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Installation Guide for 0.98 m Ku-band Antenna Model AN6-098P

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Revision record

Revision	Date of issue	Scope
A	March 2, 2007	Initial release
B	October 21, 2009	Updated to reflect that antenna is no longer upgradeable; other minor changes

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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 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

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

WARNING

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

CAUTION

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

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 alert message that concerns a potential electric shock hazard.

Indicates a safety alert message concerning a potentially hazardous situation in which you could fall.

Indicates a safety alert message concerning a potentially hazardous situation in which you could be exposed to radio frequency energy.

Antenna installation safety

Observe the following precautions when installing the satellite antenna. This guide 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 (for example, 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 from power lines.
- 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.*
- For pole mount installations, be sure to obtain information regarding underground utilities in the proposed location before digging.

WARNING

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

WARNING

- Do not work in high wind or rain; or if a storm, lightning, or other adverse weather conditions are either present or approaching.
- Do not attempt to assemble, move, or mount the antenna on a windy day. Even a slight wind can unexpectedly create sudden strong forces on the antenna surface.

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.

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.

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.

CAUTION 

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

- 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.

Note: Some installations may require additional precautions. See the HughesNet System ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001) for more information.

Chapter 1
Overview

This installation guide explains how to assemble, install, and point the Hughes model AN6-098P 0.98 m Ku-band antenna.

This chapter presents an overview of the AN6-098P antenna, a summary of the steps used to assemble and install the antenna, and supplemental information on tasks related to antenna installation. These topics are included in the following sections:

Scope and audience

This guide is written for qualified installers who are familiar with satellite antenna installation practices and are capable of properly applying the information presented in this guide.

The model AN6-098P antenna

Each remote terminal at a customer site consists of an antenna assembly and an indoor unit (IDU). The IDU at a customer site requires an antenna and radio assembly to communicate with the system satellite and the Network Operations Center (NOC). The antenna is connected to the IDU by an intra-facility link (IFL) consisting of two cables, a transmit cable and a receive cable.

The Hughes model AN6-098P 0.98 m antenna is designed for Ku-band applications. Figure 1 shows the antenna assembled, with a radio assembly installed. The main parts are labeled. The antenna shown is not yet connected, so no cables are present.

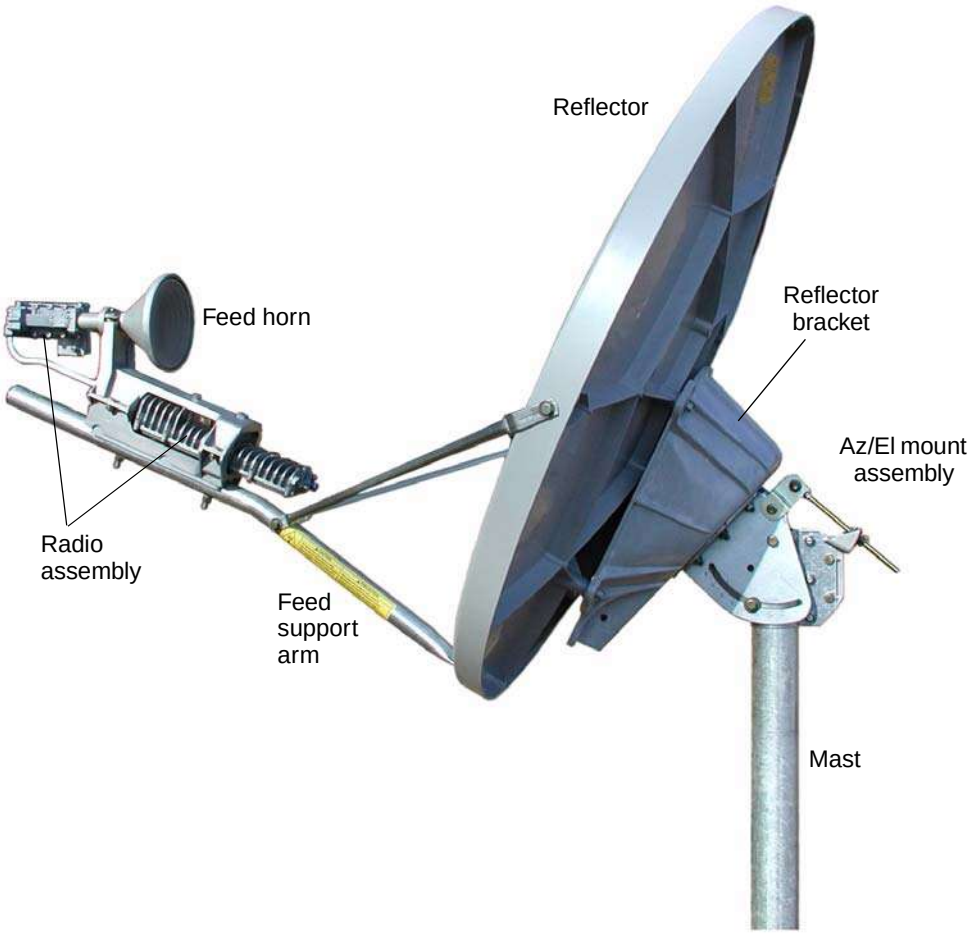


Figure 1: Hughes model AN6-098P 0.98 m satellite antenna with radio

Antenna installation summary

The antenna installation steps and related tasks are summarized below. **The steps in bold type are documented in this guide.** For more detailed information on each task, refer to the chapters and documents listed.

1. Choose an installation site.
2. Select a method for mounting the antenna.
3. Install the antenna mount.

Note: A critical requirement is that the mast must be plumb. The antenna assembly cannot be adjusted to correct for a mast that is not plumb.

4. Install the IDU.

Note: Install the IDU before installing the antenna so you can use the installation software to determine the pointing values (azimuth, elevation, and tilt).

5. **Determine the pointing values (azimuth, elevation, and tilt)** – Chapter 3
6. **Install the Az/El and reflector bracket assembly on the mast** – Chapter 3
7. **Install the antenna reflector** – Chapter 3
8. **Install the feed rods and feed support arm** – Chapter 3
9. **Install the radio assembly** –
   Chapter 4 (J-type radio) or Chapter 5 (cradle-type radio)

Note: The J-type and cradle-type radio assemblies are described in *Radio assembly types* on page 15.

10. Run cables between the IDU and ODU locations.
11. Ground the antenna assembly.
12. **Connect cables to the ODU** – Chapter 6
13. **Point the antenna** – Chapter 7

For the steps *not* shown in bold type, see the following section, *Tasks related to antenna installation*.

Note: *Outdoor unit* (ODU) refers to the antenna, radio assembly, and antenna mount.

Follow all steps in the order they are presented.

Do not tighten any hardware until you are instructed to do so.

Tasks related to antenna installation

This section explains where you can find information on tasks related to antenna installation.

Selecting the installation site

Before selecting an installation site, check the installation reference sheet to see if a customer-specific installation site has been pre-determined and specified. Also, refer to the HughesNet ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001), which discusses the factors that you should consider when selecting an installation site.

The first and most important consideration when choosing a prospective antenna site is whether the area can provide an acceptable line of sight (LOS) to the satellite. A site with a clear, unobstructed view of the southern sky is necessary. Also, consider obstructions that may occur in the future, such as the growth of trees. Be sure to select an appropriate antenna site before performing the installation, so that the antenna will be able to receive the strongest signal possible.

As with any type of construction, a local building permit may be required before installing the antenna. It is the property owner's responsibility to obtain all permits. If necessary, adapt the installation instructions in this guide in accordance with local building codes.

Installing the antenna mount

Before installing the antenna, you must first install a suitable antenna mount. Acceptable mounting methods are:

- Non-penetrating mount
- Trimast (may be used on a wood-frame roof or wood or masonry wall)
- Pole mount

Most installations in a commercial, industrial, or institutional environment use a non-penetrating roof mount.

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

For pole mounts that require a concrete base, you must allow at least 24 hr for the concrete to cure before installing the antenna. Be sure to plan and schedule the installation accordingly.

For complete information concerning antenna mount installation, refer to:

- The customer-specific installation reference sheet
- The HN System ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001)

The customer-specific installation reference sheet may include customer-specific guidelines concerning mount installation. Use only the mounting method described in the reference sheet. For mount installation instructions, see the HN System ***Antenna Site Preparation and Mount Installation Guide***.

Installing the IDU

See the installation guide for the specific IDU you are installing.

Grounding

The entire antenna assembly must be grounded. For grounding information, refer to your training, best grounding practices, the 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). Also, see Chapter 6 – *Cabling and connections* for the proper location for attaching the ground wire.

Approved cables

For a list of approved coaxial cable types for the IFL between the antenna and the IDU, see the Hughes FSB, ***IFL Cable, Approved List (with lengths) for DW7x00, DW60xx, and DW40xx Domestic Installations*** (FSB_060316_01). The FSB lists the maximum cable length for each approved cable type for all relevant radio types.

Because it is impossible to predict the requirements specific to each installation site, you must use your own judgement and best practices to determine how to route and connect the IFL transmit and receive cables.

Chapter 2

Antenna parts and required tools

This chapter describes the parts provided in the model AN6-098P antenna kit. It includes the following sections:

CAUTION

Metal components may contain sharp edges. Use care when un-packing and handling antenna parts.

Antenna kit components

This section describes the main components of the 0.98 m antenna kit:

- Az/El and reflector bracket assembly
- Antenna reflector
- Feed support arm and support rods
- Feed horn
- Mounting parts for radio assembly

For details see *Description of main components* on page 10.

Related components

The following are related components that are not part of the antenna kit:

- Radio assembly (J-type or cradle-type) – See *Radio assembly types* on page 15.
- Antenna mount – For general information about antenna mounts, see *Installing the antenna mount* on page 4.

Two antenna kits for two radio types

You can install the 0.98 m antenna with either of two radio types, the *J-type radio* or *cradle-type radio*, which are described in *Radio assembly types* on page 15.

To support these two radio types, the antenna kit is available in two configurations, as listed in Table 1. In this guide, *the antenna kit* is used to refer to either kit.

Each antenna kit consists of two boxes of parts, as detailed in Figure 2. Most parts are common to both antenna kits. The main parts that are different in the two kits are the feed support arm, support rods, and parts used to mount the radio assembly.

Before proceeding, refer to Table 1 and make sure you have the correct antenna kit.

Table 1: Two antenna kit configurations

Box contents	Hughes part number for each box
Antenna kit for J-type radio	
Box 1 – Az/El and reflector bracket assembly, feed horn, mounting brackets and adapter for radio assembly, waveguide transition, and other parts.	P/N 1501111-0001
Box 2 – Reflector, feed support arm, support rods, and other parts.	P/N 1501111-0002
Antenna kit for cradle-type radio	
Box 1 – Az/El and reflector bracket assembly, feed horn, adapter for radio assembly, and other parts.	P/N 1501111-0021
Box 2 – Reflector, feed support arm, support rods, and other parts.	P/N 1501111-0022
Box 1 is labeled *Box 1 of 2*. Box 2 is labeled *Box 2 of 2*.	

Inspecting the antenna parts

The antenna kit for each radio type is shipped in two boxes, as shown in Figure 2. The radio assembly is shipped separately. As soon as possible, unpack and inspect the antenna parts and hardware to make sure all parts have been received in good condition.

Each of the main components is illustrated in the following sections. Small hardware parts are listed in Table 2 and Table 3 on page 18. 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.

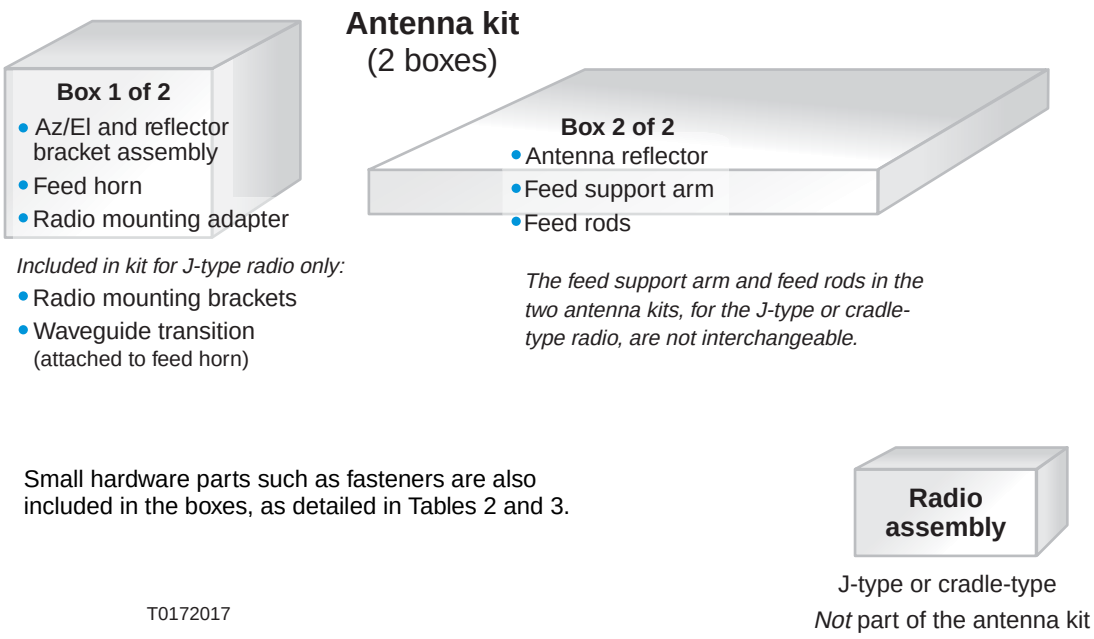


Figure 2: Shipping container contents—main components

Description of main components

The following sections describe and illustrate the antenna assembly main components.

Az/El and reflector bracket assembly

The Az/El mount assembly and reflector bracket assembly are pre-assembled for installation as a single unit, as shown in Figure 3. The Az/El mount assembly supports the antenna and is used to point the antenna at the satellite. The reflector bracket supports the antenna reflector.

Figure 3: Az/El and reflector bracket assembly (pre-assembled as one unit)

Antenna reflector The antenna reflector shown in Figure 4 focuses the transmitted and received RF signals. It attaches to the reflector bracket.

Figure 4: Antenna reflector

Feed support arm and support rods

The radio assembly mounts onto the feed support arm (Figure 5). The support rods (Figure 6) attach to the reflector and provide additional stability to the feed support arm.

Each of the two antenna kits contains one feed support arm and two support rods, for the radio type supported by the specific antenna kit. Figure 5 shows both types of feed support arms for the two radio types. The feed support arm for the cradle-type radio is stamped *TG*. Other letters or numbers may appear with *TG*.

