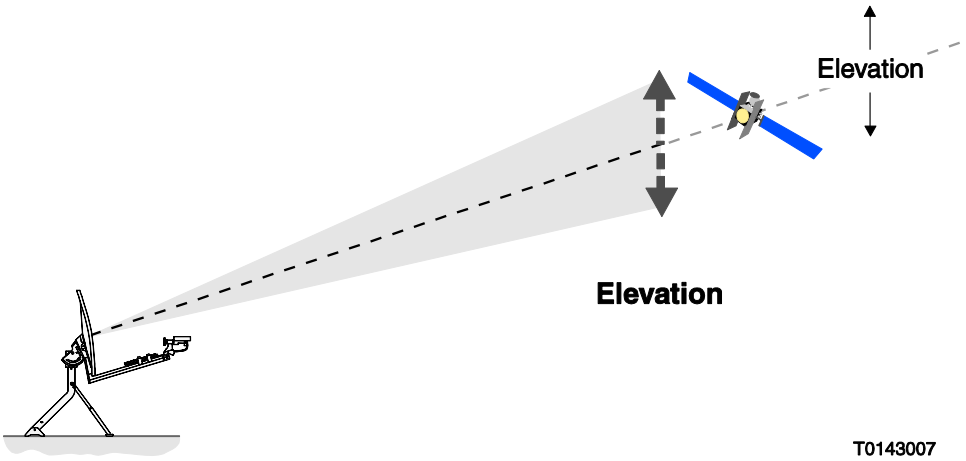


Figure 27: Adjusting antenna elevation

To adjust antenna elevation:

1. Loosen the elevation lockdown nuts on each side of the Az/El mount. See Figure 28.

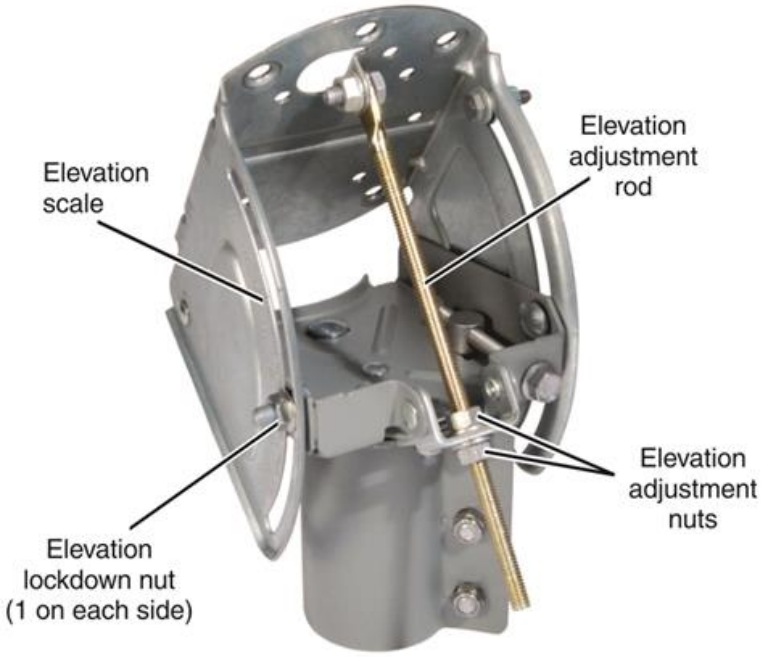


Figure 28: Elevation adjustment components

2. Loosen the top elevation adjustment nut and spin it counter-clockwise until it is an inch or two up the elevation adjustment rod.
3. Use the lower nut to adjust the elevation.

   The white line shown in Figure 29 points to the elevation value on the elevation scale. The antenna shown in Figure 29 is adjusted to 26°.

Arrow points to the elevation marker (below bolt).

