HUGHES®

# Hughes

## Installation Manual for .74 m Ku-band Upgradeable Antenna Model AN6-074S

1036469-0001
Revision D
March 31, 2006

11717 Exploration Lane, Germantown, MD 20876 T: 301.428.5500 F: 301.428.1868/2830

# Important safety information

For your safety and protection, read this entire installation manual before you attempt to install the satellite antenna. In particular, read this safety section carefully. Keep this safety information where you can refer to it if necessary.

## Types of warnings used in this manual

This section introduces the various types of warnings used in this manual to alert you to possible safety hazards.

### ⚠ DANGER

**Indicates an imminently 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

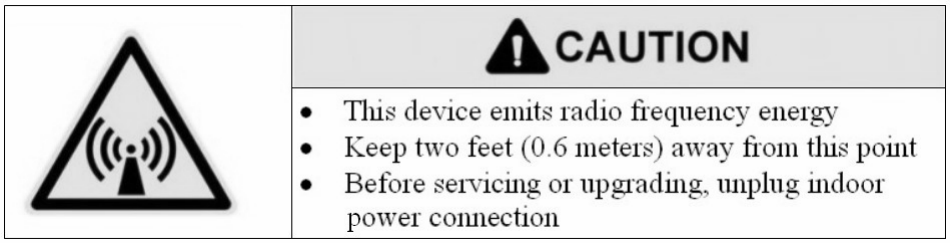
**Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury.**

### CAUTION

**Indicates a situation or practice that might result in property damage.**

## Product warning labels

The following safety alert label is affixed to each side of the satellite antenna feed arm:




This label advises that the antenna emits radio frequency (RF) energy. Because of this potential safety hazard, observe all cautions in the following section (*Antenna installation safety*) concerning RF radiation.

## Antenna installation safety

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

**⚠ WARNING**

**Only Hughes-certified installers can install or service Hughes earth stations and components. All Hughes-certified installers must expressly acknowledge the Hughes requirements for 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 they can support all loads (equipment weight, ice, and wind).**
- **Use appropriate safety equipment (for example, a lifeline), depending on the work location.**
- **Follow all safety precautions from the manufacturers of all safety equipment 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 your local power company to remove it. *Do not try to remove it yourself.***

**Failure to heed these warnings could result in serious injury or death.**

## ⚠ WARNING

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

## ⚠ CAUTION

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

- **The antenna must be installed in a location or manner 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 greater than a 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 in. 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 less than a 30° elevation must be installed such that the lower lip of the antenna reflector is at least 5 ft 9 in. above any surface upon which a person might be expected to stand, and 3 ft 3 in. from any opening (such as a door or window) in a building or adjacent structure.**

- **The antenna must be mounted such that no object which could reasonably be expected to support a person is within 6 ft 7 in. 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.**
- **The antenna must be mounted such that there is no object outside the controlled area which could reasonably be expected to support a person within 6 ft 7 in. of the edges of a cylindrical space projecting outward from the antenna reflector toward the satellite.**
- **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.**

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

## ⚠ CAUTION

- **All installations of any type or size must carry an industry standard and government approved *Radiation Hazard Caution* label on the feed arm and on the back of the antenna reflector.**
- **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 that is 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.**

Some installations may require additional precautions. See the ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001).

# Contents

# Figures

# Tables

# About this document

## Scope and audience

This manual explains how to assemble, install, and point the Hughes model AN6-074S antenna. It is written for qualified installers who are familiar with satellite antenna installation practices and are capable of properly applying the information presented.

## Organization

This manual is divided into the following chapters:

- Chapter 1 – *Overview* includes a summary of the antenna installation steps and tells you where to find information about tasks related to antenna installation.
- Chapter 2 – *Antenna components, tools, and materials* describes the components and parts provided in the antenna kit. It also lists the tools and materials needed for installation.
- Chapter 3 – *Assembling and installing the antenna* provides instructions for installing the antenna.
- Chapter 4 – *Cabling and connections* explains how to route and connect cables to the outdoor unit (ODU).
- Chapter 5 – *Pointing the antenna* explains how to point the antenna at the satellite and acquire the satellite signal.

## Related publications

For information on preparing the antenna site, including mounting options, see ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001).

## Revision record

The following table presents the revision record of this document:

| Revision | Date of issue | Scope |
|---|---|---|
| A | September 28, 2005 | Production release |
| B | December 16, 2005 | Added instruction to use extra cable to allow for future antenna upgrade. Minor corrections. |
| C | February 8, 2006 | Minor corrections |
| D | March 31, 2006 | New Hughes branding |

# Chapter 1
# Overview

The Hughes model AN6-074S .74 m antenna is designed for both Ku-band and Ka-band applications.

This chapter presents an overview of the Hughes broadband satellite system, a summary of the antenna installation steps, and information about tasks related to antenna installation. These topics are included in the following sections:



## Broadband satellite system components

The .74 m antenna (Figure 1 on page 2) is a part of the broadband satellite system, which consists of the following major components:

- Indoor unit (IDU)
- Antenna assembly (the ODU)
- Cables for connecting the IDU to the ODU and the computer
- Software

Figure 1 shows the .74 m antenna installed on a trimast mounted on a wall.

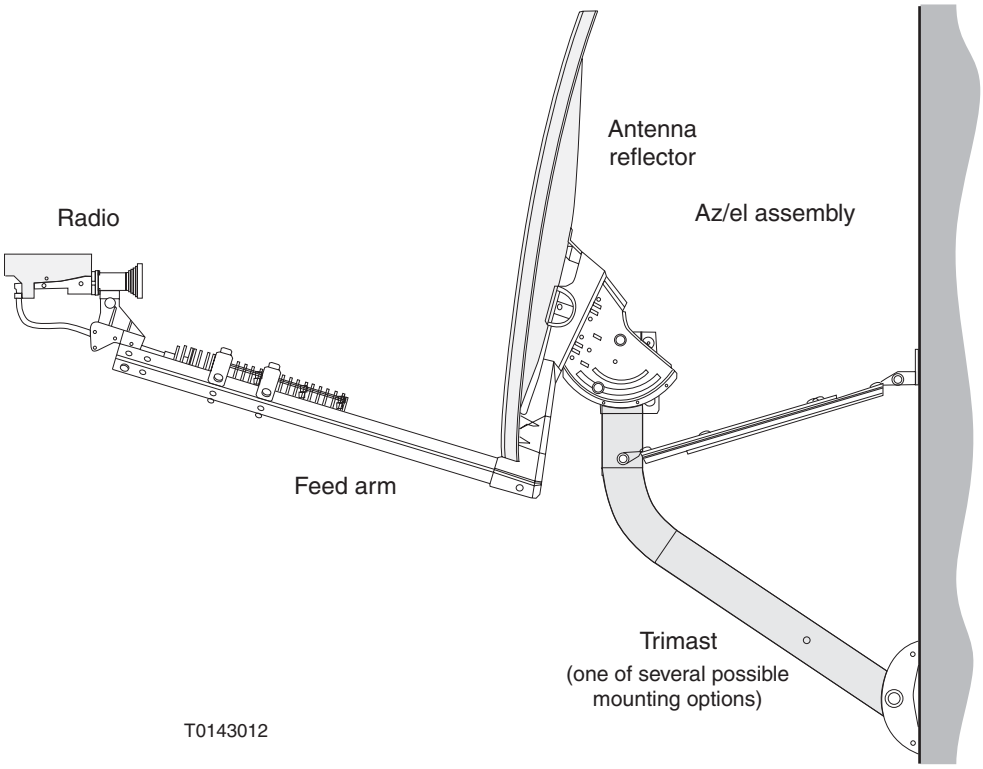



Figure 1: The .74 m satellite antenna installed on a trimast

## Antenna installation summary

The antenna installation steps and related tasks are summarized below. **The steps in bold type are documented in this manual.** Perform tasks in the order they are presented in this manual (the same order as listed below).

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

Note: Install the IDU before installing the antenna so you can run the installation software to determine the pointing coordinates (azimuth, elevation, and polarization).

5. **Assemble the antenna**.
   (Chapter 3 – *Assembling and installing the antenna*)
6. **Attach the radio and transmitter to the feed arm**.
   (Chapter 3 – *Assembling and installing the antenna*)
7. **Attach the feed arm (with radio attached) to the antenna reflector bracket**.
   (Chapter 3 – *Assembling and installing the antenna*)
8. **Attach the reflector to the reflector bracket.**
   (Chapter 3 – *Assembling and installing the antenna*)
9. **Install the antenna on the mount**.
   (Chapter 3 – *Assembling and installing the antenna*)
10. Ground the antenna assembly.
11. Run transmit and receive cables between the IDU and ODU locations.
12. **Connect the transmit and receive cables to the ODU.**
    (Chapter 4 – *Cabling and connections*)
13. **Point the antenna**.
    (Chapter 5 – *Pointing the antenna*)

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

## Tasks related to antenna installation

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

### Selecting the installation site

Factors you should consider in selecting an installation site are discussed in the Hughes ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001). For enterprise business installations, the installation site may be specified in the customer-specific installation specification.

### Installing the antenna mount

A suitable antenna mount must be installed before the antenna can be installed. For pole mounts that require a concrete base, you must allow at least 24 hr for the concrete to cure before you can install the antenna. Plan accordingly.

Before installing the antenna, use a level to make sure the mast is plumb. *This is a critical requirement* because the antenna assembly cannot be adjusted to correct for a mast that is not plumb.

For complete information concerning antenna mount installation, including various mounting methods, refer to:

- The customer-specific installation specification (if applicable)
- The Hughes ***Antenna Site Preparation and Mount Installation Guide***

If the installation is part of an enterprise business network, refer to the customer-specific installation specification for customer-specific guidelines concerning mount installation. Use only the mount installation method specified in the installation specification.

Use only the antenna mount installation methods documented in the Hughes ***Antenna Site Preparation and Mount Installation Guide***. Most installations for an enterprise or business use a non-penetrating roof mount.

### Grounding

The entire antenna assembly must be grounded. For grounding information, refer to your training, best grounding practices, and applicable parts of the National Electrical Code (NEC).