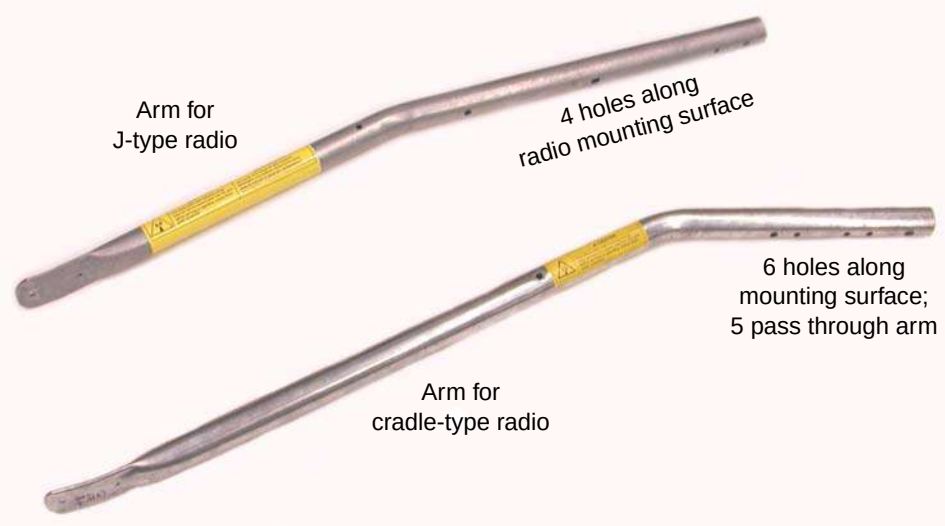


Figure 5: Feed support arms (two types)

Figure 6 shows the two types of support rods for the two radio types. The rods in the two antenna kits (for each radio type) are different lengths and are not interchangeable. The support rods for the cradle-type radio are stamped *TG*. Other letters or numbers may appear with *TG*.

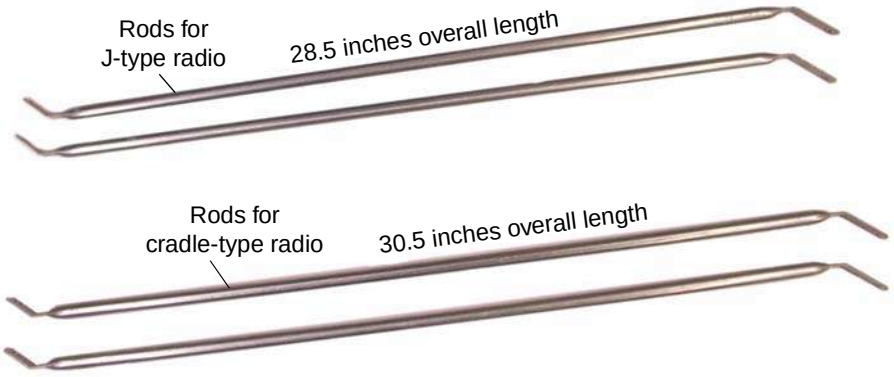


Figure 6: Support rods (two types)

The feed support arm and the support rods are the only main parts included in both antenna kits that are different.

Feed horn and waveguide transition

The feed horn (Figure 7) transmits and receives signals to and from the reflector.

The J-type radio assembly requires a waveguide transition component, as shown in Figure 7. As shown in the figure, the transition is attached to the feed horn at the factory. During assembly, you attach the transition to the radio assembly. See Chapter 3 – *Assembling the antenna* for more information.

The antenna kit for the cradle-type radio does not include a waveguide transition because the feed horn attaches directly to the cradle-type radio assembly.

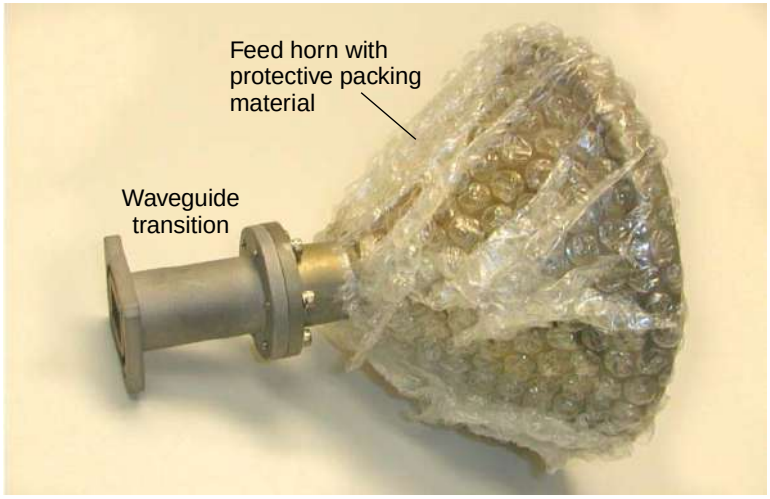


Figure 7: Feed horn and waveguide transition

NOTICE

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

Radio mounting adapter

The mounting adapter shown in Figure 8 is used for both radio types to mount the radio assembly on the feed support arm.

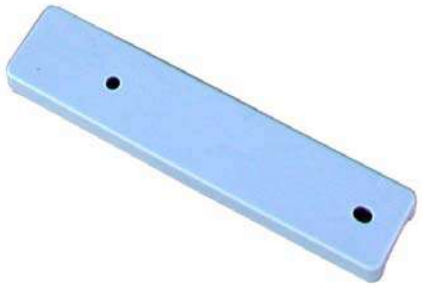


Figure 8: Radio assembly mounting adapter

Radio mounting brackets (for J-type radio only)

The antenna kit for the J-type radio assembly (only) includes two mounting brackets (Figure 9) that are used to secure the radio assembly to the feed support arm, as illustrated in Figure 10 on page 15.

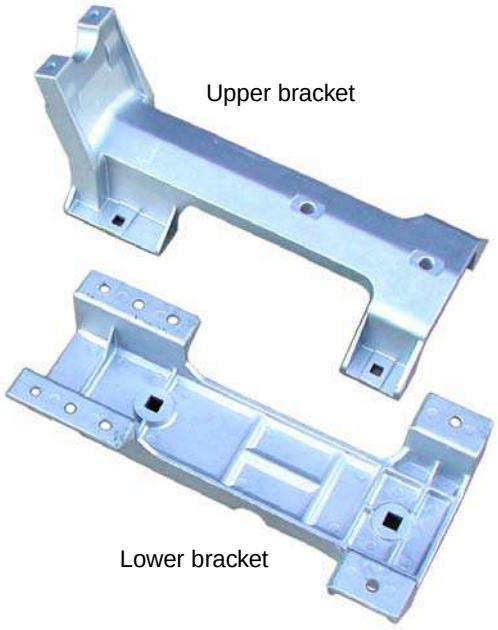


Figure 9: Radio assembly mounting brackets and adapter

Radio assembly types

The radio assembly is not part of the antenna kit; however, radio assembly installation is included in this guide because the antenna and radio assembly are usually installed at the same time. There are two possible radio assemblies available for the 0.98 m antenna, the J-type radio assembly or cradle-type radio assembly.

J-type radio assembly

Figure 10 shows the *J-type* radio assembly, referred to as *J-type* because its waveguide is shaped something like the letter J.

Figure 10: J-type radio assembly

J-type refers to the overall design of the radio; therefore, two radios with different model numbers may both be J-type radios.

Vertical shim kit (if required)

A vertical transmit shim kit may be required for the J-type radio assembly only. If the installation reference sheet states that vertical transmit polarization is required, you will need to obtain and install a vertical shim kit (Figure 11) in the radio assembly. Otherwise, a vertical shim is not required. For more information, see *Installing a shim for vertical transmit polarization* on page 32.

Figure 11: Shim for vertical transmit polarization

Cradle-type radio assembly

Figure 12 illustrates the *cradle-type* radio assembly. The main parts of the radio assembly are mounted on two circular brackets so they can be rotated, similar to the movement of a cradle, to set the polarization of the feed horn. The arrows in Figure 13 indicate how the radio assembly can be rotated.

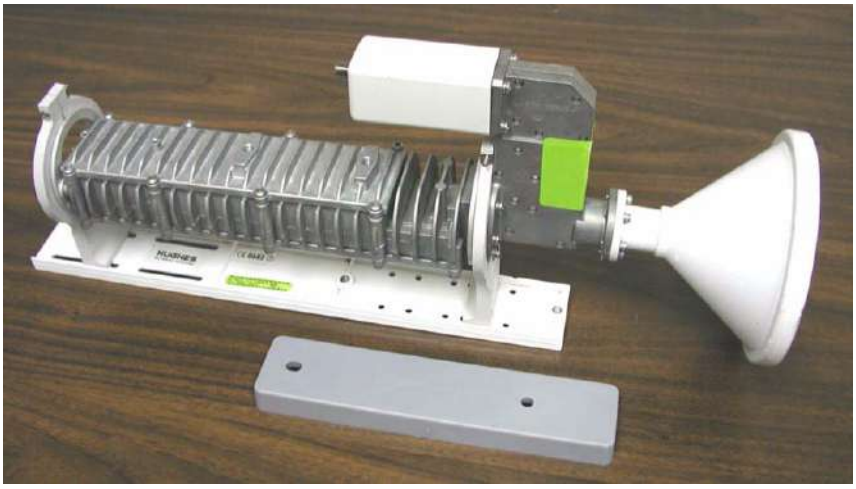


Figure 12: Cradle-type radio assembly (shown with mounting adapter)

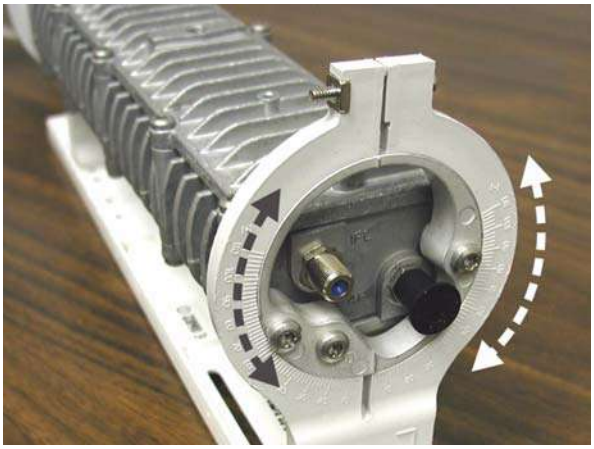


Figure 13: Cradle-like rotation of the cradle-type radio assembly

Cradle-type refers to the overall design of the radio; therefore, two radios with different model numbers may both be cradle-type radios.

Small hardware parts lists

Tables 2 and 3 list the small hardware parts included in the antenna kits for the two radio types (J-type and cradle-type).

The parts listed in Table 2 are included in *both kits*, for both radio assembly types.

Table 2: Small hardware parts used in antenna kits for both radio types

Part	Quantity	Comments
For assembling the antenna		
1/4-20 × 1-3/8-inch thread-cutting screws	4	These parts are used for attaching the: • Reflector • Support rods • Feed support arm The hardware for each task is specified in Chapter 3 – *Assembling the antenna*.
1/4-20 × 1-inch hex bolts	3	
1/4-20 × 2-inch hex bolt	1	
1/4-inch flat washers	8	
1/4-inch lock washers	4	
1/4-inch hex nuts	4	
For mounting the radio assembly (both types)		
0.9-inch inside diameter O-ring *	1	These parts are used for both radio assemblies, to: • Attach the feed horn • Mount the radio assembly The hardware for each task is specified in: • Chapter 4 – *Installing a J-type radio assembly* • Chapter 5 – *Installing a cradle-type radio assembly*
No. 6-32 × 0.5-inch socket-head cap screws *	7	
No. 6 internal tooth lock washers *	7	
Silicone grease capsule	1	
5/16-18 × 2.25-inch carriage bolts	2	
5/16-inch flat washers	4	
5/16-inch lock washers	4	
5/16-inch hex nuts	2	

* In the antenna kit for the J-type radio, the waveguide transition is attached to the feed horn at the factory, so these parts are factory installed.

Additional parts for J-type radio

The parts listed in Table 3 are included *only* in the antenna kit for the J-type radio. The antenna kit for the J-type radio also includes the part listed in Table 2.

Table 3: Additional small hardware parts included in the antenna kit for the J-type radio assembly

Part	Quantity	Comments
1-inch inside diameter O-ring	1	These parts are used to attach the: • Waveguide transition to the radio assembly • Upper mounting bracket to the transmitter • Upper and lower mounting brackets to each other The hardware for each task is specified in Chapter 4 – *Installing a J-type radio assembly*.
M4 x 12-mm socket-head cap screws	4	
M4 lock washers	4	
5/16-18 × 1-inch hex bolts	2	
¼-20 × 1-inch hex bolts	2	
¼-20 × 0.75-inch carriage bolts	4	
¼-inch flat washers	4	
¼-inch lock washers	6	
¼-inch hex nuts	4	
Feed horn clamp	1	

Tools

Table 4 lists the tools required to install and point the antenna.

Table 4: Tools required to install and point the antenna

Tool	Details
(2) 7/16-inch combination wrenches *	For ¼-inch bolts. Some nuts and bolts require a second wrench to prevent turning.
(2) ½-inch combination wrenches *	For 5/16-inch bolts. Two of the canister nuts are not accessible with a socket wrench. Some nuts and bolts require a second wrench to prevent turning.
Torque wrench	With ½-inch and 7/16-inch sockets capable of torquing to 15 ft-lb.
M7 hex key	For J-type radio.
7/64-inch hex key	For cradle-type radio. The 7/64-inch hex key is included in the antenna kit.
Long-shaft hexagonal ball driver, 3-mm	For socket-head cap screws (Allen screws) with a 3-mm hexagonal socket. Driver shaft should be at least 5 inches long. (Recommended for attaching or removing the J-type radio assembly to or from the waveguide transition. A short-arm hex key is provided with the screws, but the long-shaft ball driver is much easier. The long-shaft ball driver cannot be used for the cradle-type radio.)
Torque wrench for hexagonal socket	Must fit a 3-mm hexagonal socket and be capable of torquing to 15 inch-lb.
Bubble level	Used to make sure the mast is plumb.
Compass	Hand-held, magnetic.
Pencil	Carpenter's pencil.
Outdoor pointing interface (OPI)	Optional. Hughes P/N 1031393-0002. Portable repeater that displays signal strength values during antenna pointing. For additional information, see *Installing the DAPT* on page 61.
Ladder	If needed.
* A socket wrench with 7/16-inch and ½-inch sockets makes some tasks easier, but for some nuts or bolts there is not enough clearance to use a socket wrench.	

See the HN System ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001) for a complete list of tools and items that may be needed for installation.