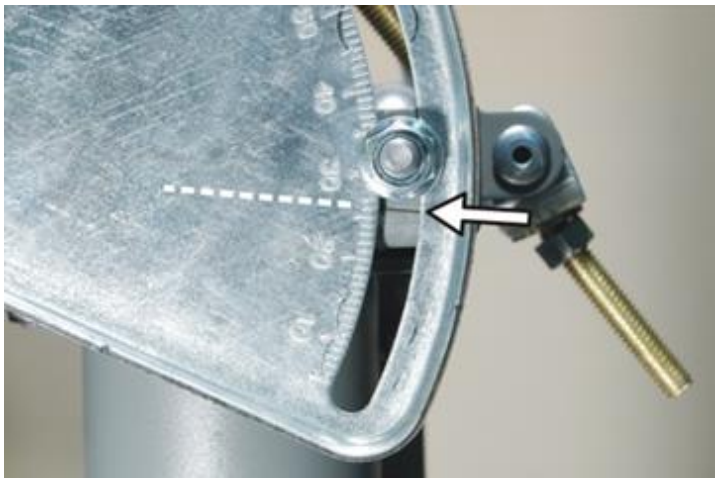

Figure 29: Elevation marker

4. Spin the top elevation adjustment nut clockwise until it is snug against the base plate.
5. Secure the coarse elevation setting by tightening the two elevation lockdown nuts on either side of the Az/El mount.

## Adjusting azimuth

Figure 30 illustrates how you adjust antenna azimuth by moving the antenna horizontally, from side to side.

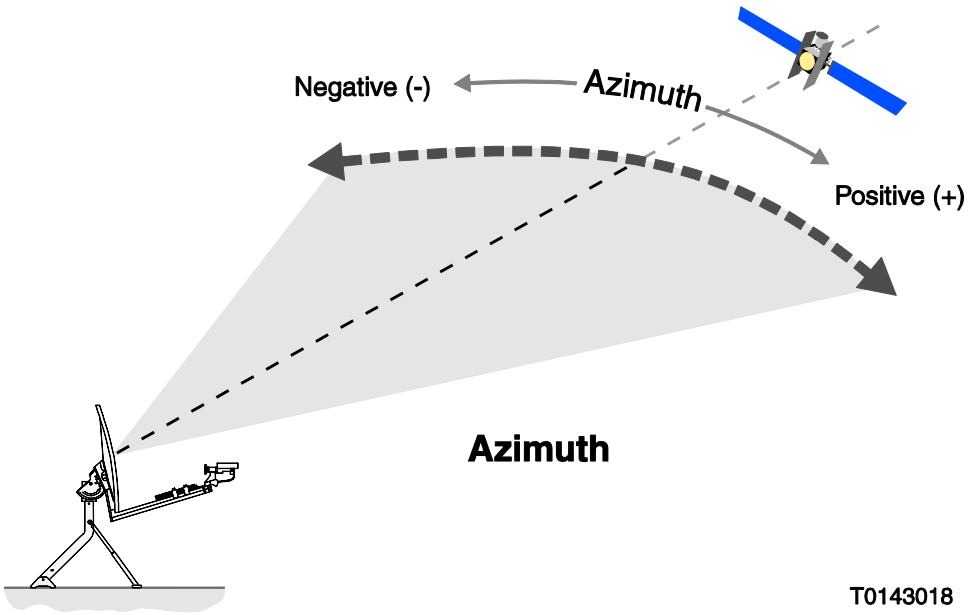


Figure 30: Adjusting antenna azimuth

### *Checking the azimuth base starting position*

Before making any azimuth adjustments, ensure that the azimuth lockdown bolts are centered in the curved slots in the azimuth base. See Figure 31 on page 50.

*If the bolts are not centered in the slots:*

1. From underneath the azimuth base, ensure that the four $^{5}/_{16}$ inch azimuth lockdown nuts are loose.
2. Use a $^{1}/_{2}$ inch wrench to turn the fine azimuth adjustment bolt until the lockdown bolts are centered in the curved slots.

   You should not have to turn the two inner nuts on the adjustment bolt, but if they are loose, tighten them.

   Because this is a fine adjustment bolt, you may have to turn it many times.

   Leave the lockdown nuts loose so you can adjust azimuth.