### Installing the IDU

See the IDU installation manual.

### Cables and cabling

For cable specifications, see the IDU manual. How the cable is run depends on the specific installation site. Route and connect the inter-facility link (IFL) cable according to your training and best practices.

*Chapter 2?*

# Antenna components, tools, and materials

This chapter describes the components and parts provided with the model AN6-074S antenna kit. It includes the following sections:



## Antenna kit components

This section identifies and describes the components of the .74 m antenna kit. For an illustration of an installed .74 m antenna, see Figure 1 on page 2.

The .74 m antenna consists of the following main components:

- Antenna reflector
- Reflector bracket
- Polarization plate
- Elevation bracket and canister
- Feed arm and feed horn

Each of these components is described and illustrated in the following sections.

The antenna assembly is mounted on a trimast or other suitable mount. For mounting options, see the Hughes ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001).

**Antenna reflector** The antenna reflector is shown in Figure 2.

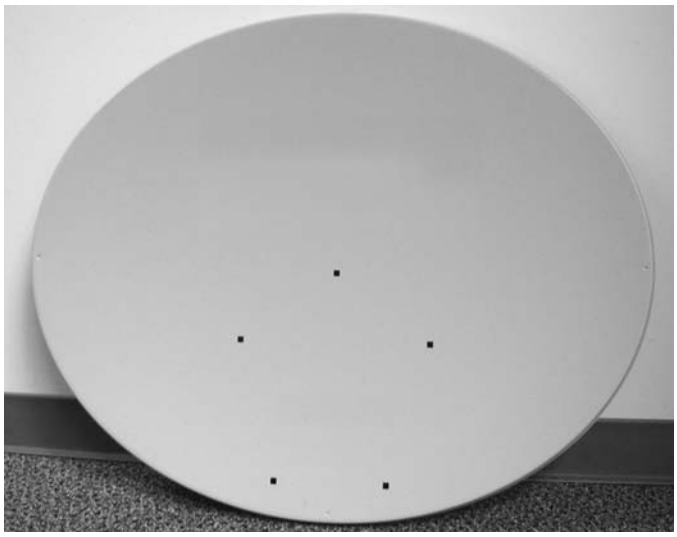


Figure 2: Antenna reflector

---

**CAUTION**

**Take care not to bend the antenna reflector. Prior to installation, do not place heavy objects on the antenna shipping box or antenna reflector.**

---

**Reflector bracket** The reflector bracket (Figure 3) attaches to the back of the antenna reflector. It supports the reflector and includes a scale for polarization adjustment.

Figure 3: Reflector bracket

### Polarization plate

The polarization plate (Figure 4) attaches to the front of the elevation bracket (Figure 5). The polarization plate, when loosened, allows you to rotate the reflector to adjust polarization.

Figure 4: Polarization plate

### Elevation bracket and canister

The elevation bracket includes a scale to help you adjust the antenna elevation. The canister fits onto the trimast or other mast. It secures the antenna assembly to the mast. The mast outside diameter must be 2-3/8 in.

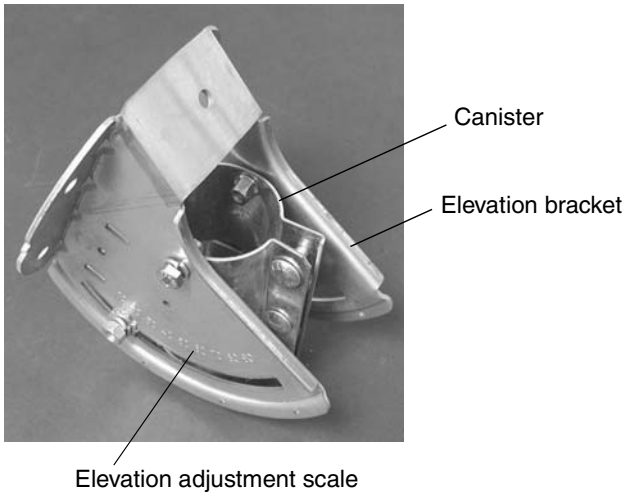



Figure 5: Elevation bracket

### Feed arm and radio assembly

Figure 6 shows the feed arm and feed horn. The feed horn is attached to the feed arm at the factory.

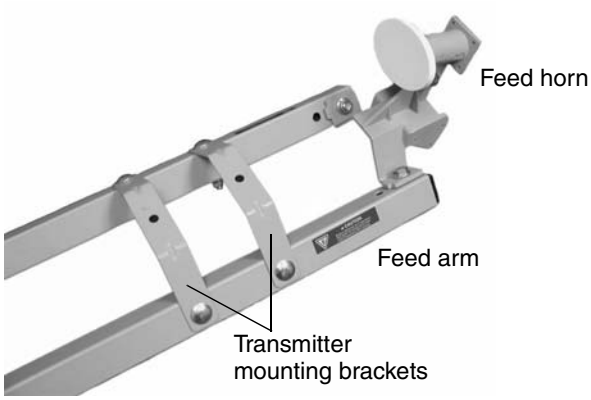



Figure 6: Feed arm and attached feed horn

### Trimast (or other antenna mount)

The trimast is not part of the antenna kit. It is shown here because it is the most commonly used mounting option for the .74 m antenna. As shown in Figure 7, the trimast can be configured and manipulated in several ways to adapt it for mounting onto surfaces of various angles. For other suitable antenna mount options, see the Hughes ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001).

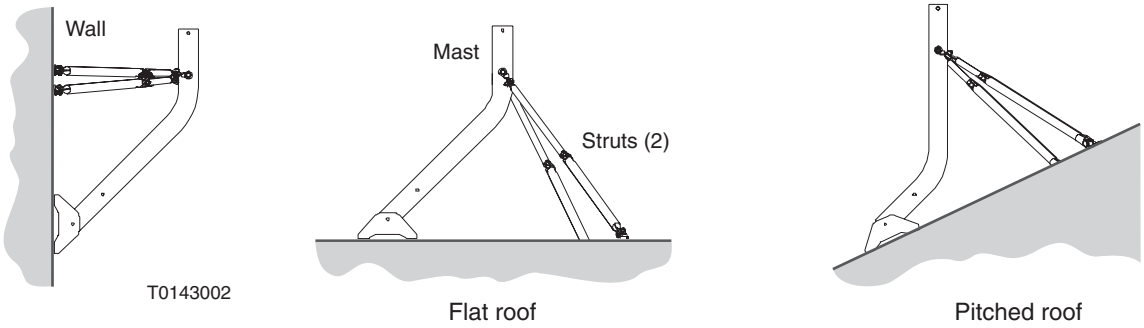



Figure 7: Trimast in various configurations

## Hardware and materials

The antenna includes the small hardware parts listed in Table 1. Table 1 does not include parts that are pre-installed at the factory.

Table 1: Hardware parts shipped with antenna

| Part | Use | Type or size | Quantity |
|---|---|---|---|
| O-ring gasket for feed horn | Provides seal between feed horn and TRIA | Ku band, standard, 1-inch inside diameter | 1 |
| Screws (with lock washers) for feed horn | Secure TRIA to feed horn | M4 x 10 mm Allen screws (hex socket head) | 4 |
| Hex head bolts (with flat washers and lock washers) for transmitter | Attach transmitter to feed arm mounting brackets | 5/16-18 x 5/8 UNC | 2 |
| Carriage bolts (with serrated flange nuts) for reflector | Attach reflector bracket to antenna reflector | 5/16-18 x ¾ UNC | 5 |
| Carriage bolts (with nuts, flat washers, and lock washers) for elevation bracket | Attach polarization plate to elevation bracket | 5/16-18 x ¾ UNC | 4 |
| Feed arm: Hex head bolts (with flat washers, and lock washers) | Attach feed arm to antenna reflector | 5/16-18 x ¾ UNC | 4 |

If you use a trimast mounted on a wall, you need weather grade silicon sealant to seal bolt holes in the wall. If you use a trimast mounted on a roof, you need a roof sealant to seal bolt holes in the roof.

## Required tools

To install the antenna, you need the tools listed in Table 2.

Table 2: Tools needed to install the antenna

| Tool | Description |
|---|---|
| Socket wrench | 1/2-in. socket with 1/2-in. drive. |
| Open-end wrench | 1/2-in. (quantity 2). |
| Torque wrench | 22 in-lbf – 177 in-lbf with 1/2-in. drive (such as Ripley Co. P/N TW-207-AH-B). |
| Long-shaft ball driver 3-mm Allen wrench | Shaft should be at least 5 in. long. |
| Compass | |
| Fine elevation pointing tool | Hughes model DW-ELTOOL, P/N 1029130-0403. |

*Chapter 3*

# Assembling and installing the antenna

This chapter includes:



## Unpacking the antenna

To avoid possible damage, leave the antenna in its protective packaging until you are ready to install it. Chapter 2 – *Antenna components, tools, and materials* contains a list of package components.

**⚠ CAUTION**

**Before you install the antenna, read all safety information in the section titled *Important safety information* on page iii.**

**⚠ CAUTION**

**When unpacking or handling the antenna components, be careful of sharp edges that may be present on the metal components.**

## Assembling the antenna

Assemble the antenna on a flat, stable surface, before mounting it on the mast. Antenna assembly consists of the following four steps:

- Attach the polarization plate to the elevation bracket
- Attach the radio assembly to the feed arm
- Attach the feed arm (with radio attached) to the reflector bracket
- Attach the reflector to the reflector bracket

## Attaching the polarization plate

Assemble the polarization adjustment assembly by attaching the polarization plate to the front of the elevation bracket, through the reflector bracket, as shown in Figure 8.

1. Place the polarization plate into the circular hole in the reflector bracket, as shown in Figure 8, *with the raised outer edge of the polarization plate facing* ***away from*** *the elevation bracket*.

Note: You may need to rotate the polarization plate until it snaps flush.

2. Pass four 5/16-in. x 3/4-in. carriage bolts through the polarization plate and through the front of the elevation bracket.