Table 5 specifies the correct tool size for each hardware size included in the antenna kit:

Table 5: Tool sizes matched to hardware sizes

Hardware size	Tool size
¼-inch	7/16-inch
5/16-inch	½-inch
#6-32 socket-head cap screw	7/64-inch hex key
M4 x 20 mm screw	M7 key wrench

Chapter 3

Assembling the antenna

This chapter explains how to install:

- **The antenna reflector**
- **The feed support arm and support rods** – The support rods attach to the reflector to provide additional stability to the feed support arm.
- **The Az/El and reflector bracket assembly** – The Az/El mount assembly and reflector bracket assembly are pre-assembled for installation as a single unit, as shown in Figure 3 on page 10.

For instructions on installing the radio, see Chapter 4 for the J-type radio and Chapter 5 for the cradle-type radio.

Topics in this chapter include:

⚠ CAUTION

Before you install the antenna, read all safety information in *Understanding safety alert messages*.

Determining the pointing values

Satellite-based commissioning (SBC) is an automated web-based method for pointing the antenna. SBC configures the IDU, calculates its exact location, and uses the location and other information to help you point the antenna. SBC calculates the values you use to set the antenna's azimuth, elevation, and tilt, based on the information you enter and the satellite you select. It then downloads the necessary software and completes the IDU registration process.

In this guide, *installation software* refers to installation, pointing, and commissioning software accessed through the IDU, which works in conjunction with SBC.

Before proceeding, use the installation software to determine the initial values to use for setting azimuth, elevation, and tilt. Record these values and keep them handy for reference as you install and point the antenna. To use the installation software, follow the instructions in the IDU installation guide for commissioning the IDU.

General instructions for assembling the antenna

Before you assemble the antenna, read these important instructions:

- Mast – *The mast must be installed before you can install the antenna*. For information on antenna mounting methods, see the HughesNet System ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001). The mast must have an outside diameter of 2 3/8 inches (2.375 inches).
- Sequence of steps – When you assemble the antenna, *follow the instructions in this chapter in the order they are presented.*
- Tightening hardware– *Do not tighten any nuts or other hardware until you are instructed to do so.* (See also the next item, Torque.)
- Torque – To ensure successful installation of the antenna, you *must* tighten all nuts and socket-head cap screws to the maximum torque values shown in Table 6. This is a critical requirement.

Table 6: Torque specifications

Fastener	Maximum torque
¼-inch bolts	6 ft-lb
5/16-inch bolts	15 ft-lb
¼-20 thread-cutting screws used to secure reflector bracket to reflector	10 ft-lb
No. 6-32 and M4 socket-head cap screws	15 inch-lb

For bolts that use a split lock washer, tighten the bolt until the washer is flattened, but do not tighten the bolt further. When the washer is flattened, this indicates that sufficient torque has been applied.

Attaching the reflector

Begin the assembly by attaching the antenna reflector to the reflector bracket.

Note: This task is easier if someone assists you.

1. Orient the reflector so the HughesNet logo on the front is near the top, as shown in Figure 14.

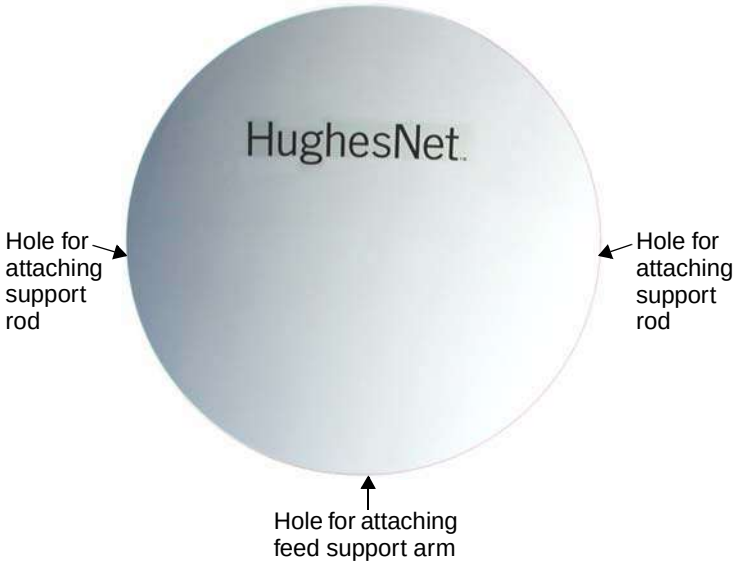


Figure 14: Reflector in correct position for installation

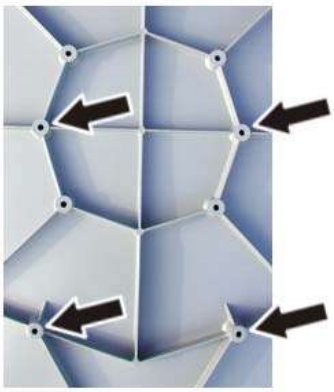
2. Lift the reflector and align the four mounting holes on the back of the reflector with the four mounting holes on the reflector bracket. See Figure 15.

Note: To make it easier to position the reflector and insert the screws (steps 2 and 3), you can adjust the elevation of the Az/El and reflector bracket assembly beyond the 80° mark on the elevation scale so the surface of the reflector bracket that attaches to the reflector is nearly horizontal. Then you can lay the reflector on the bracket, with the holes in the reflector facing the bracket. This method (not illustrated here) is especially useful when one person installs the antenna.

To use this method you must loosen the fine elevation adjustment nuts and elevation lockdown bolts identified in Figure 48 on page 65. Be sure to tighten the elevation lockdown bolts before laying the reflector on the bracket.

Reflector attached to bracket

Arrows above point to mounting screws. One screw, indicated by the gray arrow, is not visible in this photo.



Mounting holes (arrows) on back of reflector

Figure 15: Mounting the reflector on the reflector bracket

3. Insert two ¼-20 × $1^{3}/_{8}$-inch hex thread-cutting screws (without washers) through the upper holes on the reflector bracket and into the reflector holes indicated in Figure 15 (upper arrows on the right photo).
4. Partially tighten the screws.
5. Insert two ¼-20 × $1^{1}/_{16}$-inch hex thread-cutting screws (without washers) through the lower holes on the reflector bracket and into the lower reflector holes.
6. Tighten each screw a little; then move on to the next screw.
7. Use a torque wrench to tighten the screws to 10 ft-lb force maximum.

NOTICE

To avoid damaging the mounting holes in the back of the reflector, do not overtighten the reflector bracket screws. Use a torque wrench.

Installing the feed support arm

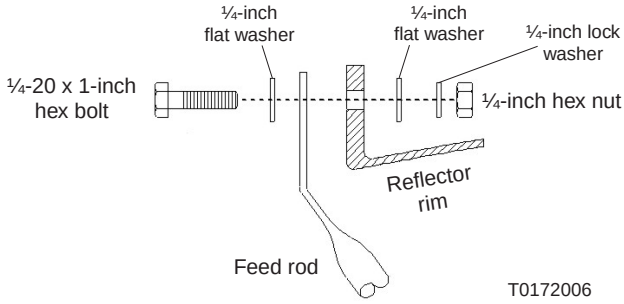
Install the support rods and feed support arm as explained in the following two sections. These instructions apply to *both* types of feed support arms and support rods for both the J-type and the cradle-type radio.

Note: If you are installing an antenna that will use a cradle-type radio assembly, make sure the feed support arm and support rods are stamped *TG*. (Other letters or numbers may appear with *TG*.) If these parts are not stamped *TG*, they are the wrong parts for the cradle-type radio. Contact your distributor or installation manager to obtain the correct parts.

Attaching the support rods

Attach the support rods to the reflector:

1. Attach the support rods to the rim of the reflector as shown in Figure 16.
   The support rod end with the longer flat part attaches to the reflector rim; the end with the shorter flat part attaches to the feed support arm (as shown in Figure 17 on page 26).
   Point the lower end of each support rod inward, toward the space in front of the lower part of the reflector. When both support rods are correctly installed, their lower ends are just a few inches apart.



Detail – Attaching left support rod
(right rod is the same but opposite)

Figure 16: Attaching support rods to the reflector

Note: The photos in this section show the feed support arm and support rods for the J-type radio. These parts for the cradle-type radio are very similar and are installed in the same way.

2. Tighten each nut just enough to keep the hardware in place.

Securing the feed support arm

Secure the feed support arm:

1. Attach the lower ends of the support rods to the feed support arm as follows: Insert the ¼-20 × 2-inch hex bolt through the arm, and use the hardware shown in Figure 17.
   Make sure the flat end of the feed support arm points toward the reflector.
2. Tighten the nut just enough to keep the hardware in place.

Support rod ends attached to feed support arm, in front of reflector

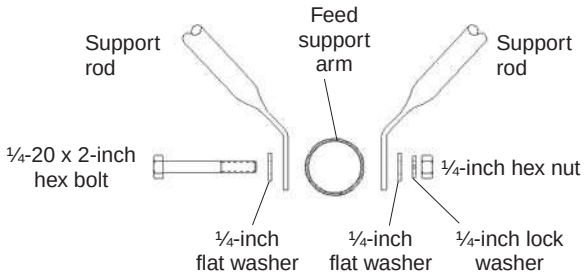


Figure 17: Attaching the support rods to the feed support arm

3. Attach the flat end of the feed support arm to the rim of the reflector, as shown in Figure 18.
4. Tighten the nut just enough to keep the hardware in place.

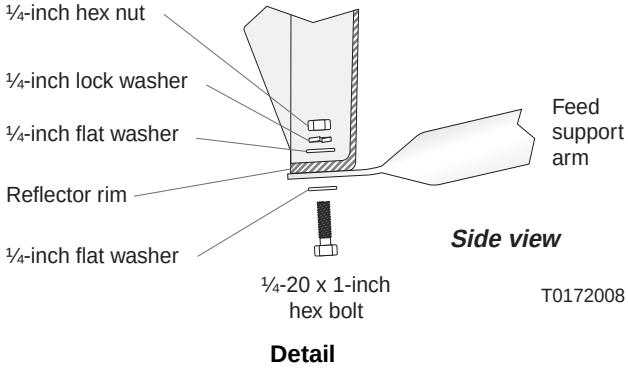


Figure 18: Attaching the feed support arm to the reflector rim

Tightening the hardware

Tighten the hardware as follows:

1. Tighten the three nuts on the reflector rim (indicated by the black arrows in Figure 19).
2. Tighten the nut where the support rods attach to the feed support arm (indicated by the white arrow in Figure 19).

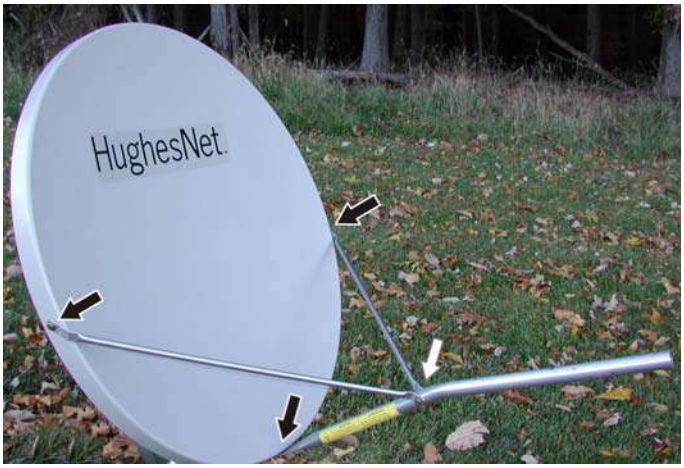


Figure 19: Tightening nuts on support rods and feed support arm

The antenna is now assembled, as shown in Figure 20, and ready for installation of the radio assembly.

- If you are installing a J-type radio, go to Chapter 4 – *Installing a J-type radio assembly,* on page 31.
- If you are installing a cradle-type radio, go to Chapter 5 – *Installing a cradle-type radio assembly,* on page 43.

Figure 20: Completed antenna assembly (without radio)

Installing the antenna assembly onto the mast pipe

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

1. Before you install the assembled antenna assembly onto the mast pipe, use a bubble level to make sure the mast is plumb. Check the mast at two perpendicular locations, as shown in Figure 21.

Note: The mast must be plumb. The antenna assembly cannot be adjusted to correct for a mast that is not plumb.

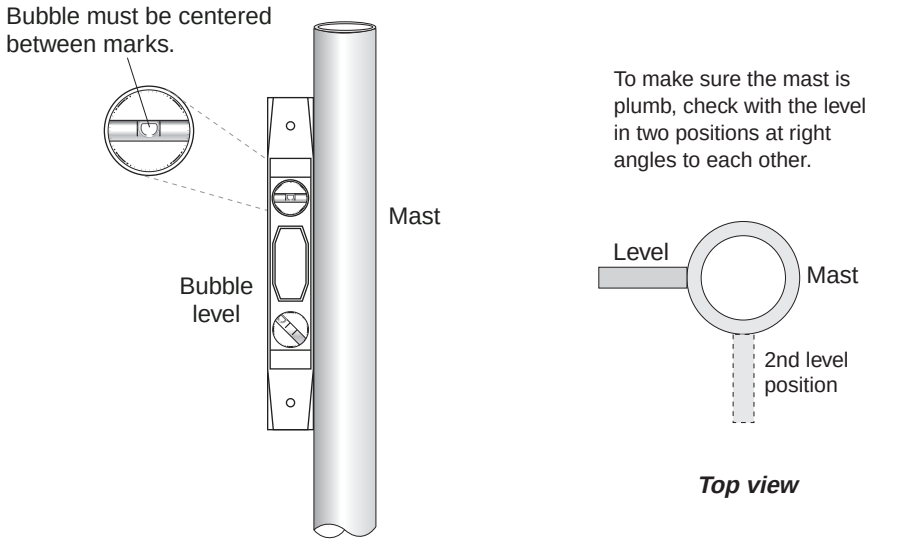


Figure 21: Making sure the mast is plumb

2. Slide the canister of the Az/El and reflector bracket assembly down onto the mast.
   Figure 22 shows the Az/El and reflector bracket assembly on the mast.

Note: The mast must have an outside diameter of $2^3/_8$ inches (2.375 inches).

Figure 22: Az/El and reflector bracket assembly on the mast

3. *Optional:* If you adjust the antenna elevation now to the coarse elevation value, before installing the reflector, it is easier than making this adjustment after the reflector is attached. You can make this adjustment at this time or you can do it as part of the antenna pointing procedure. (See *Setting coarse elevation* on page 66.)
4. Rotate the Az/El and reflector bracket assembly until the reflector side is oriented in the general direction of the satellite.

   If necessary, loosen the canister nuts just enough to allow the assembly to rotate.
5. Snug the three canister nuts just enough to prevent the assembly from rotating.

   Do not tighten the nuts at this time.

Chapter 4

Installing a J-type radio assembly

This chapter applies to the J-type radio assembly only. If you are installing a cradle-type radio assembly, go to Chapter 5 – *Installing a cradle-type radio assembly*.

This chapter includes:

NOTICE

- Do not remove the protective packing material from the feed horn until installation of the radio assembly is complete.
- Do not remove the transparent moisture seal on the small end of the feed horn. However, if the seal is damaged, wrinkled, or loose, remove it.
- Be careful not to damage the feed horn window. Do not touch the plastic film.