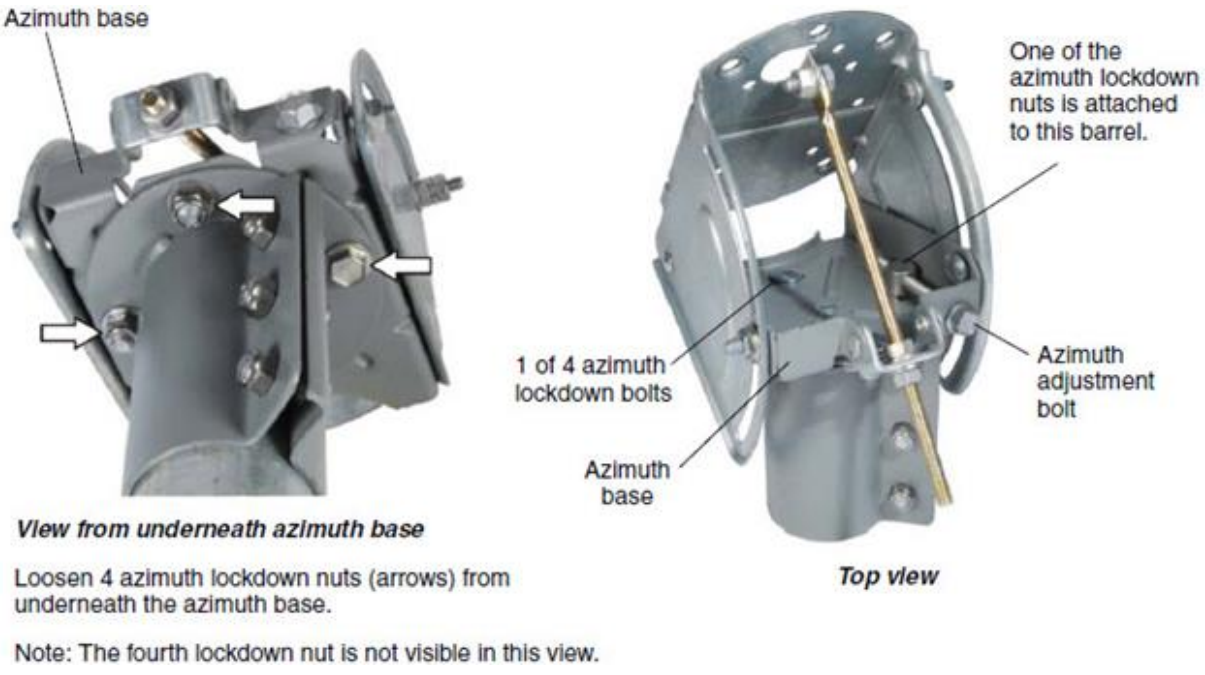


Figure 31: Checking the azimuth base starting position

## *Coarse azimuth adjustment*

Make coarse azimuth adjustment as follows:

1. Loosen the three Az/El canister nuts shown in Figure 32 enough to allow the antenna assembly to rotate freely on the mast.

Figure 32: Az/El canister nuts

2. Holding the reflector bracket, point the antenna reflector as accurately as possible in the direction indicated in OAISS or on the installation reference sheet.
3. Lock down the Az/El canister by fully tightening the three canister nuts.

### *Fine azimuth adjustment*

For fine azimuth adjustment, use the azimuth adjustment bolt:

1. Ensure that the Az/El canister nuts are tight enough to prevent the antenna from rotating on the mast.
2. Using a $^{1}/_{2}$ inch wrench, rotate the azimuth adjustment bolt shown in Figure 32 on page 50 in either direction to achieve the desired azimuth angle.

**NOTICE**

Do not pull on the antenna reflector or feed support arm to make pointing adjustments. Doing so could cause permanent damage to the antenna.

3. When the azimuth is set as desired, tighten the four azimuth lockdown nuts under the azimuth base.

## Weatherproof the cable connections

**NOTICE**

Hughes radio connectors, in conjunction with the dielectric grease, provide weatherproofing for outdoor connections. These connectors should be used in new installations, upgrades, and repairs for audits.