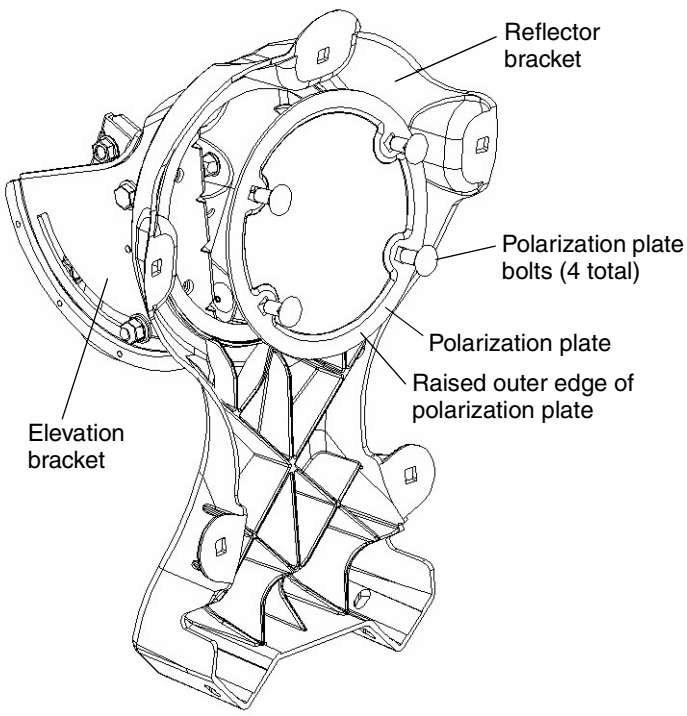



Figure 8: Fastening the polarization plate to the elevation bracket

3. Before installing the polarization plate, tighten the four bolts that secure the elevation bracket to the canister. See Figure 9. If you don't tighten these bolts, you may have difficulty placing the polarization plate into the reflector bracket (step 4).
4. Place the polarization plate into the reflector bracket.
5. Secure the polarization plate using a 5/16-in. flat washer, 5/16-in. lock washer and 5/16-in nut on each carriage bolt, as shown in Figure 9.

   If you have difficulty starting the nuts (with the washers installed), the polarization plate may not be correctly placed. Make sure the raised outer edge of the polarization plate faces *away from* the elevation bracket and that the polarization plate is flush against the reflector bracket.

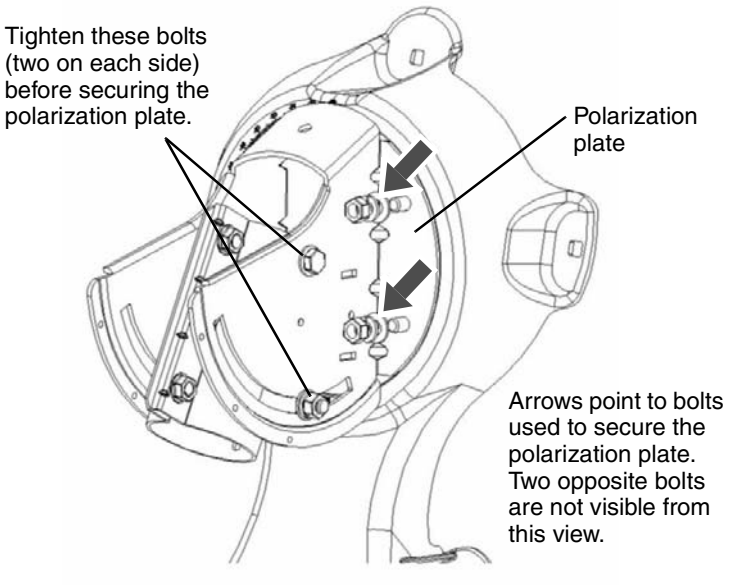



Figure 9: Securing the polarization plate

## Installing a shim for vertical transmit polarization

*Follow the instructions in this section only if the installation specification or service order states that vertical transmit polarization is required.*

If vertical transmit polarization is not required, go to *Attaching the radio assembly to the feed arm* on page 17.

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 arm, you will have to remove the radio assembly from the feed arm before you can follow the instructions in this section.

Figure 10 shows where the shim is located and shows three of the four M4 x 10 mm Allen screws that hold the shim in place.

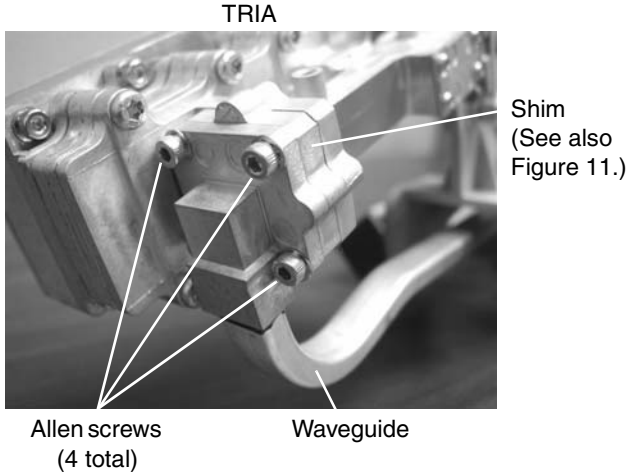



Figure 10: Shim location next to TRIA

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 11 on page 15 shows what a vertical shim looks like.
2. Loosen and remove the four Allen screws and lock washers that hold the shim in place. See Figure 10.
3. Separate the end of the waveguide from the shim.

Figure 11 illustrates the difference between the horizontal shim and vertical shim. Note the positions of the alignment pins.

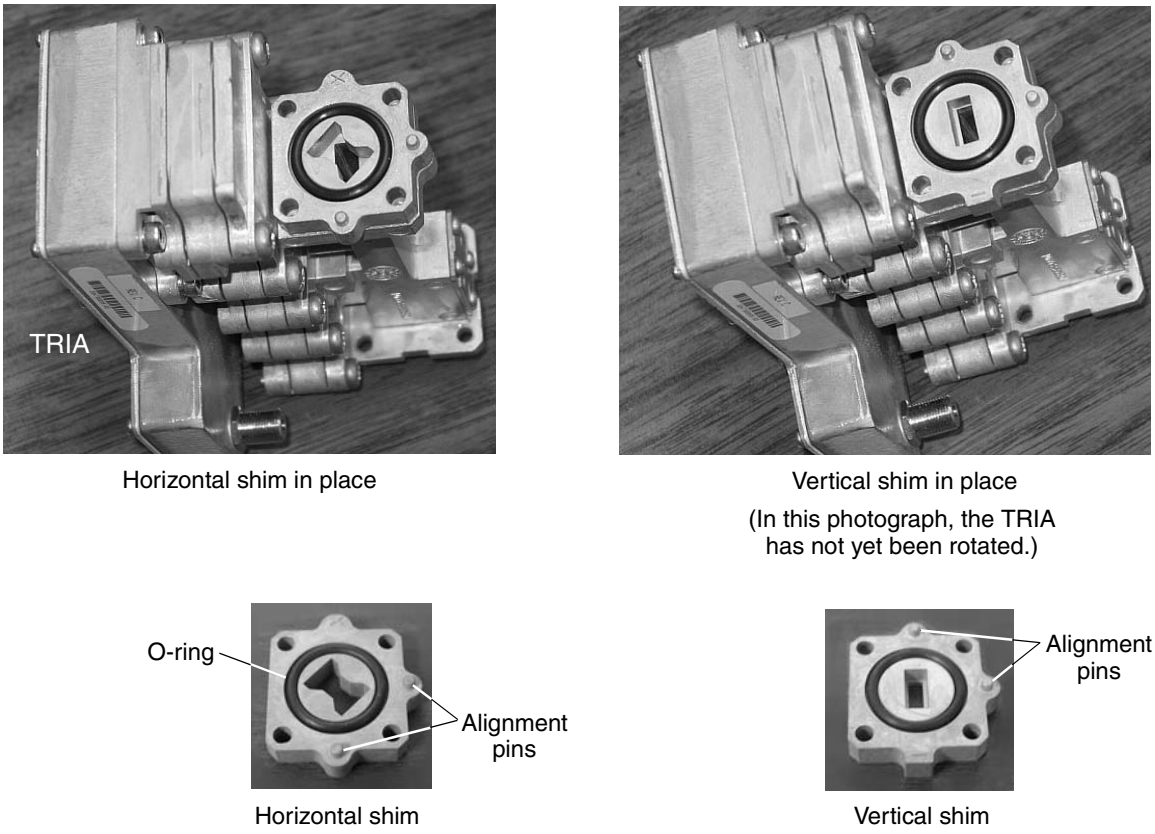



Figure 11: Horizontal shim and vertical shim for transmit polarization

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 11 (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 12 and 13.

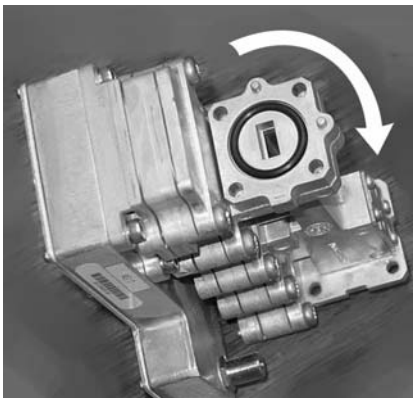
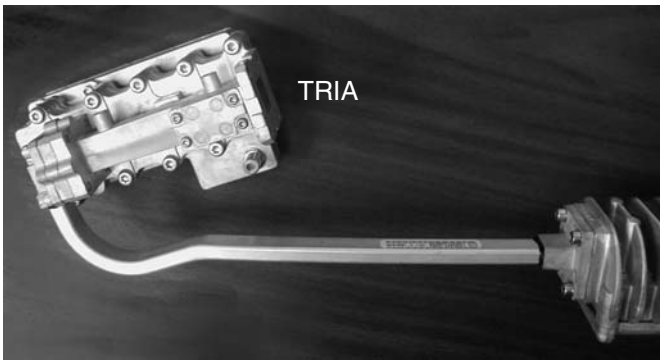
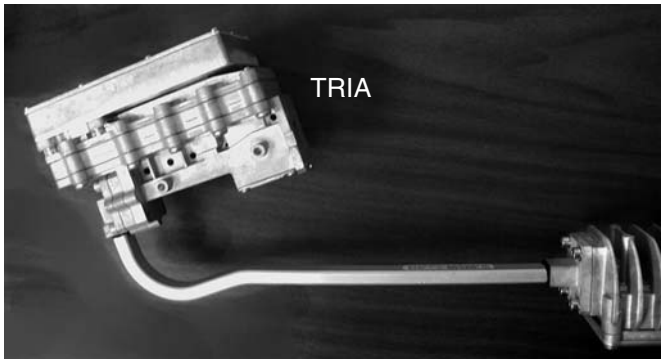


Figure 12: Direction of TRIA rotation for vertical polarization

Figure 13 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 13: TRIA position for horizontal and vertical transmit polarization

6. Make sure the O-ring shown in Figure 12 on page 16 is in place in the shim.

Note: Be sure to install the O-ring.