Installing a shim for vertical transmit polarization

Follow the instructions in this section only if the installation reference sheet or service order states that vertical transmit polarization is required. (The vertical shim kit is *not* used with the cradle-type radio.)

If vertical transmit polarization is not required, go to *Installing the radio assembly* on page 36.

The radio assembly is shipped with a horizontal transmit polarization shim installed. If vertical transmit polarization is required, you must remove the horizontal shim and replace it with a vertical transmit polarization shim.

Note: If you need to change from horizontal to vertical transmit polarization on an antenna that has the radio assembly already installed on the feed support arm, you will have to remove the radio assembly from the feed support arm before you can follow the instructions in this section.

Figure 23 shows where the shim is located and shows three of the four Allen screws that hold the shim in place.

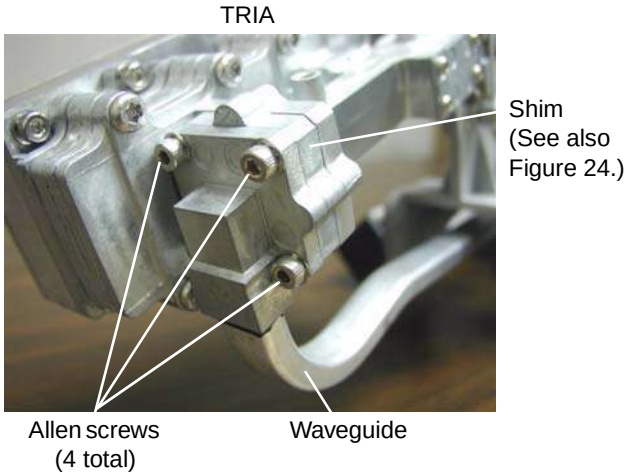


Figure 23: Shim location next to TRIA

To replace the horizontal shim with a vertical shim, follow these steps:

1. Obtain a vertical transmit polarization shim kit (Hughes model VTX-SHIM-KIT, P/N 1033809-0001).
   Figure 24 on page 33 shows what a vertical shim looks like.
2. Loosen and remove the four Allen screws that hold the shim in place. See Figure 23.
3. Separate the end of the waveguide from the shim.

Figure 24 illustrates the difference between the horizontal shim and vertical shim. Note the positions of the alignment pins.

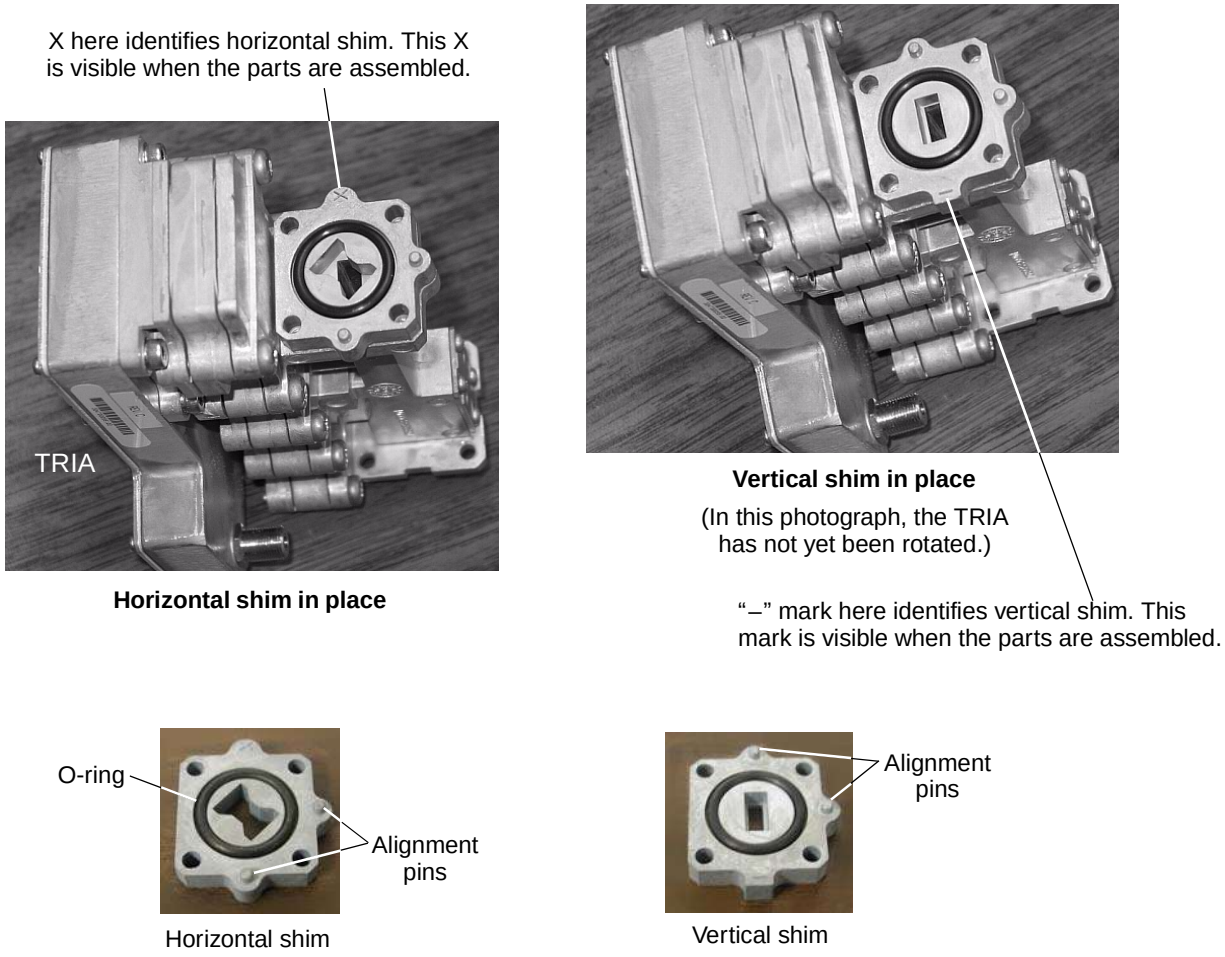


Figure 24: Horizontal shim and vertical shim for transmit polarization

4. Remove the horizontal shim and O-ring.

5. Install the vertical shim and O-ring in the same location. Because of its shape and alignment pins on the transmit/receive isolation assembly (TRIA), the vertical shim can only be installed in the position shown in Figure 24 (upper right photo). Note the position of the alignment pins. Likewise, the horizontal shim can only be installed in one position.

   Because of the shim's alignment pins, you must rotate the TRIA 90° from its horizontal polarization position. You must rotate the TRIA *before* you re-attach the waveguide end so you can insert the shim alignment pins into the waveguide end plate. See Figures 25 and 26.

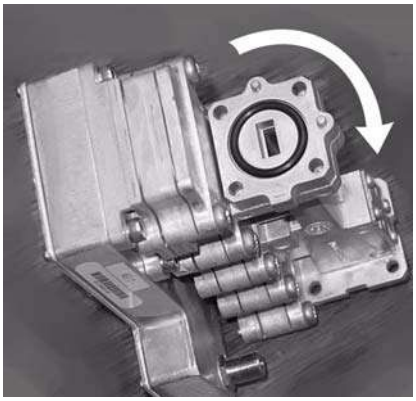
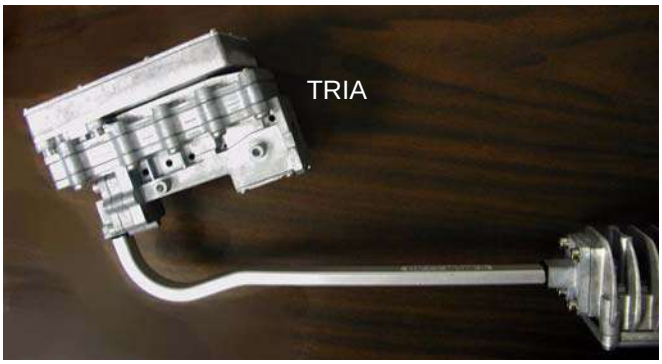


Figure 25: Direction of TRIA rotation for vertical polarization

Figure 26 shows how the TRIA is positioned for horizontal transmit polarization compared to how it is positioned for vertical transmit polarization.

Horizontal polarization



TRIA rotated for vertical polarization

Figure 26: TRIA position for horizontal and vertical transmit polarization

6. Make sure the O-ring shown in Figure 25 on page 34 is in place in the shim.
7. With the TRIA correctly positioned (rotated), place the waveguide end plate against the shim.
8. Insert and tighten the four Allen screws.

You can now install the radio assembly.

Installing the radio assembly

This section explains how to install the J-type radio assembly. You must use the antenna kit indicated in Table 1 on page 8 for the J-type radio assembly.

Attaching the upper mounting bracket

Attach the upper mounting bracket to the transmitter:

1. Place the upper mounting bracket onto the transmitter, in the position shown in Figure 27. Align the two bolt holes in the bracket with the holes in the transmitter.
2. Secure the bracket to the transmitter with two $^{5}/_{16}$-18 × 1-inch hex bolts, lock washers, and flat washers.
3. Tighten the bolts.

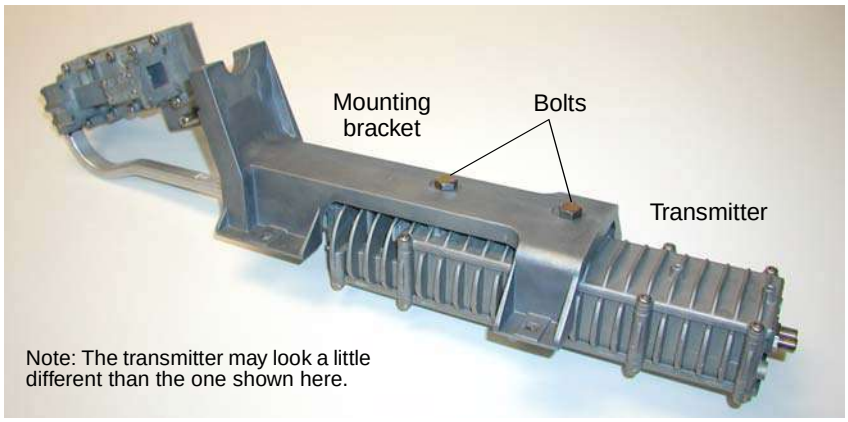


Figure 27: Attaching the upper mounting bracket

Attaching the feed horn and transition to the radio assembly

The feed horn and waveguide transition are shipped from the factory pre-attached, as shown in Figure 28.

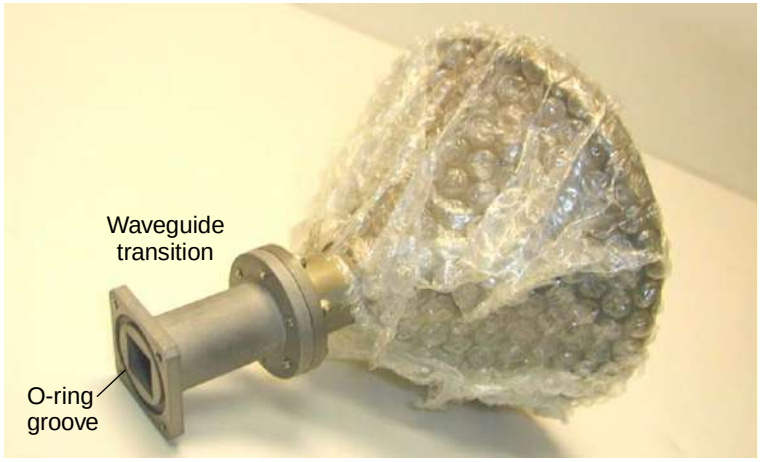


Figure 28: Feed horn with waveguide transition attached

Attach the square end of the waveguide transition (with the feed horn attached) to the radio assembly—specifically, to the transmit/receive isolation assembly, or TRIA:

1. Apply silicone grease to the O-ring groove in the waveguide transition. See Figure 29.
   The silicone grease is provided in a small plastic capsule.
2. Place the O-ring (1-inch inside diameter) in the O-ring groove in the square end of the waveguide transition.

Note: The O-ring and small hardware for the square end of the waveguide transition are shipped in a bag that contains four socket-head cap screws.

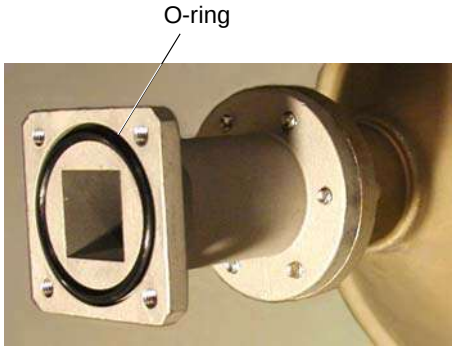


Figure 29: O-ring in groove in waveguide transition

3. Place the neck of the feed horn into the upper mounting bracket, and position the square end of the waveguide transition close to the TRIA. See Figure 30.
   Make sure the feed horn packing material is out of the way so it will not get stuck between the feed horn neck and the upper mounting bracket.

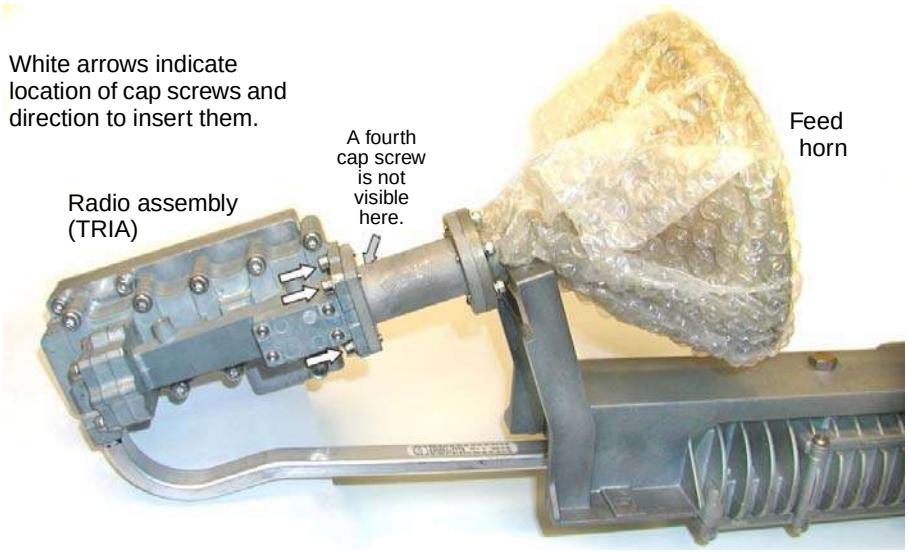


Figure 30: Attaching the waveguide transition to the TRIA

4. Attach the square end of the waveguide transition to the TRIA using the provided M4 × 12-mm socket-head cap screws and M4 lock washers with teeth on the inner edges. (See Figure 30.)
   Insert the screws in the direction indicated by the white arrows in Figure 30.
   Make sure the O-ring remains in the O-ring groove.
5. Use a long-shaft 3-mm ball driver to tighten the M4 cap screws.