You must further protect radio connectors by wrapping them with weatherproof tape, such as GB Electronics silicone tape, or by covering them with a full-length weather boot that has been filled with dielectric grease.

Weatherproof and secure all cable connections, as shown in Figure 33 on page 52.

1. Apply a small amount of dielectric grease to the inside of a coaxial cables weather boots and place the weather boots on the radio connectors, or wrap the connectors and cables with weatherproofing tape and secure the tape with a cable tie.

**NOTICE**

If you use tape and cable ties, they must be resistant to ultraviolet rays.

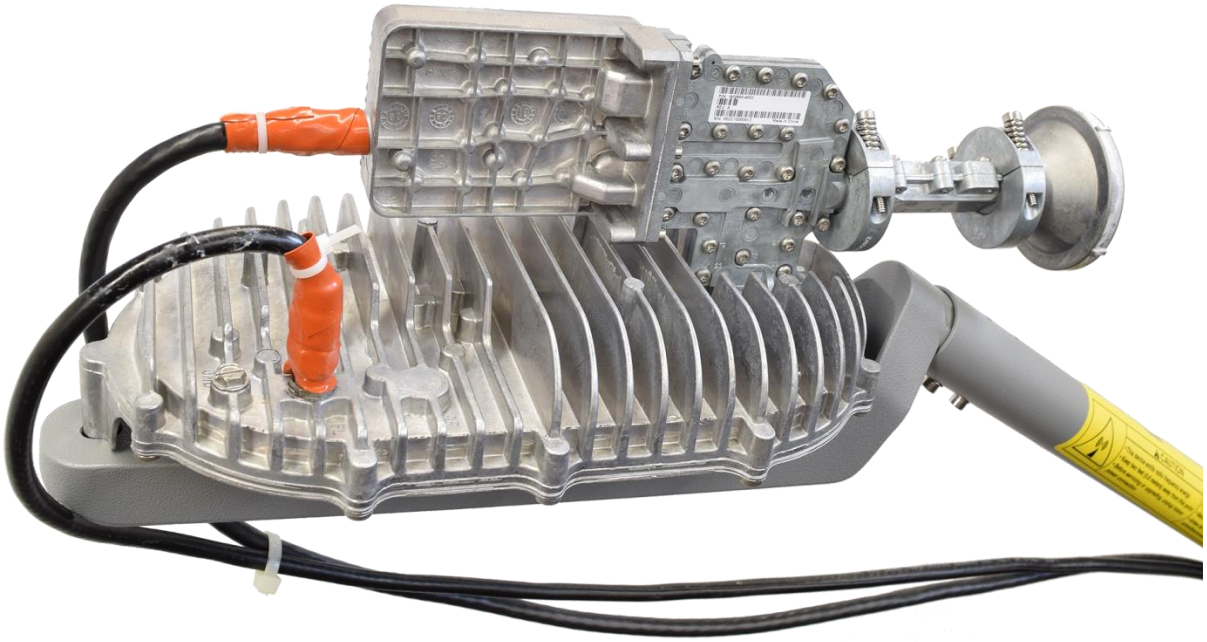

Figure 33: Weatherproofed connections with cable ties

# Acronyms

## *A*

Az/El – Azimuth/elevation

## *F*

FSB – Field service bulletin
ft – Foot
ft-lb – Foot-pound

## *G*

GPS – Global positioning system

## *H*

hr – Hour

## *I*

IFL – Intra-facility link
inch-lb – Inch-pound

## *L*

LHCP – Left-hand circular polarization
LOS – Line of sight

## *M*

m – Meter

## *N*

NEC – National Electrical Code
NOC – Network Operations Center

## *R*

RHCP – Right-hand circular polarization
RX – Receive

## *T*

TRIA – Transmit/receive integrated assembly
TX – Transmit

# Index

## A



## C



## F



## G



## H



## I

## *M*



## *P*



## *R*



## *S*



## *T*



## *W*