7. With the TRIA correctly positioned (rotated), place the waveguide end plate against the shim.
8. Insert and tighten the four Allen screws. (Use the lock washers).

Now you are ready to attach the radio assembly to the feed arm.

## Attaching the radio assembly to the feed arm

When you unpack the feed arm, the feed horn and transmitter mounting brackets are installed, as shown in Figure 14.

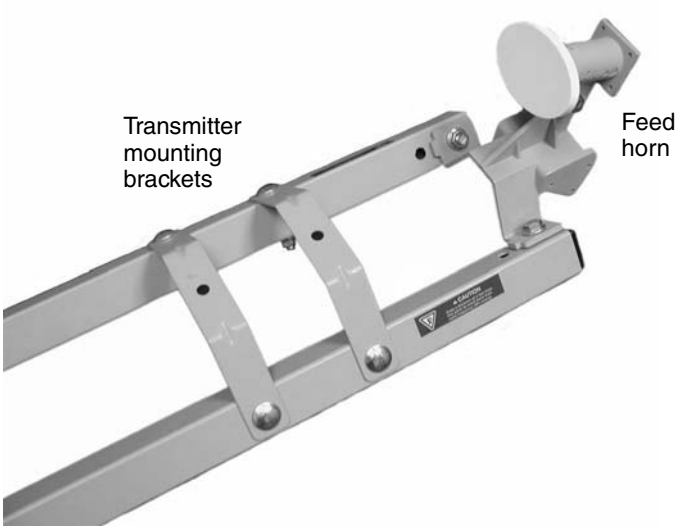



Figure 14: Feed arm and feed horn

Follow these steps to attach the radio assembly to the feed arm and feed horn:

1. Obtain the required radio assembly.
   The radio assembly, consisting of the TRIA, low noise block converter (LNB), transmitter, and waveguide, is not part of the antenna kit.
2. Place the radio assembly on the floor or other flat, stable surface.

3. Place the O-ring in the circular depression in the square end of the feed horn. See Figure 15.

Note: Be sure to install the O-ring.

Figure 15: O-ring on back end of feed horn

4. Position the feed arm so the transmitter mounting brackets rest on top of the transmitter, as shown in Figure 16.

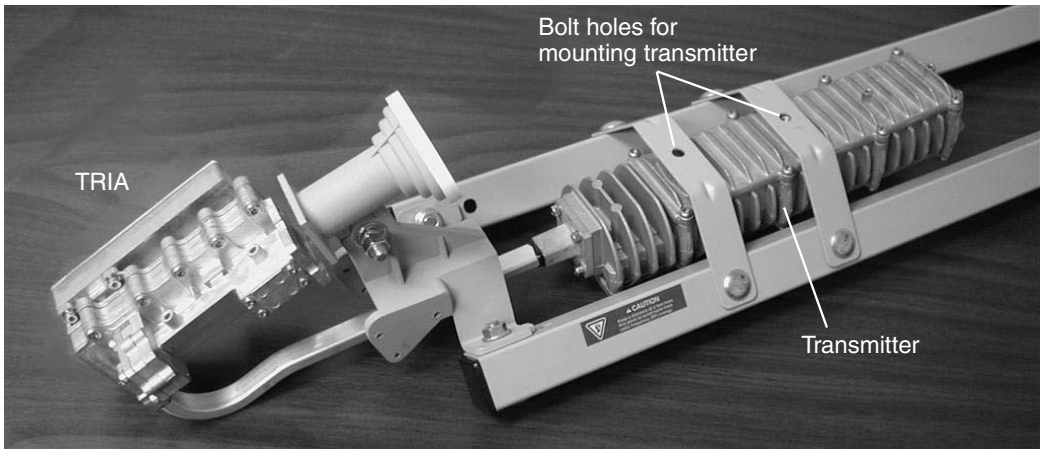



Figure 16: Radio assembly in position to be attached to feed arm

5. Lift the transmitter up to the transmitter mounting brackets, and align the two bolt holes on the mounting brackets with the two bolt holes on the top of the transmitter.
6. Insert two 5/16-18 x 5/8 UNC bolts in the aligned holes. Use a lock washer and a flat washer for each bolt. Leave the bolts loose; turn them just enough to hold the transmitter in place.

7. Align the square end of the feed horn (Figure 15) with the square end of the TRIA.

   Make sure the feed horn O-ring stays in place.
8. Hold the feed horn end and the TRIA end together, and insert four M4 Allen screws with lock washers as shown in Figure 17.

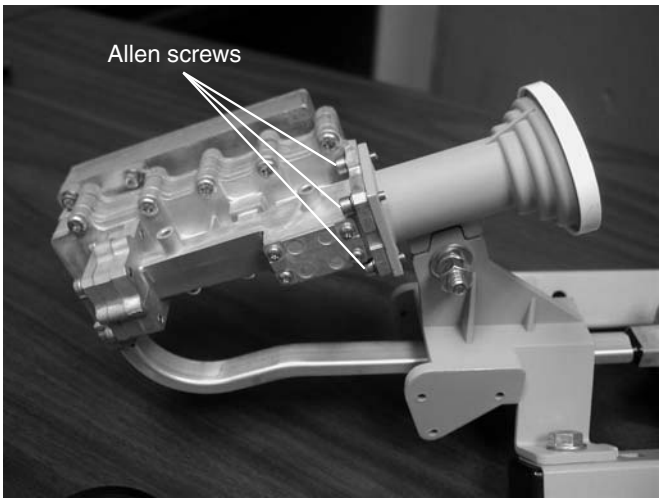



Figure 17: Attaching the radio assembly to the feed horn

9. Use a long-shaft (at least 5 in.) 3-mm ball driver Allen wrench to tighten the screws.
10. Tighten the two bolts on the transmitter mounting brackets.

Figure 18 shows the radio assembly attached to the feed arm.

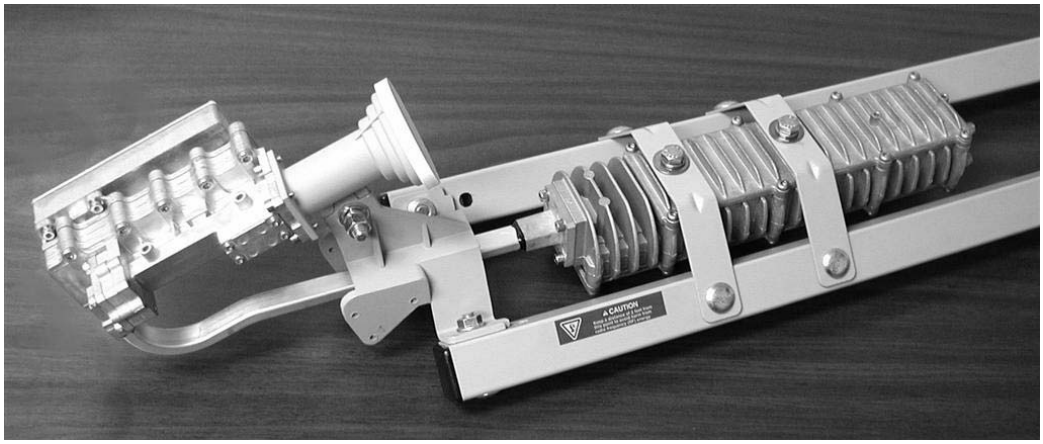


Figure 18: Radio assembly attached to feed arm

### Attaching the reflector bracket to the reflector

Fasten the reflector bracket (with polarization plate and elevation bracket attached) to the elliptical antenna reflector:

**CAUTION**

**Take care not to bend the reflector.**

1. Insert five 5/16-18 x ¾ UNC carriage bolts through the front of the reflector and the five tabs located on the rim of the reflector bracket.
2. Secure the reflector to the reflector bracket using a 5/16-in. serrated flange nut on each carriage bolt.