6. Place the feed horn clamp over the neck of the feed horn, as shown in Figure 31.
7. Insert two ¼-20 × 1-inch hex bolts (with lock washers)—one on each side of the clamp.

   Make sure the packing material is out of the way so it will not get stuck under the clamp.

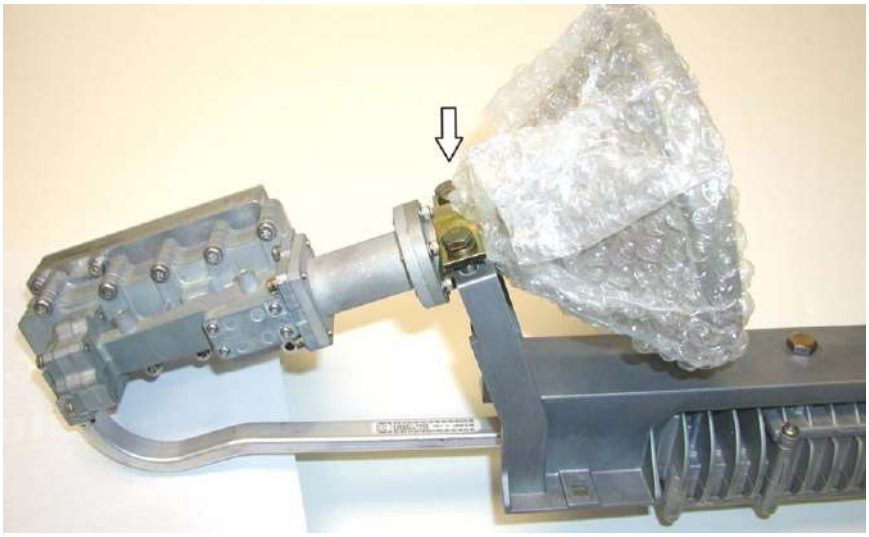


Figure 31: Securing the feed horn clamp (arrow)

8. Tighten the bolts alternately, a little at a time.

Mounting the radio assembly on the feed support arm

To mount the radio assembly on the feed support arm, first mount the lower mounting bracket on the feed support arm:

1. Position the lower mounting bracket and mounting adapter on the feed support arm, with the bolt holes aligned, as shown in Figure 32.
   There are four holes on the top surface of the feed support arm. Two of these holes are oval slots. Use the round hole and oval slot *closest to the reflector* to mount the radio. (See Figure 32.)

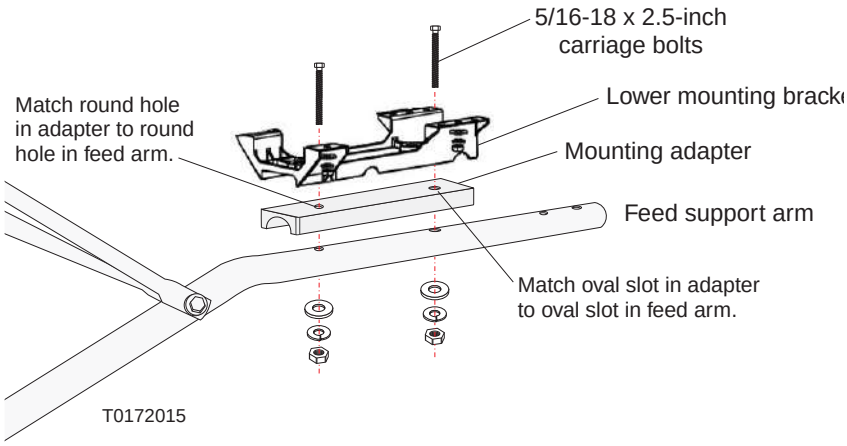


Figure 32: Attaching the radio assembly to the feed support arm

2. Insert two $^{5}/_{16}$-18 × 2.5-inch carriage bolts from above, one into each of the two mounting holes.
3. From below, place a $^{5}/_{16}$-inch flat washer, lock washer, and hex nut on each bolt.
4. Tighten the nuts.

Attach the upper and lower mounting brackets to each other, as shown in Figure 33:

1. Place the radio assembly (attached to the upper bracket in previous steps) onto the lower bracket.
2. Align the four mounting holes on the upper and lower mounting brackets.
3. Insert a ¼-20 × 0.75-inch carriage bolt through each of the four mounting holes.
4. From below, place a ¼-inch flat washer, lock washer, and hex nut on each bolt.
5. Tighten the four bolts.

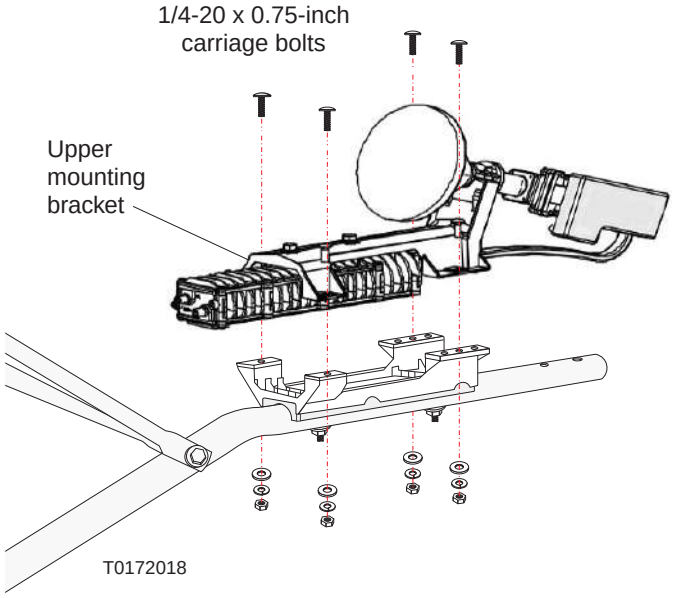


Figure 33: Attaching the radio assembly to the feed support arm

6. Remove the protective packing material from the feed horn.

This completes installation of the radio assembly.

Chapter 5

Installing a cradle-type radio assembly

This chapter applies to the cradle-type radio assembly only. If you are installing a J-type radio assembly, go to Chapter 4 – *Installing a J-type radio assembly*, on page 31.

This chapter includes:

NOTICE

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

Installing the radio assembly

This section explains how to install the cradle-type radio assembly. You must use the antenna kit indicated in Table 1 on page 8 for the cradle-type radio assembly.

Attaching the feed horn

To attach the feed horn to the radio assembly, refer to Figures 34 and 35 and follow steps 1 through 4 in this section.

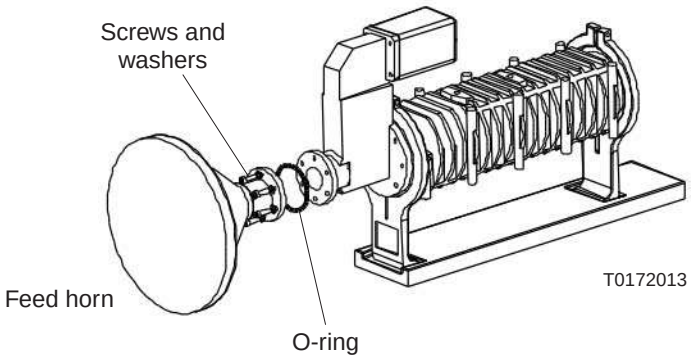


Figure 34: Attaching the feed horn and radio assembly

NOTICE

- Do not remove the transparent moisture seal on the small end of the feed horn. However, if the seal is damaged, wrinkled, or loose, remove it.
- Do not remove the protective packing material from the feed horn until you finish installation of the radio assembly.

1. Apply silicone grease to the O-ring groove in the feed horn.
2. Place the O-ring (0.9-inch inside diameter) in the groove.

Note: The O-ring is shipped in a bag that contains seven socket-head cap screws for attaching the feed horn. Six screws are required; one is an extra part.

Make sure the O-ring remains in the O-ring groove.

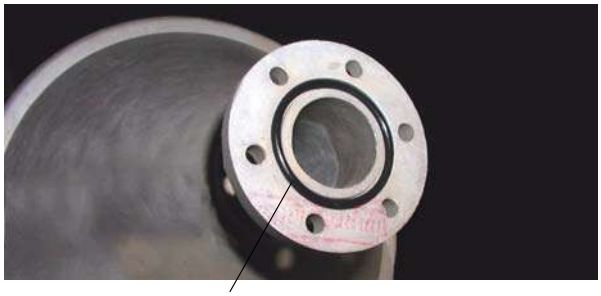


Figure 35: O-ring in groove

3. Insert the six socket-head cap screws through the flange on the small end of the feed horn and into the matching flange on the radio assembly. See Figure 34.
4. Tighten the screws.

Mounting the radio assembly on the feed support arm

Use the mounting adapter to attach the radio assembly to the feed support arm.

1. Place the mounting adapter and radio assembly onto the feed support arm, as shown in Figure 36.
2. Align the mounting holes in the base of the radio assembly, mounting adapter, and feed support arm.
   There are six holes on the top surface of the feed support arm. Use the oval slot at the end of the arm and the second hole from the bend in the arm, as shown in Figure 36.

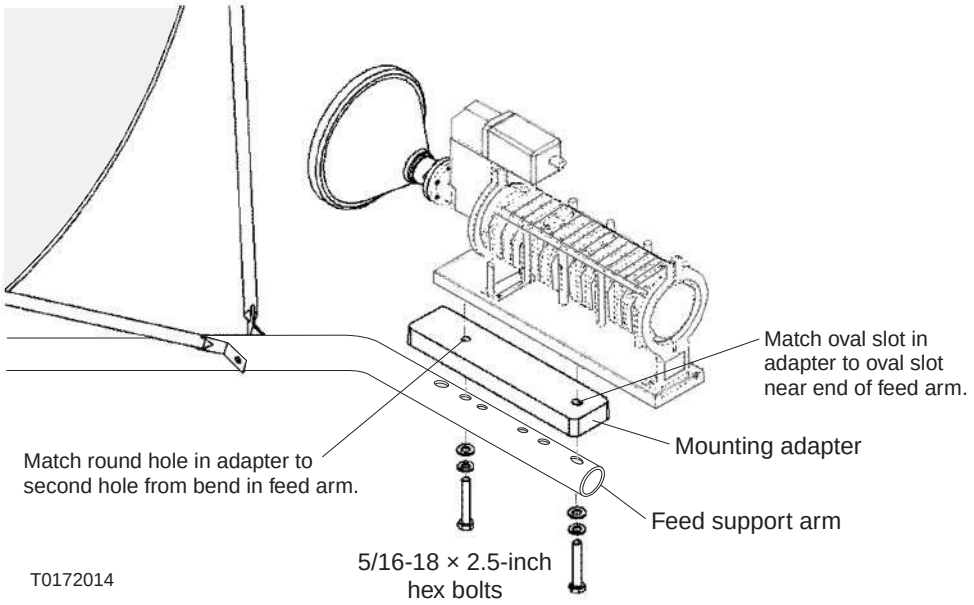


Figure 36: Mounting the radio on the feed support arm

3. From below, insert two $^{5}/_{16}$-18 × 2.25-inch hex bolts (using a $^{5}/_{16}$-inch lock washer and flat washer on each bolt) through the feed support arm, adapter, and base.
4. Tighten the bolts securely.
5. Remove the protective packing material from the feed horn.

Setting polarization for the cradle-type radio

To set polarization for the cradle-type radio, you adjust the radio, not the antenna. This section explains how to calculate and set the polarization value for the cradle-type radio assembly.

Calculating the radio polarization setting

To calculate the polarization setting, refer to the section for the type of uplink and downlink that will be used. In these instructions, *SBC initial value* refers to the polarization value calculated by the installation software.

For a horizontal uplink/vertical downlink

To calculate the radio polarization setting for a horizontal uplink/vertical downlink:

1. Multiply the SBC initial value by –1,
   then offset the result by 90° as follows:
   If the SBC initial value is positive, *add* 90.
   If the SBC initial value is negative, *subtract* 90.

   Example 1, positive initial value of 41°
   41 × –1 = –41
   Add 90:
   –41 + 90 = 49
   Radio polarization setting = 49°

   Example 2, negative initial value of –41°
   –41 × –1 = 41
   Subtract 90:
   41 – 90 = –49
   Radio polarization setting = –49°.

2. Make a note of the setting.
3. Go to *Setting the radio polarization* on page 48.

For a vertical uplink/horizontal downlink

To calculate the radio polarization setting for a vertical uplink/horizontal downlink:

1. Multiply the SBC initial value by –1 (with no offset).

   Example 1, SBC initial value of 38°
   38 × –1 = –38
   Radio polarization setting = –38°.

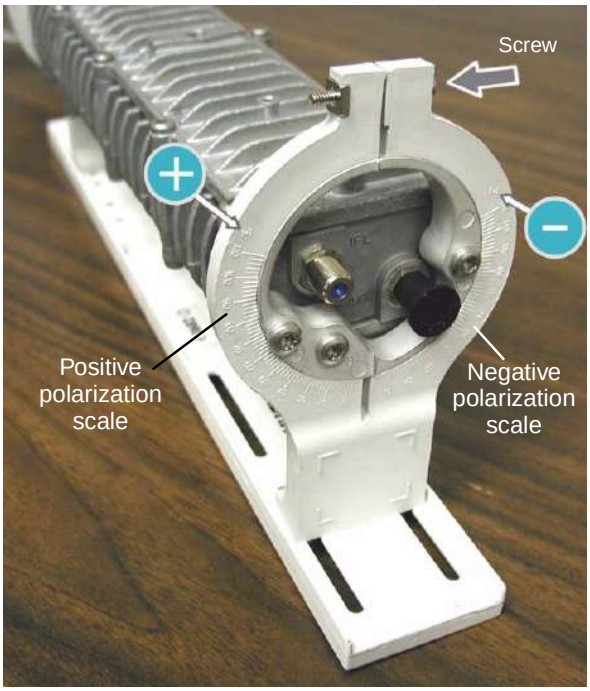
   Example 1, SBC initial value of 38°
   –38 × –1 = 38
   Radio polarization setting = 38°.

2. Make a note of the setting.
3. Go to *Setting the radio polarization* on page 48.

Setting the radio polarization

Set polarization on the cradle-type radio as follows:

1. Before proceeding, make sure the antenna tilt is set to 0°. See *Setting the tilt angle* on page 68.
2. On the radio assembly, loosen the two screws at the top of the two circular brackets at each end of the transmitter. (Each of these brackets has a polarization scale.) See Figure 37.



To set polarization, align marker indicated by black arrow to the desired value on the scale. The setting in this photo is close to 0°.

Figure 37: Rear circular bracket with polarization scale

3. Set the polarization to the calculated setting by rotating the radio and using the polarization scales on the circular brackets. Plus (+) and (–) minus signs at the top of each scale indicate positive or negative values. Make sure you read the correct scale.
4. Tighten the two screws on the circular bracket.

This completes installation of the radio assembly.

Chapter 6

Cabling and connections

This chapter illustrates where the antenna transmit, receive, and ground connectors are located; shows how to route the transmit and receive cables at the antenna; and explains how to connect the transmit and receive cables and the ground wire to the radio assembly. You must connect each of these cables before you can point the antenna (as described in Chapter 7).

Topics in this chapter include:

Cabling requirements

For a list of approved coaxial cable types for the IFL between the antenna and the IDU, see the Hughes FSB, ***IFL Cable, Approved List (with lengths) for DW7x00, DW60xx, and DW40xx Domestic Installations*** (FSB_060316_01). This FSB lists the maximum cable length for each approved cable type, for all relevant radio types.

Because each installation site has unique requirements, you must use your own judgment and best practices to determine how to safely route the IFL cables.

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, ***HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks and Ground Block Location*** (FSB 50518_01).

Routing the cables at the antenna

Route the coaxial transmit and receive cables at the ODU as follows:

1. Begin by marking the transmit cable with blue electrical tape near each end and the receive cable with red electrical tape near each end so that you can easily differentiate the two cables when making the necessary connections.
2. Route the transmit cable over the Az/El mount and down behind the reflector to the rear of the transmitter, in a configuration similar to that shown in Figure 38.

Note: Be careful not to exceed the minimum bending radius specified by the cable manufacturer.

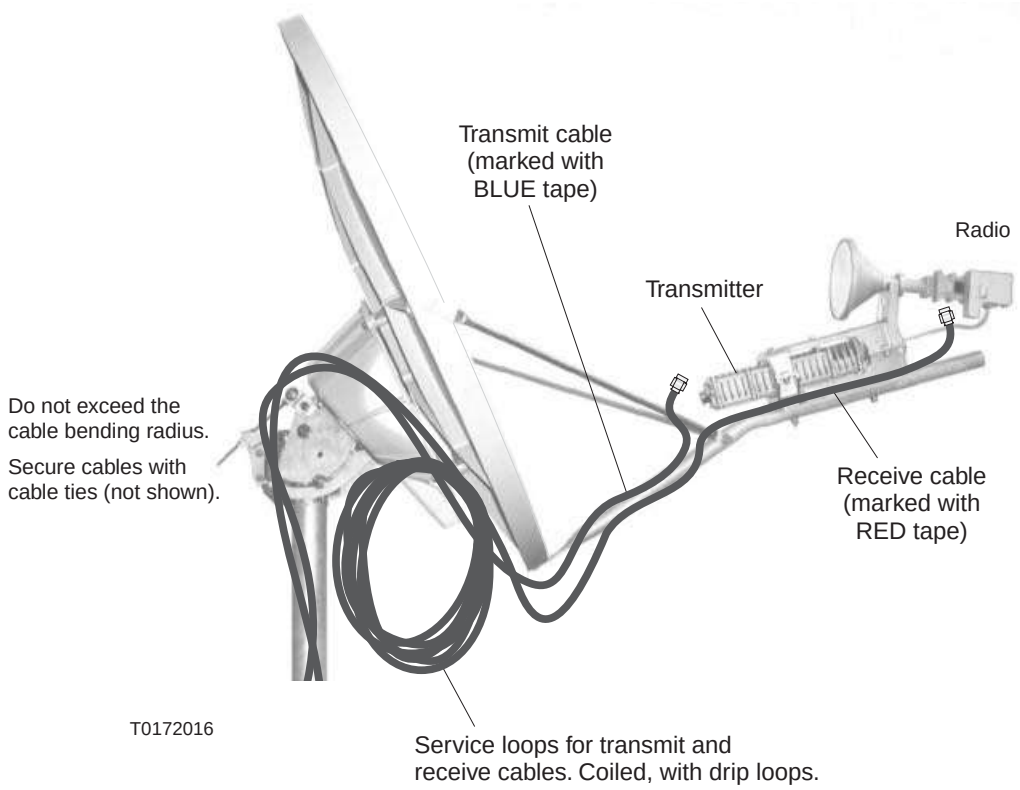


Figure 38: Transmit and receive cable configurations

3. For the transmit cable, leave a 10-ft service loop secured to the mast, or Az/El mount assembly.

   Do not leave the service loop lying on the roof or other mounting surface.

   Do not block access to the azimuth and elevation adjustment nuts on the Az/El mount assembly.
4. Coil the extra cable, leave a drip loop, and secure the transmit cable with cable ties.
5. Route the receive cable over the Az/El mount assembly, down behind the reflector, and along the feed support arm to the TRIA, in a configuration similar to that shown in Figure 38 above.

   Be careful not to exceed the minimum bending radius specified by the cable manufacturer.
6. For the receive cable, leave a 10-ft service loop secured to the mast, Az/El mount assembly, or reflector bracket.

   Do not leave the service loop lying on the roof or other mounting surface.

   Do not block access to the azimuth and elevation adjustment nuts on the Az/El mount assembly.
7. Coil the extra cable, leave a drip loop, and secure the receive cable with cable ties.

Note: Use a torque wrench to tighten all ground block connectors to 22 inch-lb.

Connecting the transmit and receive cables

This section explains how to connect the transmit and receive cables to the radio assembly at the antenna.

Note: You should protect all outdoor cable connections with dielectric grease and weatherproofing tape. However, because the antenna pointing procedure requires that you disconnect these cables, you should wait until the pointing process is complete before weatherproofing these connections.

Transmit cable

Connect the transmit cable to the radio transmitter as follows:

1. Disconnect power from the IDU.
2. Fill the transmit cable connector (marked with blue electrical tape) with dielectric grease.
3. Connect the transmit cable to the transmitter connector marked *IFL*.
   Figure 39 shows the transmit connector location for the J-type radio assembly, and Figure 40 shows the connector location for the cradle-type radio assembly. In both cases the connector is a female F connector.

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.

4. Use a torque wrench to tighten the cable connector to 22 inch-lb.

5. If necessary, secure the cable with cable ties.

Figure 39: Transmit connector – J-type radio

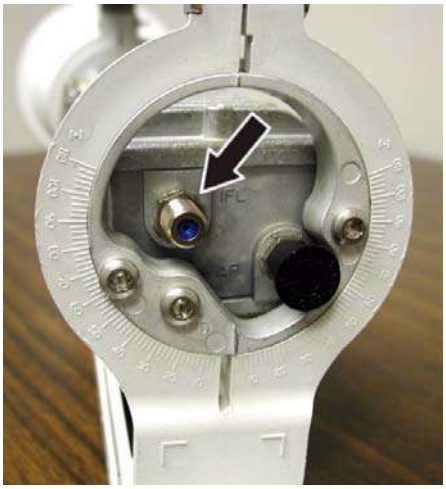


Figure 40: Transmit connector – cradle-type radio

Receive cable Connect the receive cable to the LNB:

1. Ensure that power has been removed from the IDU.
2. Fill the receive cable connector (marked with red electrical tape) with dielectric grease.
3. Connect the receive cable to the receive connector on the LNB.

   Figure 41 shows the receive connector location on the J-type radio assembly, and Figure 42 shows the connector location on the cradle-type radio assembly. In both cases the connector is a female F connector.

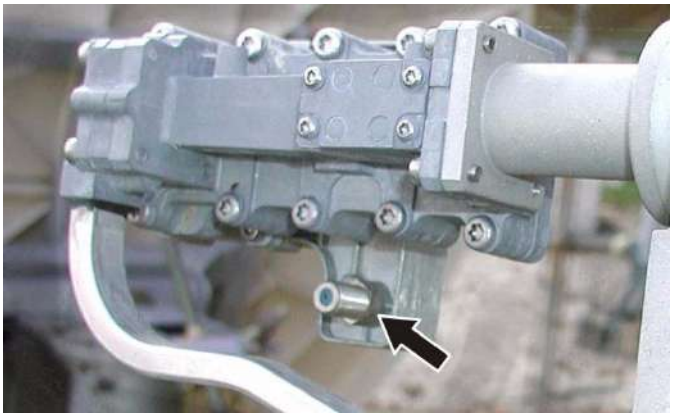


Figure 41: Receive connector – J-type radio

Figure 42: Receive connector – cradle-type radio

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.

4. Use a torque wrench to tighten the cable connector to 22 inch-lb.
5. If necessary, secure the cable with cable ties.
6. After both the transmit and receive cables are connected to the radio and the IDU, reapply power to the IDU in accordance with the instructions in the IDU installation guide.

Grounding

Ground the antenna as instructed in the documents listed in *Grounding* on page 5. Use of the ground screw on the radio assembly is optional. The radio is grounded through the shield in the coaxial cable and the ground block.

Chapter 7

Pointing the antenna

This chapter explains the antenna pointing procedure, a critical part of the antenna installation process. If the antenna is not properly pointed toward the HughesNet system satellite, system performance will be degraded.

Topics in this chapter include:

As you perform these procedures, observe the following safety precautions:

⚠ CAUTION

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

- This device emits radio frequency energy when in transmit mode. To avoid injury, do not place head or other body parts between feed horn and antenna when system is operational. Keep at least 3 ft away from the area between the feed horn and the reflector when the system is operational.
- Make sure the cylindrical space projecting outward from the antenna reflector toward the satellite does not intersect or come close to any inhabited areas.
- Disconnect power from the IDU before performing maintenance or adding upgrades to any antenna components.

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

Antenna pointing overview

This chapter describes a general procedure for pointing the antenna. The objectives of antenna pointing are to:

- Locate and detect the satellite signal
- Peak the signal to achieve the greatest possible signal strength

Correct antenna alignment is critical to the operation of the system. When the antenna is pointed directly at the satellite, it receives a strong signal. If it is not pointed properly, the signal may be weak, causing errors to occur during data transfers.

Antenna pointing is accomplished by first *receive pointing* the antenna and then *isolating the transmit signal*. Receive pointing adjusts the antenna to obtain the best receive signal. Isolating the transmit signal fine-tunes the antenna alignment for the strongest possible signal received by the HN System NOC. Both of these processes are explained later in this chapter.

The pointing process requires that you make a number of small position adjustments to the antenna until you are satisfied that you have obtained the strongest possible signal. When you have achieved the strongest possible signal, you have *peaked* the signal.

Using the installation software

The exact pointing procedure depends on the installation software used, whether SBC or WebSetup. (For a description of SBC and WebSetup, see *Determining the pointing values* on page 21.)

The installation software guides you through a step-by-step process for installing the IDU and pointing the antenna. It calculates your exact location and the values you use to set tilt, elevation, and azimuth. (Note that the installation software may refer to tilt as *polarization*.)

Use the information in this chapter as a guide for the overall pointing process and for instructions on how to make mechanical adjustments to the antenna. For specific steps, follow the instructions in the IDU installation guide and on the installation software screens.

In general, you will alternate between two activities. These are:

- Following the software prompts and instructions
- Adjusting the antenna (azimuth, elevation, and tilt) to acquire and then peak the satellite signal. The required adjustments are different for each installation location.

Peaking the signal

Peaking describes the process of achieving the highest possible signal strength available from the satellite. You may achieve the strongest signal strength after just a few adjustments, or you may find that several adjustments are needed. By obtaining the strongest possible signal, you ensure that the IDU can operate at the optimum performance level.

Personnel requirements

The antenna pointing process usually requires two people—one person to aim and adjust the antenna, and a second person to watch the signal strength display on the computer and relay the readings back to the first person. However, if you use a DAPT for pointing, only one person is required. When two people are needed, a cell phone or walkie-talkie can be very helpful.

Pointing parameters

Prior to antenna pointing, you must use the installation software to enter pointing parameters such as proper longitude, latitude, and tilt angle. Alternatively, you can enter the local ZIP code and let the software calculate these values for you.

Prerequisites for antenna pointing

The following are required for antenna pointing:

- The antenna must be installed.
- The IDU must be installed.
- The IFL transmit and receive cables must be connected to both the IDU and the antenna.
- Both the antenna and the IDU must be grounded.
- If used, the pointing tool (DAPT or OPI) must be installed. (See *Installing the DAPT* on page 61 or *Installing the OPI* on page 63.)
- You must have access to the installation software. (See *Using the installation software* on page 58.)

Pointing tools

Hughes has developed two tools that make antenna pointing easier, faster, and more accurate. Both tools are optional; however, Hughes highly recommends that you use *one of them* for easier and more accurate antenna pointing. The pointing tools are:

- DiSEqC antenna pointing tool (DAPT)
- Outdoor pointing interface (OPI)

Both devices display values that indicate signal strength during antenna pointing, eliminating the need for a laptop computer at the antenna installation site.

DAPT

The DAPT, Hughes P/N 1501471-0002, is a digital satellite equipment control (DiSEqC) tool. It has two connectors, a large back-lit display, and three buttons, as shown in Figure 43. For Ku-band antenna pointing, only the **Advance** button (button 3) is used.

Figure 43: DiSEqC Antenna Pointing Tool (DAPT)

Installing the DAPT

To install the DAPT, you need:

- The DAPT, Hughes P/N 1501471-0002
- A 22 kHz filter, P/N 1500950-0001
- Two short jumper cables

To use the DAPT for Ku-band antenna pointing, you must use the filter specified above.

For the jumper cables, use the same cable type as the IFL cables with male F connectors. Use short jumpers to keep the DAPT close to the antenna so it can be easily read during pointing.

Install the DAPT as follows:

1. Make sure the IDU is powered ON.
2. Make sure the transmit cable is connected between the radio transmitter (IFL connector) and the IDU (SAT OUT connector).
3. Disconnect the receive cable from the low-noise block converter (LNB) on the radio.
4. Use the jumper cables to connect the DAPT and filter inline between the IDU and the LNB, exactly as shown in Figure 44.