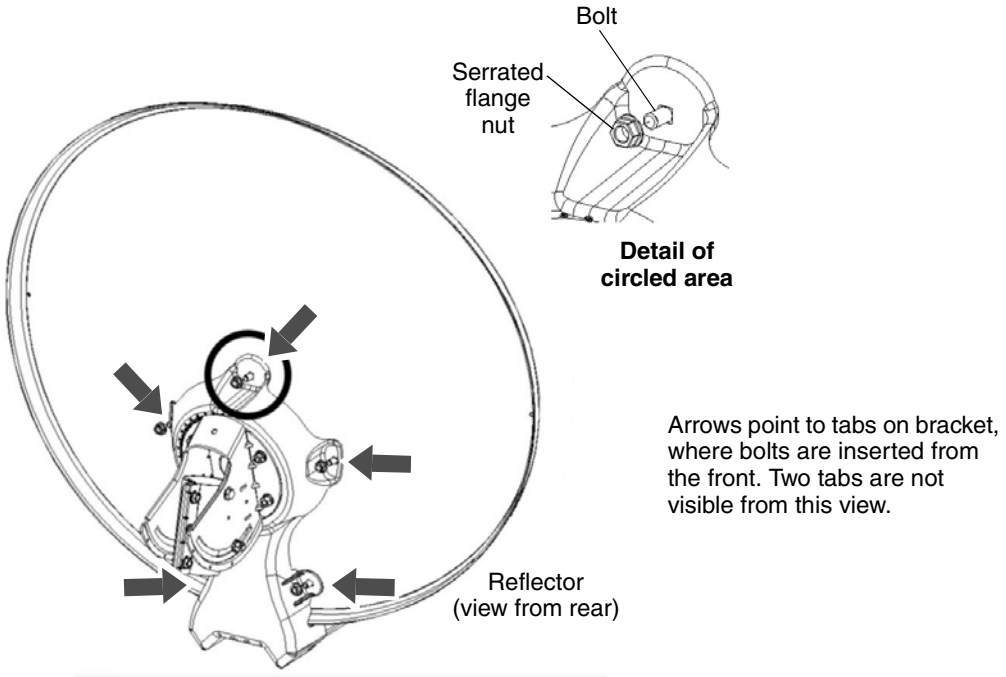



Figure 19: Attaching the reflector bracket to the reflector

## Attaching the feed arm to the reflector bracket

Attach the feed arm (with radio attached) to the reflector bracket:

1. Slide the feed arm and radio assembly into the slots at the bottom of the reflector bracket, aligning the four bolt holes. See Figure 20.
2. Fasten one of the feed arm tubes to the reflector bracket, using four 5/16-18 x ¾ UNC hex head tap bolts. For each bolt, use a nut, lock washer, and flat washer.
3. Repeat this process to fasten the other feed arm tube.

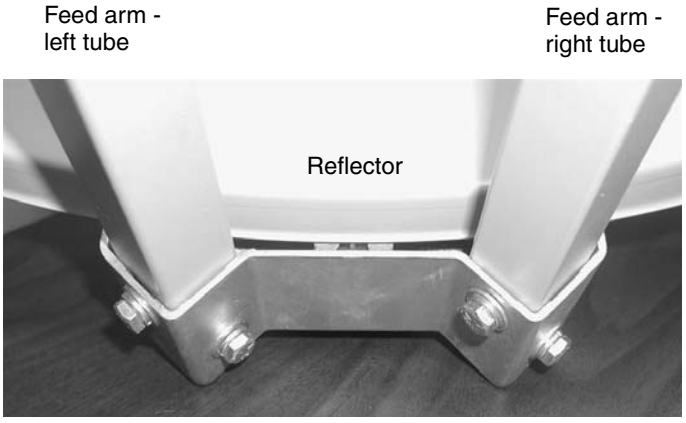



Figure 20: Attaching the feed arm to the reflector bracket

## Mounting the antenna

After the antenna assembly is complete, follow the steps below to mount the antenna onto the mast. The mast must be mounted using only the mount types described in the Hughes ***Antenna Site Preparation and Mount Installation Guide*** (1035678-0001). The mount may be a trimast, a non-penetrating mount, or a pole mount. *The mount mast must have an outside diameter of 2-3/8 inch.*

*The mast must be plumb.* Before mounting the antenna, check the mast with a level to make sure it is plumb. If it is not, take steps to make sure the mast is plumb before you continue. This is a critical requirement because the antenna assembly cannot be adjusted to correct for a mast that is not plumb.

Mount the antenna as follows:

1. Carry the antenna assembly to the mast location.

**⚠ CAUTION**

**Read the safety information and follow the safety instructions in *Antenna installation safety* on page iv.**

2. Slide the canister onto the top of the mast as shown in Figure 21.
3. Secure the canister by tightening the nuts on the three canister flange bolts.
4. Hand-tighten the flange nuts.

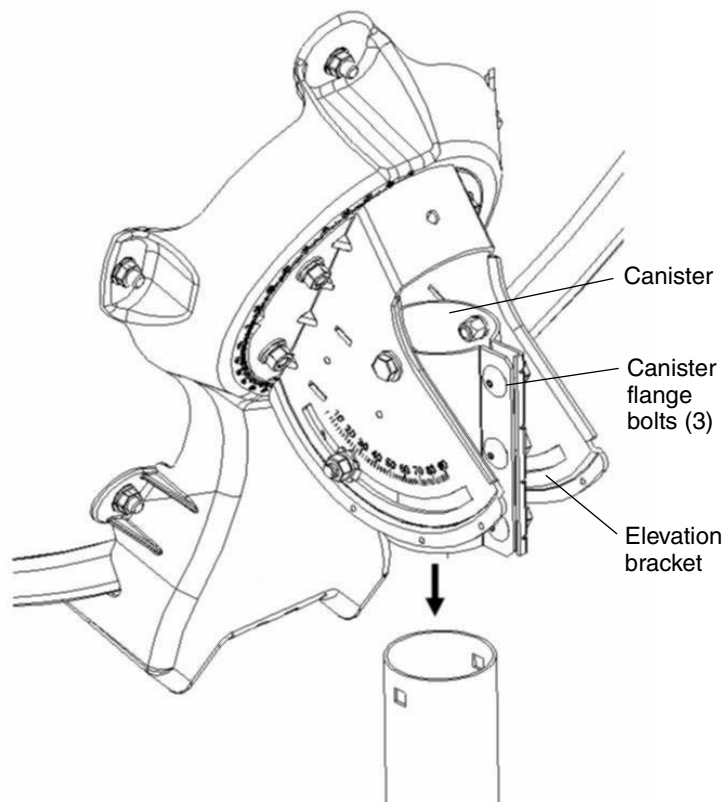



Figure 21: Sliding the antenna assembly onto the mast

## Installing the fine elevation pointing tool

Install the fine elevation pointing tool (Hughes P/N 1029130-0403) onto the back of the elevation bracket, as shown in Figure 22. You install and use this tool for pointing; then remove for re-use in subsequent installations.

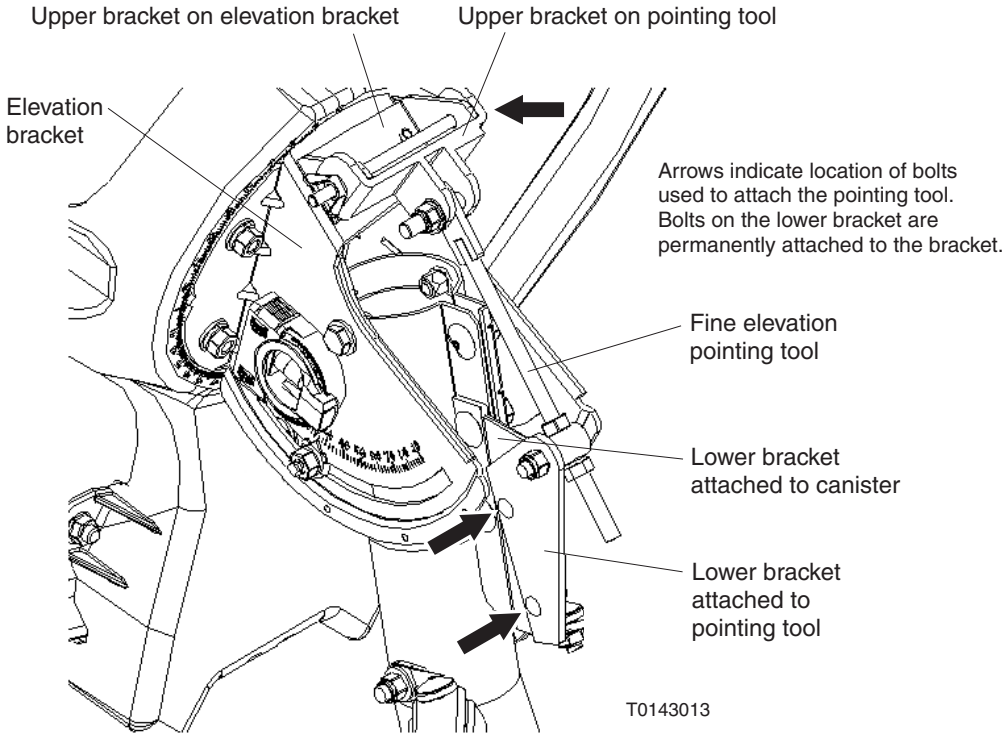



Figure 22: Installing the fine elevation pointing tool

Refer to Figure 22 and follow these steps to install the fine elevation pointing tool:

1. Attach the lower bracket that is attached to the pointing tool to the bracket that is attached to the canister:
   a. Remove the nuts from the two fixed bolts on the pointing tool's lower bracket.
   b. Insert the fixed bolts on the lower bracket into the two holes in the canister bracket.
   c. Replace and tighten the nuts onto the fixed bolts.
2. Attach the upper bracket on the pointing tool to the upper bracket on the elevation bracket:
   a. Remove the wing nut and 4-in.-long bolt from the pointing tool's upper bracket.
   b. Place the pointing tool upper bracket over the upper bracket on the elevation bracket, and insert the bolt.
   c. Replace the wing nut on the bolt.

*Chapter 4*

# Cabling and connections

This chapter illustrates how to route and connect the transmit and receive cables to the radio assembly. You must connect the transmit, receive, and ground cables before you can point the antenna (Chapter 5 – *Pointing the antenna*).

The chapter includes these sections:



*Before you perform the steps explained in this chapter, you must route and terminate the transmit and receive cables from the IDU to the ODU.* For cable specifications and cabling between the IDU and ODU, see the IDU instruction manual. How the cable is run depends on the specific installation site. Route and connect the cable according to your training and best practices.

**CAUTION**

**Use only the Hughes-approved connectors listed in Hughes Field Service Bulletin 050518_01A.**

Note: Fill all outdoor connectors with dielectric grease before connecting them to the ODU or ground block. See Hughes Field Service Bulletin 050518_01A for a list of Hughes-approved dielectric grease vendors.

## Routing the cables at the ODU

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

1. Route the transmit cable to the back of the transmitter in a configuration similar to that shown in Figure 23.
   Leave 32 in. of extra length on the transmit cable. This makes it possible to install a future Ka-band radio upgrade.
2. Coil the extra cable, leave a drip loop, and tie it.
3. Mark the transmit cable with blue electrical tape, unless it has already been marked.