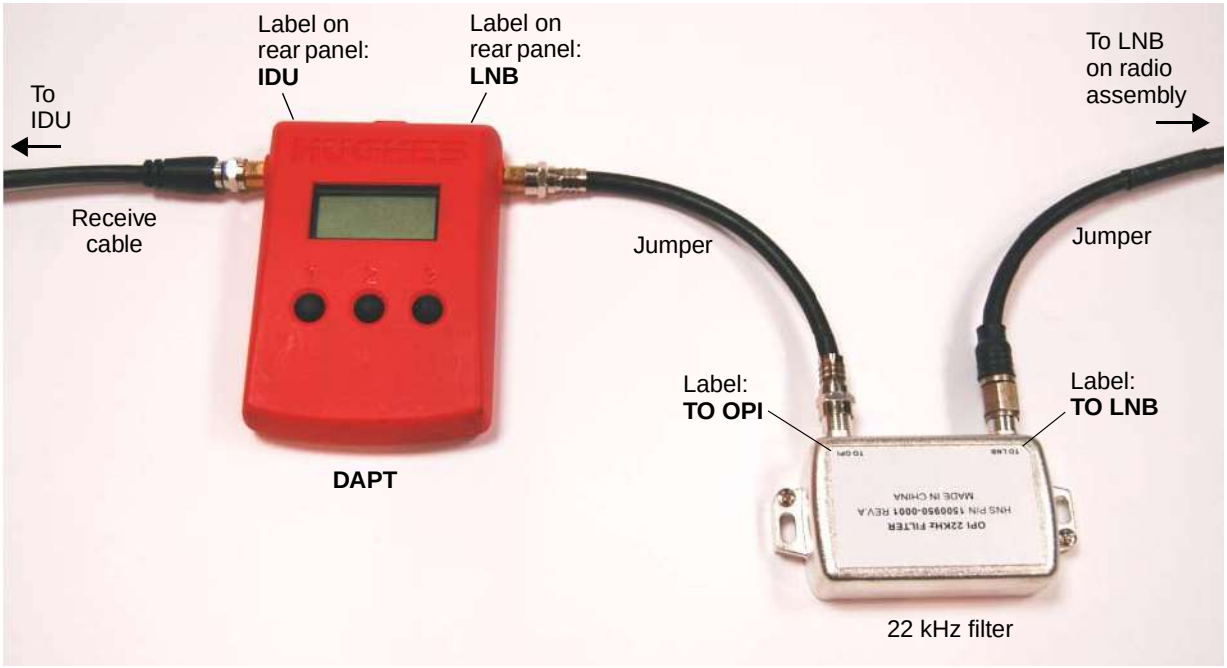


Figure 44: Installing the DAPT

Understanding the DAPT display

When connected properly, the DAPT initially displays the IFL receive cable voltage on its LCD display, as shown in this example (the actual voltage may vary):

Important: To see pointing values, as described below, you must check the box labeled Enable OPI Display on the appropriate installation software screen on the installer laptop computer.

If the IDU is in receive pointing mode and you press the **Advance** button (3), the display changes from IFL cable voltage to `COMM Startup` and then (automatically) to `Mode` and `Value`:

The mode is either 0 or 2:

- 0 – Receive pointing.
- 2 – Automatic cross-pol (ACP), manual or automatic:
  - Manual – The value is dynamic; it changes constantly.
  - Automatic – The value is static; it does not change.

You cannot change the mode from the DAPT; you can only change modes through the laptop.

In all modes the value is a *relative* indication of signal strength. A higher number indicates a stronger signal.

OPI

The OPI, P/N 1031393-0002 (Figure 45) is a portable repeater that displays signal strength values during antenna pointing.

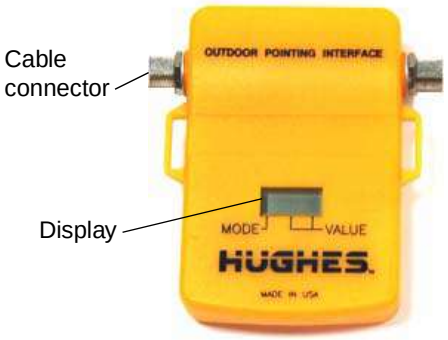


Figure 45: Outdoor Pointing Interface (OPI)

Installing the OPI

To install the OPI, you need:

- The OPI, Hughes P/N 1031393-0002
- A 22 kHz filter, P/N 1500950-0001.
- Two short jumper cables

To use the OPI for Ku-band antenna pointing, you must use the filter specified above.

For the jumper cables, use the same cable type as the IFL cables with male F connectors. Use short jumpers to keep the OPI close to the antenna so it can be easily read during pointing.

Install the OPI as follows:

1. Make sure the IDU is powered ON.
2. Make sure the transmit cable is connected between the radio transmitter (IFL connector) and the IDU (SAT OUT connector).
3. Disconnect the receive cable from the LNB on the radio.
4. Use the jumper cables to connect the OPI and filter inline between the IDU and LNB, exactly as shown in Figure 46.

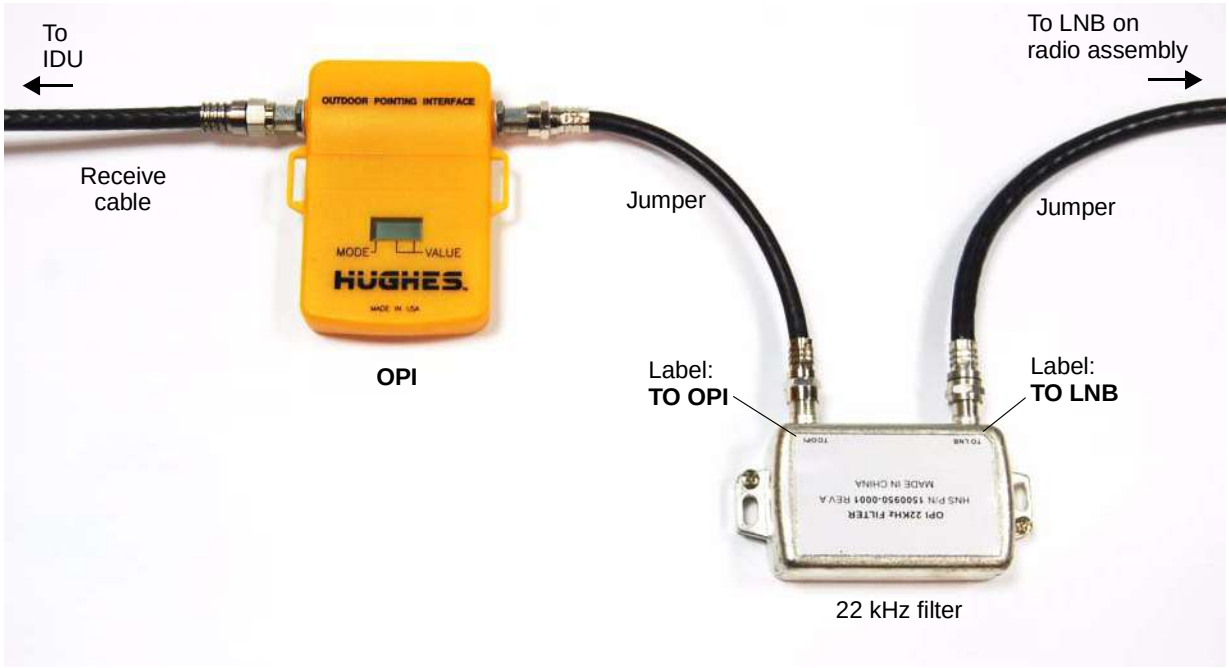


Figure 46: Installing the OPI

Important: The OPI will not work unless it is enabled on the appropriate screen on the installation software. (Check the box labeled Enable OPI Display.) For further details, see ***Outdoor Pointing Interface Operating Instructions*** (1031832-0001).

Adjusting the antenna

To point the antenna, you must make three adjustments to the position of the antenna reflector:

- Elevation – Adjustment up and down
- Tilt angle – Rotational adjustment
- Azimuth – Side-to-side adjustment

These adjustments are illustrated in Figure 47. The corresponding mechanical adjustments on the antenna are shown in Figure 48.

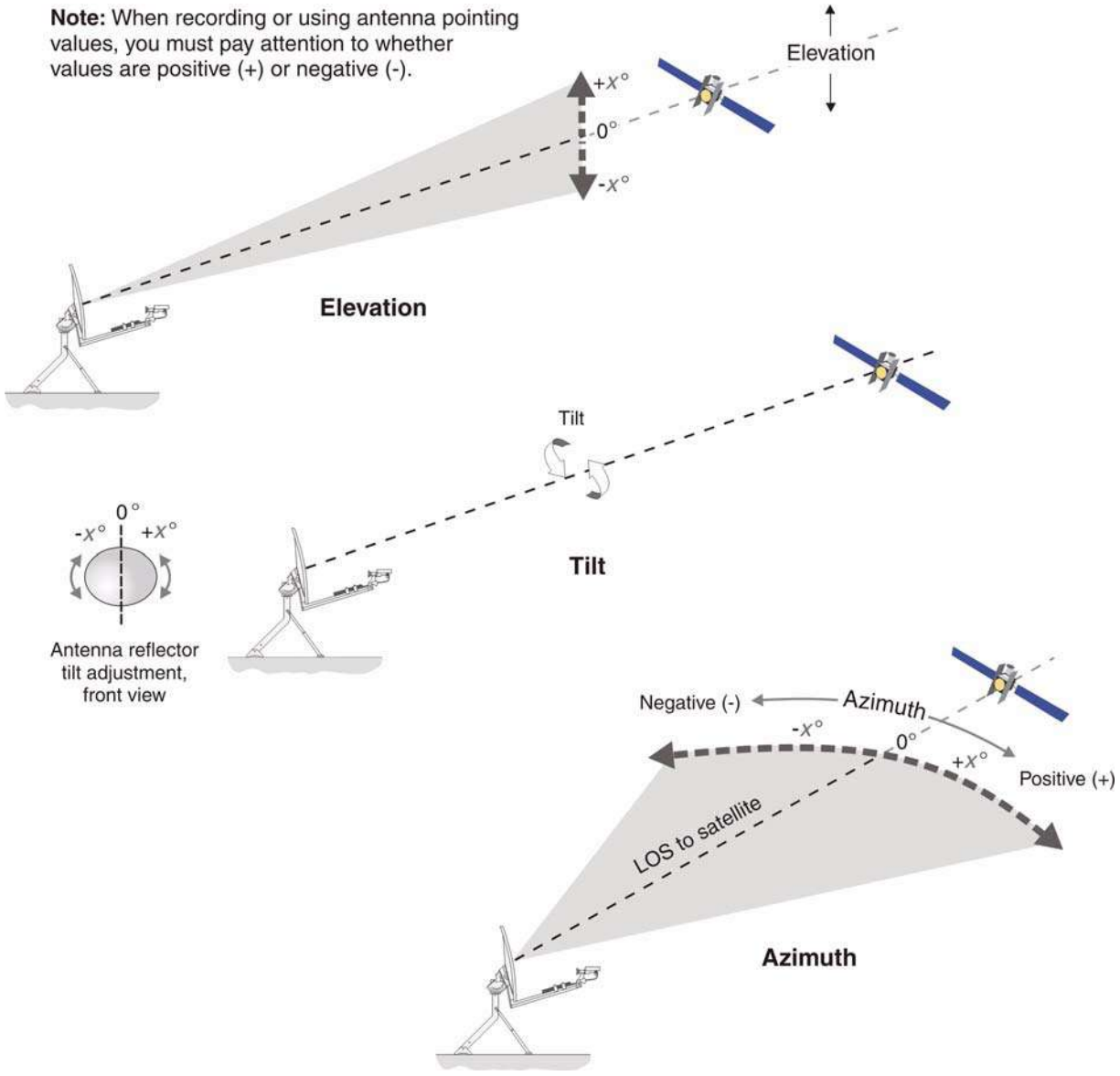


Figure 47: Adjusting azimuth, elevation, and tilt

Adjustment locations on the antenna

Figure 48 shows the mechanical adjustments for azimuth, elevation, and tilt. All pointing adjustments require a ½-inch wrench.

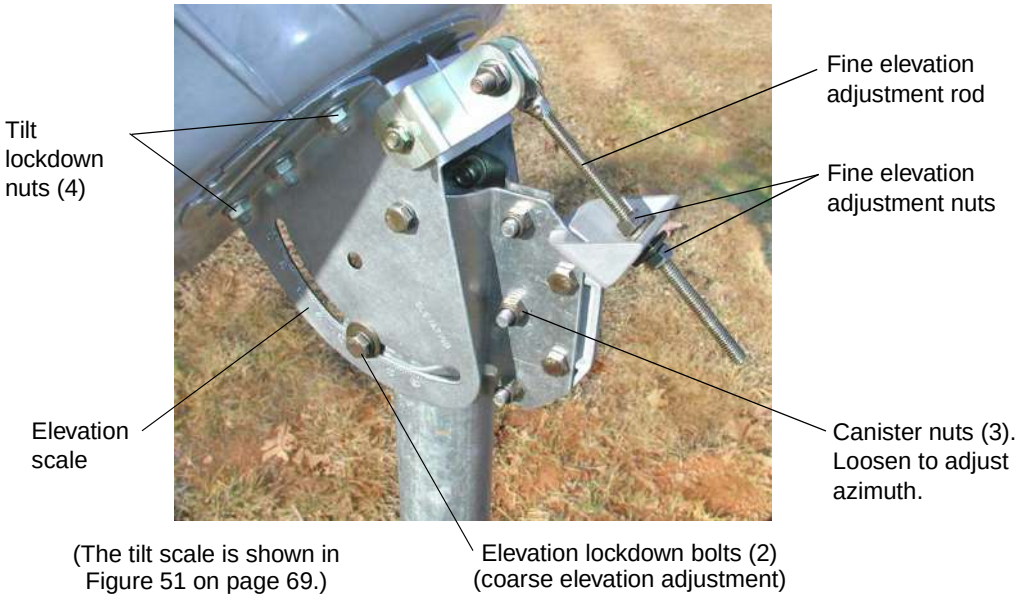


Figure 48: Pointing adjustments on the antenna—elevation, tilt angle, and azimuth

Note: The elevation lockdown hardware shown in Figure 48 may be two nuts or two bolts (one on each side of the Az/El assembly).

Detailed procedures for adjusting the antenna are included in the sections that follow. As you make pointing adjustments, tighten the lockdown nuts or bolts enough to prevent movement of the antenna reflector. When you are done pointing, you fully tighten all lockdown nuts and bolts.

Setting coarse elevation

The antenna pointing procedure begins with the steps described in this section and continues through the end of this chapter. Follow the instructions in the order they are presented.

Set the initial (coarse) antenna elevation to the initial elevation value given by the installation software, as follows:

1. Loosen the two fine elevation adjustment nuts indicated in Figure 49 so the antenna reflector can move forward and backward.
2. Loosen the two elevation lockdown bolts indicated in Figure 49, a little at a time, until you can rotate the antenna reflector forward and backward to adjust the elevation.

NOTICE

To avoid damage to the antenna reflector, handle it with care. Do *not* use the reflector to rotate the antenna.