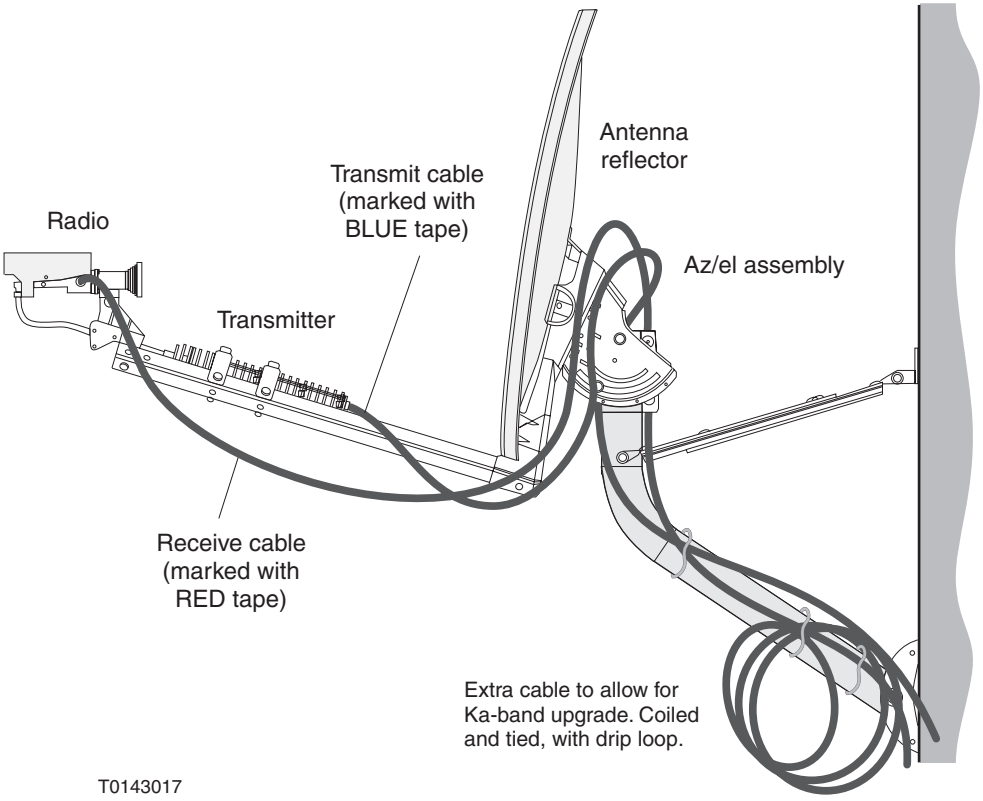



Figure 23: Transmit and receive cable configurations

4. Route the receive cable (marked with red electrical tape) up the mast, behind the reflector, and along the feed arm to the LNB to achieve a configuration similar to that shown in Figure 23.
   Leave 18 in. of extra length on the receive cable to allow for a future Ka-band radio upgrade.
5. Coil the extra cable, leave a drip loop, and tie it.
   Mark the receive cable with red electrical tape, unless it has already been marked.

## Connecting the transmit and receive cables

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

### Transmit cable

Connect the transmit cable to the transmitter as follows:

1. From inside the building, disconnect the IDU power supply.
2. Go outside and connect the transmit cable to the connector marked *IFL* on the transmitter, as shown in Figure 24.

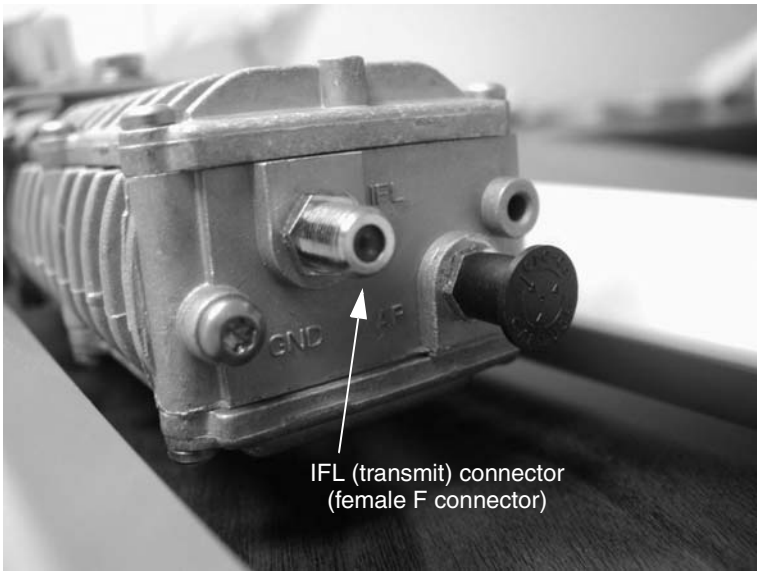



Figure 24: Connecting the transmit cable

3. Tighten the connection to 22 in-lbf with a 7/16-in. torque wrench.

**CAUTION**

**Do not over-tighten the connection; doing so can break the center pin.**

4. Secure drip loops and other points on the cable with black ultraviolet-resistant cable ties.
5. Back inside the building, reconnect the power transformer.

**Receive cable** Connect the receive cable to the LNB as follows:

1. Connect the receive cable (marked with red tape) to the LNB connector, which is shown in Figure 25.

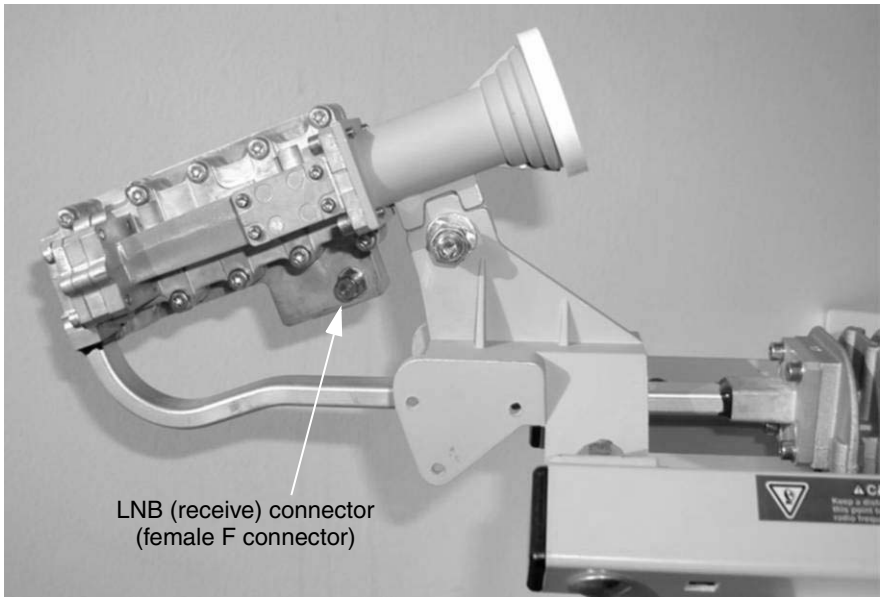



Figure 25: Connecting the receive cable to the LNB

2. Tighten the cable connector with a 7/16-in. wrench.
3. Fill the connection with dielectric silicone grease.
4. Secure the cable with black ultraviolet-resistant cable ties.

## Ground connection

Figure 26 shows the location of the ground screw on the transmitter. Ground the transmitter and mast. For grounding procedures, refer to your training, best grounding practices, and applicable parts of the NEC.

Note: Wrap the ground wire clockwise around the ground screw so that the screw head tightens against the wire.

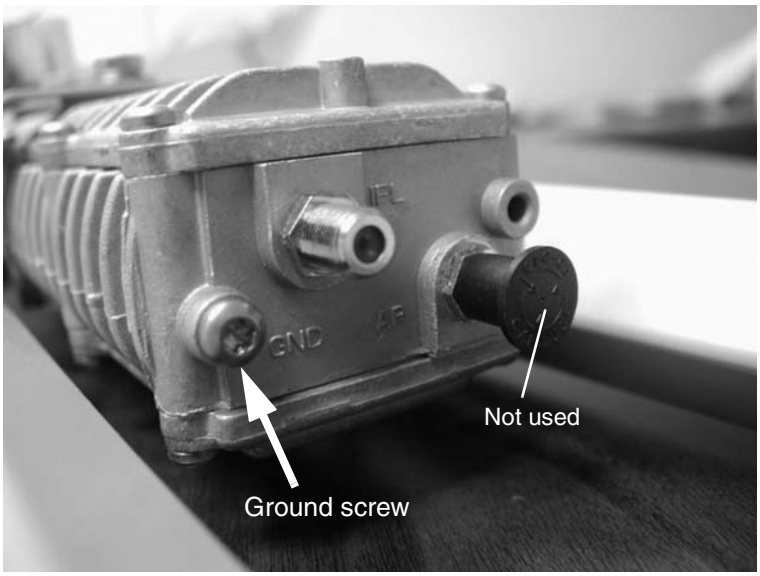



Figure 26: Ground screw on the transmitter

*Chapter 5*

# Pointing the antenna

This chapter explains how to point the antenna and connect the transmitter. Topics include:



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

**⚠ CAUTION**

- **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 2 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.**

## Antenna pointing overview

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

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

### Determining the pointing values

Before proceeding, use the installation software to determine the initial values to use for setting azimuth, elevation, and polarization. Record these values and keep them handy for reference as you install and point the antenna. In this manual, *installation software* refers to:

- Satellite-based commissioning (SBC) – This is the preferred and most automated method for pointing the antenna. You connect to a Web-based auto-commissioning system (WebACS) and follow the on-screen instructions.

  *or*
- WebSetup – You log onto a MyHughesNet Web site and use the WebSetup installation software. WebSetup requires an analog phone line.

You may use installation software from either of these sources. In each case, the software configures the IDU, calculates your exact location, and uses the location and other information to help you point the antenna. The installation software calculates the values you use to set azimuth, elevation, and polarization.

Follow the instructions in the IDU installation manual for accessing and using SBC or WebSetup.

### Using the installation software

The exact pointing procedure depends on the installation software used, SBC or WebSetup. The installation software guides you through a step-by-step process for installing the IDU and pointing the antenna.

Use 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 manual and on the installation software screens.

In general you will alternate between these two activities:

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

## Peaking the signal

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, and errors may result 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 Hughes Network Operations Center (NOC). Both processes are explained later in this chapter.

To point the antenna, you go through cycles of making small adjustments to the antenna until you are satisfied you cannot get a stronger satellite signal. When you have achieved the strongest possible signal, you have *peaked* the signal.

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 terminal can use all the system's capacity.

## Personnel requirements

One person can point the antenna if an outdoor pointing interface (OPI) is used (as explained in *Outdoor pointing interface* on page 34). Otherwise, pointing is usually a two-person task. One person aims and adjusts the antenna while the other watches the signal strength display on the computer and relays the readings to the person at the antenna. A portable telephone or walkie-talkie is helpful for this.

## Pointing parameters

Prior to antenna pointing, you use the installation software to enter parameters such as longitude, latitude, and polarization angle. Or you can enter the local ZIP code and let the software calculate these values.

## Outdoor pointing interface

The OPI, shown in Figure 27, is an optional tool that eliminates the need for a laptop computer on the roof. It is a portable repeater that displays the same values that are shown on the computer running the installation software.

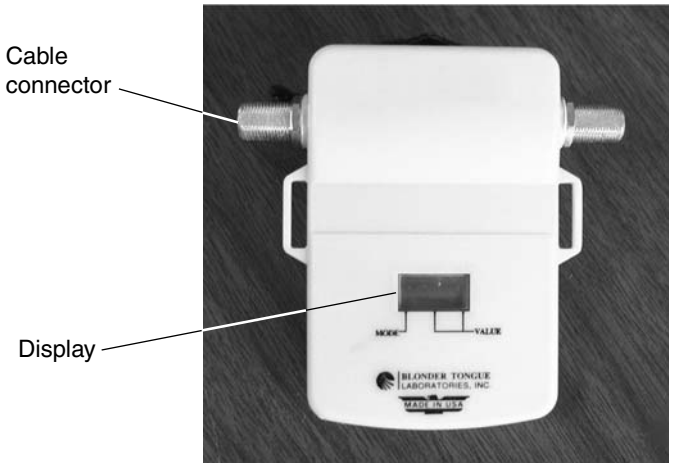



Figure 27: OPI (optional tool)

The OPI attaches to the receive cable from the LNB, as shown in Figure 28. Note that 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).

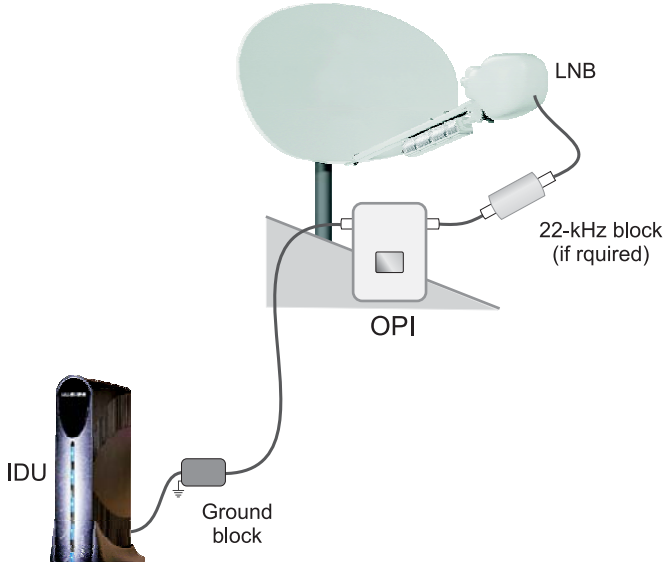



Figure 28: OPI installation

***OPI block*** If you use an OPI with a model RA6-074 or RC6-074 radio assembly, you must use a 22-kHz block (filter). This block, illustrated in Figure 29, is included in the OPI kit. Its model number is OPI-Block 22 KHZ-BLOCK.


Figure 29: OPI block

Install the block between the OPI and the radio as illustrated in Figure 28. Some variations of this block may have female F connectors at both ends. If the block you use has two F connectors, you will have to make a jumper cable to connect to the OPI.

## Prerequisites for antenna pointing

The following are required for antenna pointing:

- The antenna must be installed.
- The IDU must be installed.
- The transmit and receive cables must be connected to the IDU and ODU.
- The OPI must be installed.
- The ODU and IDU must be grounded.
- You must have access to the installation software. (See *Using the installation software*.)

## Adjusting the antenna

To point the antenna you make three adjustments:

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

These adjustments are illustrated in Figure 30. The corresponding mechanical adjustments on the antenna are explained in the sections that follow.

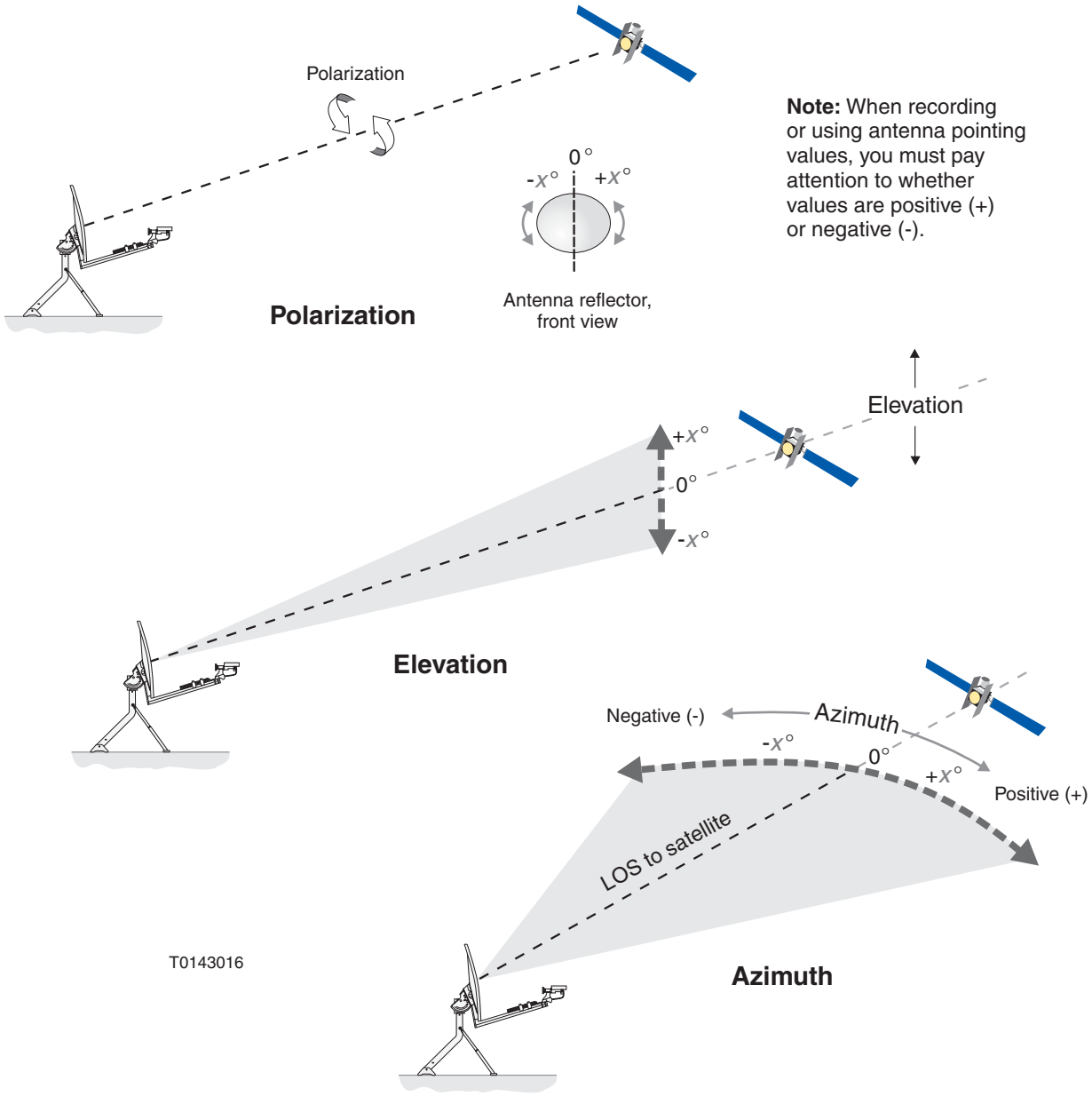



Figure 30: Adjusting azimuth, elevation, and polarization

## Adjusting polarization

*Polarization* refers to rotation of the antenna, as shown in Figure 31). Polarization values are measured in degrees from zero (no rotation), positive or negative. Polarization is positive east of the satellite longitude and negative west of the satellite longitude.

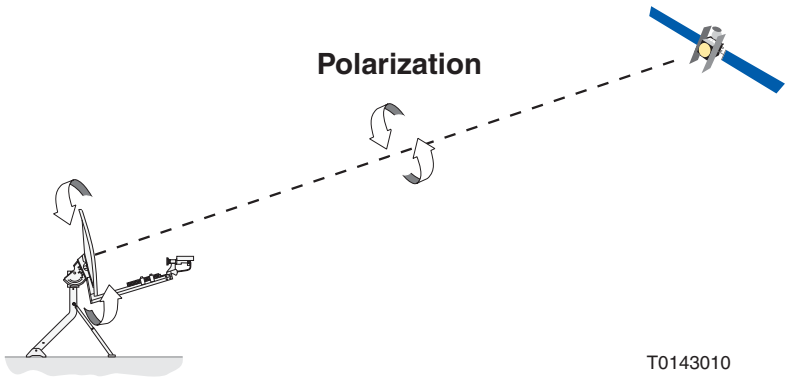



Figure 31: Adjusting polarization

Figure 32 illustrates the mechanical polarization adjustments on the antenna.