3. Set the elevation to the value given by the installation software.

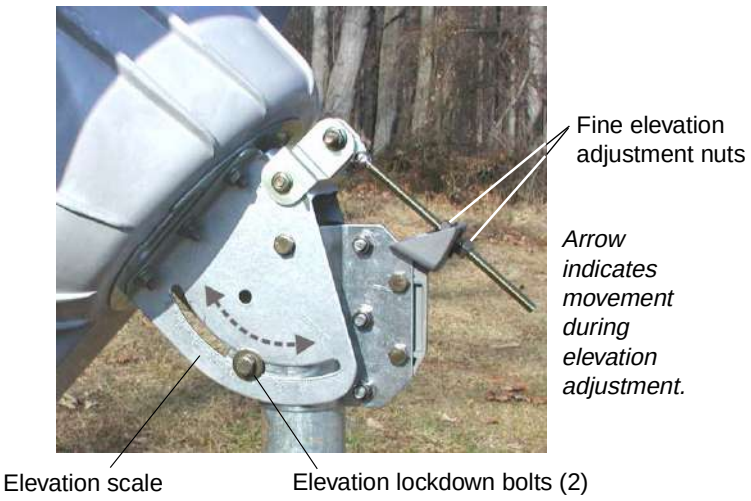


Figure 49: Setting coarse elevation

Note: Do not tighten the elevation lockdown bolts yet because you will be adjusting elevation further, as explained in *Fine elevation adjustment* on page 67.

Fine elevation adjustment

The fine elevation adjustment rod (shown in Figure 50) allows you to make fine adjustments of the antenna elevation. Where subsequent instructions call for fine adjustment of the antenna elevation, fine-tune the elevation setting as follows:

1. Make sure the two elevation lockdown bolts are loose enough to allow the reflector to move as indicated by the arrow in Figure 50.
2. While watching the signal strength display, adjust the fine elevation adjustment nuts (Figure 50) to achieve maximum signal strength:
   a. Move the top nut to allow movement, then make adjustments with the bottom nut.
   b. Adjust by turning the bottom nut a few turns clockwise and counterclockwise, until you peak the signal.

Figure 50: Fine elevation adjustment

3. When the signal is peaked, tighten the two elevation lockdown bolts.

Receive pointing

Receive pointing peaks the receive signal. You must peak the signal even if the antenna is locked to it.

Use either the installation software or one of the two pointing tools (DAPT or OPI) to check the signal strength, then adjust the antenna to peak the signal. Detailed instructions for these procedures are given in the following sections.

Initial elevation setting

Make sure that the antenna is set to the initial elevation value given by the installation software. If you haven't already done so, follow the instructions outlined in *Setting coarse elevation* on page 66.

Setting the tilt angle

Tilt angle refers to the rotation of the antenna reflector (as shown in Figure 47 on page 64) and is measured in degrees from zero (no rotation), either positive or negative. The tilt angle is positive when east of the satellite longitude and negative when west of the satellite longitude.

For antennas with a J-type radio, you adjust the tilt angle on the antenna only. For an antenna with a cradle-type radio, set the tilt angle on the antenna to 0° and then set polarization on the radio. If you are installing the antenna with a cradle-type radio, see *Setting polarization for the cradle-type radio* on page 47. (You will also use the instructions in this section.)

To set the antenna tilt to the initial value provided by the installation software, perform the following procedure:

1. Loosen the four tilt lockdown nuts just enough so that you can rotate the antenna reflector. See Figure 51.
   Do not adjust the center nut on each side, as noted in Figure 51.

NOTICE

To avoid damage to the antenna reflector, handle it with care. Do *not* use the reflector to rotate the antenna.

2. Rotate the antenna to the desired tilt value as indicated by the tilt scale (shown in Figure 51).

   J-type radio: Set the antenna tilt angle to the initial value given by the installation software.

   Cradle-type radio: Set the antenna tilt angle to 0°; then see *Setting polarization for the cradle-type radio* on page 47.

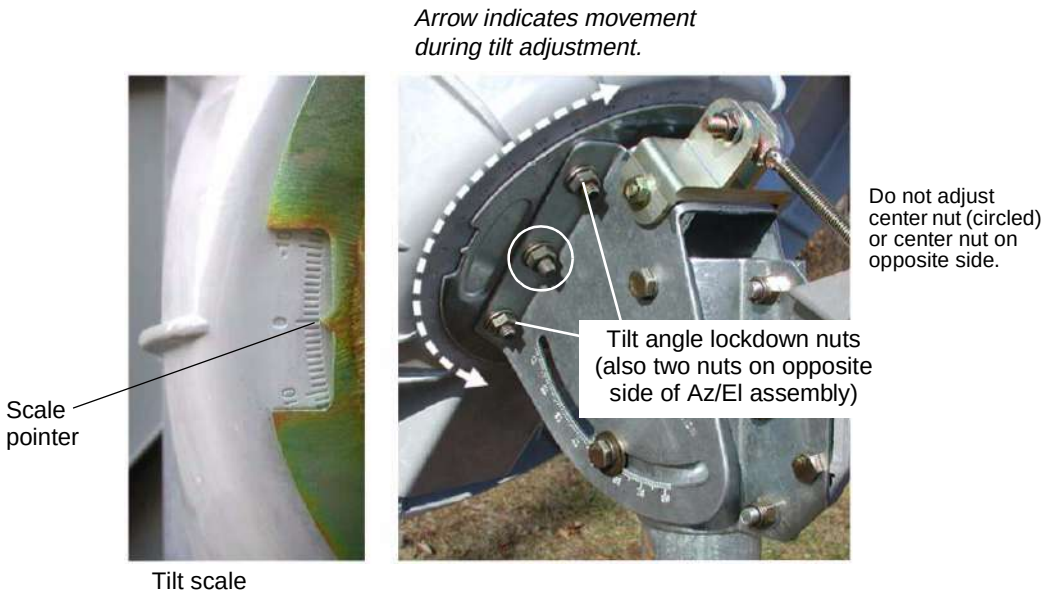


Figure 51: Tilt adjustment on the antenna

Setting the azimuth

Once you have set the elevation and tilt angle to their initial values, perform the following procedure to set the azimuth to its initial value as specified by the installation software, and adjust it as necessary:

To adjust the antenna azimuth:

1. Use a compass to determine the azimuth bearing as specified by the installation software.
2. Prepare to make azimuth adjustments as follows:
   a. Fully loosen the three canister nuts shown in Figure 52.
   b. Tighten the top nut only, just enough so you *cannot* rotate the Az/El assembly around the mast.
   c. Loosen the top nut incrementally until you can rotate the Az/El assembly by holding and moving it.

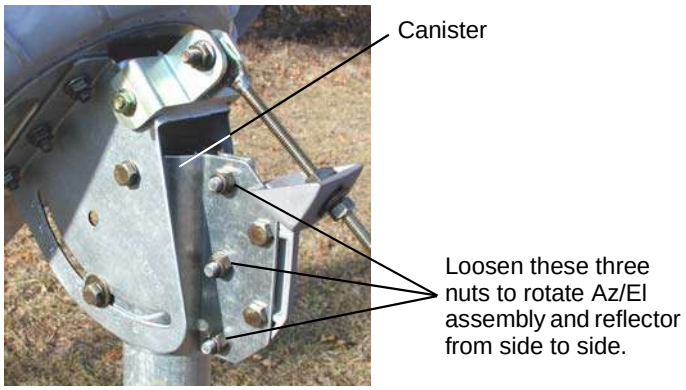


Figure 52: Azimuth adjustments on the antenna

3. *Stand behind the antenna*, grasp the antenna reflector bracket (not the reflector), and rotate the antenna assembly about the mast until the reflector is pointed in the approximate azimuth heading.

NOTICE

Do *not* attempt to adjust the azimuth manually by pulling on the antenna reflector or feed support arm. This could cause permanent damage to the antenna.

4. Adjust the azimuth to the right about $^{1}/_{8}$ inch.
5. Let go of the reflector bracket and count slowly to 5 while reading the signal strength value from the OPI or computer.

You must allow the IDU enough time to track and register the signal strength.

Note: Make small adjustments (not more than 1/8 inch of azimuth as measured at the mast). Wait 5 sec between adjustments to give the IDU enough time to lock onto the satellite signal.

6. After acquiring a signal, adjust the azimuth to obtain the highest signal quality.
7. Go to *Peaking the azimuth signal* on page 72 and follow the instructions there.

If you cannot detect a signal

If, after following the instructions in *Setting the azimuth*, you do not detect a signal, perform the following instructions:

1. Repeat steps 3 through 5 in *Setting the azimuth* on page 70. (Adjust the reflector to about 1/8 inch to the right of the approximate azimuth.)
2. Keep moving the antenna reflector to the right a little at a time until you detect a signal.
3. If there is no signal, sweep back 1/8 inch at a time to the left until you detect a signal.

If you still cannot detect a signal, there may be an error. *If there is no signal,* perform the following quick checks.

1. Check the coaxial cable connections at the LNB, IDU, and all the connections in between.
2. Make sure there are no obstructions such as trees blocking the signal.
3. Make sure you recorded and properly set the azimuth, elevation, and polarization values.
4. Verify the azimuth setting by moving 15 ft in front of or behind the antenna and taking another compass reading. Metal near the compass, such as a car or even a belt buckle, can give a false reading.
5. Point the front of the antenna reflector to the left of the estimated bearing.
6. Go back to step 3 in *Setting the azimuth* on page 70 and try again.

When you have acquired a signal and adjusted azimuth to obtain the highest signal quality, go to *Peaking the azimuth signal* on page 72 and follow the instructions there.

Peaking the azimuth signal

Peaking describes the process of achieving the highest possible signal strength available from the satellite. Once you have detected a satellite signal, peak the signal as follows:

1. Mark the current azimuth bearing on the mast with a pencil so that you can find it again later.
2. After detecting the satellite, continue turning the antenna reflector a small amount in the same direction you were turning it when you began receiving the satellite signal.
   Pause for 5 sec after each time you move the reflector.
3. Turn the reflector in this fashion until the signal strength values displayed by the installation software begin to decrease.
4. When the numbers begin to decrease, slowly turn the reflector in the opposite direction until you regain the highest number that was previously achieved.
   (Achieving this maximum signal strength is called *peaking the signal*.)
   Make a note of the peaked signal strength for reference as you complete the pointing process.
5. When you have peaked the azimuth, snug down the three canister nuts as follows:
   a. Alternately and incrementally tighten the lower two nuts until the flanges makes contact.
   b. Snug the top nut.
6. Fine tune the elevation adjustment to verify that signal strength remains at the highest level.
7. If necessary, fine tune the adjustments for azimuth, elevation, and tilt to make sure you have achieved and maintained the highest possible signal strength.
8. Erase all marks previously made on the mast.
9. Lock down (fully tighten) all adjustment nuts.

Isolating the transmit signal

To prevent any overlap between the transmit and receive signals, you must use a procedure known as Automated Cross-Polarization (ACP) to isolate the transmit signal from the receive signal. ACP test functions are included in the installation software.

The ACP test software operates in two modes—*manual* and *automatic*. Manual mode provides real-time feedback of cross-polarization isolation measurements while you adjust the antenna. Automatic mode takes a snapshot of the current cross-polarization isolation measurement.

ACP fine pointing tests the antenna position using both the manual and automatic modes, and adjusts the antenna in small increments (if necessary) until it passes both the manual and automatic ACP tests.

The instructions provided in the following sections are general instructions only. The installation software screens initiates the tests and walks you through the actual procedures.

Manual ACP test

To run a manual ACP test:

1. Lock down all antenna adjustment bolts.
2. Initiate the manual installation software ACP test and select the **Manual** cross polarization test.

If the manual ACP test passes, stop the test and proceed to *Automatic ACP test* on page 74.

If the manual ACP test fails, let the test continue and follow these steps:

1. Make small, 1° or less changes in the tilt angle while observing the transmitter isolation.
2. Peak the tilt angle to the highest possible transmitter isolation.
3. Tighten the tilt lockdown nuts.
4. Check the signal strength.

When the manual ACP test passes, stop the test and proceed to *Automatic ACP test*.

Automatic ACP test

Initiate the automatic ACP test using the installation software by selecting the **Automatic** cross-polarization test. If the automatic ACP test passes *and* the peak signal strength in maintained to within 3 points on the signal strength scale, the antenna is pointed and ready to be registered.

If the antenna fails the automatic ACP test, follow these steps:

1. Initiate a manual ACP test.
2. When the test starts, make small, 1° or less changes in the tilt angle while observing the transmitter isolation.
3. Peak the tilt angle to the highest possible transmitter isolation.
4. Tighten the tilt lockdown nuts.
5. If the antenna passes the manual test, stop the manual test and run the automatic ACP test again.
6. Check the signal strength.

If the antenna passes the automatic ACP test *and* maintains signal strength within 3 points on the signal strength scale, it is pointed and ready to be registered.

If the antenna passes the automatic ACP test, but the signal strength drops more than 3 points after the test, you must repeat the fine adjustments for azimuth and elevation:

1. Repeat the fine adjustments for both azimuth and elevation to maximize the signal strength.
2. Repeat the automatic ACP test.
3. Check the signal strength.

If the antenna passes the automatic ACP test *and* maintains signal strength within 3 points on the signal strength scale, it is pointed and ready to be registered.

If the antenna still does not meet both criteria, repeat very small tilt, azimuth, and elevation adjustments and ACP tests as many times as necessary until you have peaked the signal and the antenna passes the automatic ACP test and signal strength is maintained within 3 points.

Important: When you are finished pointing the antenna, lock down all pointing adjustments. All adjustment points are shown in Figure 48 on page 65.

Final steps

Complete the following steps before leaving the installation site.

Remove the pointing tool

To remove either the DAPT or the OPI:

1. Disconnect the tool and filter, if used.
2. Reconnect the receive cable to the radio.

Check for safety labels and signs

Make sure the required safety labels and/or signs are present:

- Make sure a *Radiation Hazard Caution* label is present, legible, and visible on the feed arm and on the back of the antenna reflector.
- If the antenna is enclosed by a fence, make sure a *Radiation Hazard Caution* sign is present, legible, and visible on the entrance gate.
- If the antenna is installed on a roof with a permanently mounted access ladder, make sure a *Radiation Hazard Caution* sign is present, legible, and visible on or near the ladder.

Subsequent steps

The antenna is now installed, pointed, and ready for operation.

To commission the IDU, refer to the specific installation guide for the IDU you are installing.

Acronyms and abbreviations

A

ACP – Automated Cross-Polarization

Az/El – Azimuth and elevation

D

DAPT – DiSEqC antenna pointing tool

DiSEqC – Digital satellite equipment control

F

ft – Foot

ft-lb – Foot-pound

H

hr – Hour

I

IDU – Indoor unit

IFL – Intra-facility link

inch-lb – Inch-pound

L

LCD – Liquid crystal diode

LNB – low-noise block converter

LOS – Line of sight

M

mm – Millimeter

N

NEC – National Electrical Code

NOC – Network Operations Center

O

ODU – Outdoor unit

OPI – Outdoor pointing interface

P

P/N – Part number

S

SBC – Satellite-based commissioning

sec – Second

T

TRIA – Transmit/receive isolation assembly

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