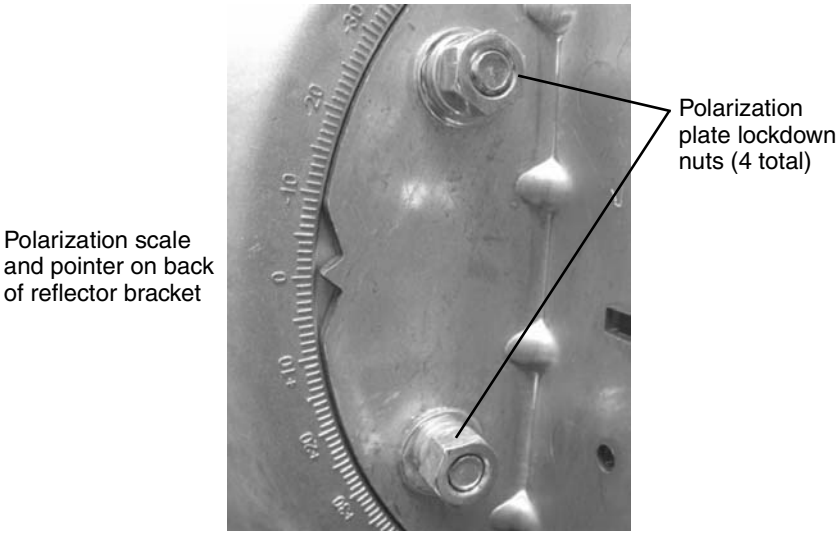



Figure 32: Polarization adjustments on the antenna

Fine-tune polarization as follows:

1. Loosen the four polarization lockdown nuts (two are shown in Figure 32) just enough so you can rotate the antenna reflector a few degrees in each direction.

Note: If you loosen the bolts too much, they can fall inside the reflector bracket, where they are hard to reach.

2. Rotate the antenna slightly.
3. If the signal strength does not change, set polarization to the value given by the installation software. Otherwise, set polarization at the setting where the signal peaked.
4. While monitoring the signal strength to make sure that it stays at maximum, tighten the polarization lockdown nuts.
5. After fine-tuning the antenna pointing direction, erase all marks previously made on the mast. Mark the present position with a permanent marker.

## Adjusting elevation

Figure 33 illustrates how you adjust the antenna elevation by moving the antenna up and down.

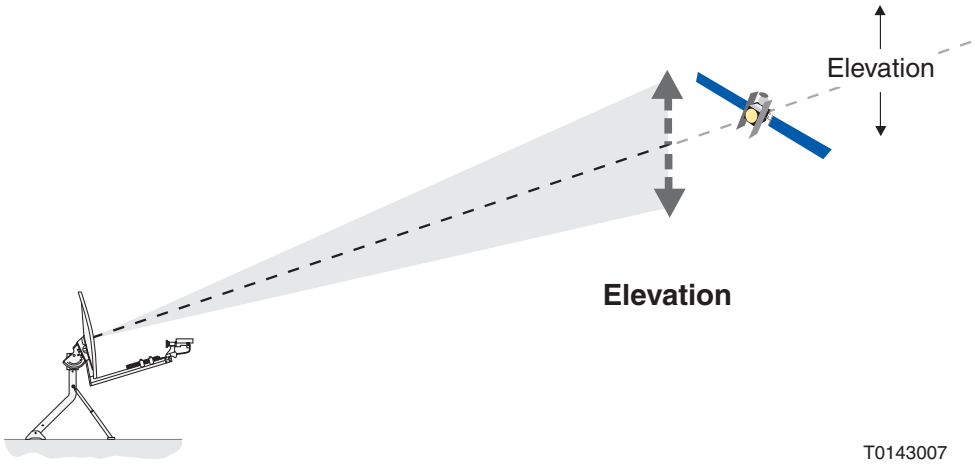



Figure 33: Adjusting elevation

Figure 34 illustrates the mechanical elevation adjustments on the antenna.

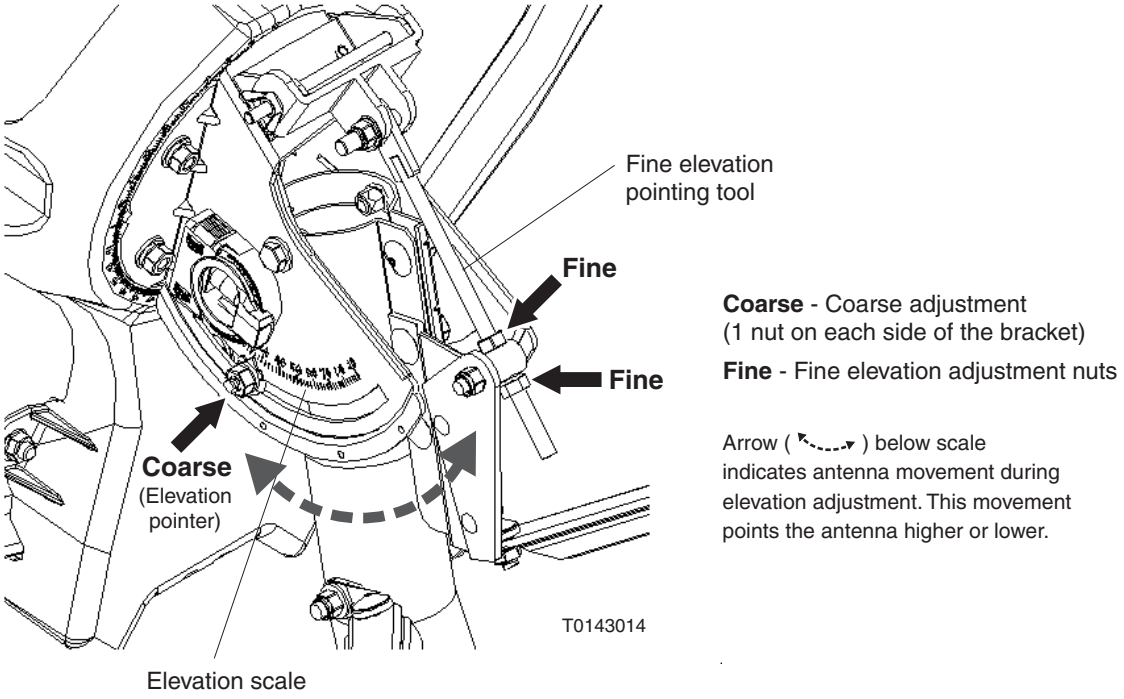



Figure 34: Elevation adjustments on the antenna

Adjust the elevation as follows:

### *Coarse elevation adjustment*

First set the elevation to a coarse setting:

1. Loosen the nut just below the elevation scale, and loosen the nut on the opposite side of the elevation bracket. (See Figures 34 and 35.)
2. Adjust the elevation bracket until the elevation pointer (Figure 35) points to the elevation angle specified by the installation software.

Figure 35: Elevation pointer

Leave the nuts loose so you can fine-tune the elevation adjustment.

### *Fine elevation adjustment*

Fine-tune the antenna elevation as follows:

1. While watching the signal strength display to ensure that the signal strength stays at maximum, adjust the elevation adjustment nuts on the pointing tool (Figure 34):
   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 again.
2. When the signal is peaked, tighten the two coarse elevation adjustment nuts.
3. Repeat both the coarse and fine adjustment steps to be sure you have acquired the strongest possible signal.

4. Adjust azimuth, then elevation, then azimuth again and continue until there is no improvement in signal strength.
5. Tighten the three canister flange nuts—however, because tightening them can cause loss of signal strength, monitor the signal strength while tightening these nuts in the following sequence:
   a. Tighten the top nut until the signal strength begins to degrade, then loosen the nut until you have regained the peak signal.
   b. Tighten the bottom nut until the signal strength begins to degrade, then loosen the nut until you have regained the peak signal.

      If you cannot tighten *either* the top or bottom nut without losing signal strength, further elevation adjustment is necessary. Repeat the previous coarse and fine elevation adjustment steps before proceeding.
6. If you were able to tighten the top and bottom canister flange nuts without losing signal strength, tighten the coarse elevation nuts in the following sequence:
   a. Hand tighten the left nut.
   b. Hand tighten the right nut.
   c. Fully tighten the left nut (torque to 12 ft-lbf).
   d. Fully tighten the right nut (torque to 12 ft-lbf).

## Setting azimuth

To prepare for pointing, set the antenna azimuth.

### Setting azimuth

Figure 36 illustrates how you adjust antenna azimuth by moving the antenna from side to side.

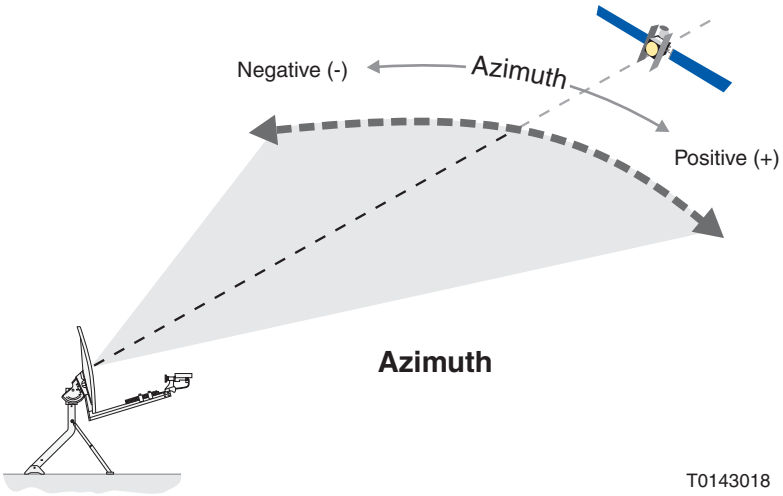



Figure 36: Adjusting the antenna azimuth

Figure 37 illustrates how you loosen the canister so you can adjust the antenna for azimuth. Figure 38 shows how you physically move the antenna from side to side.

Set the antenna azimuth as follows:

1. Use a compass to determine the azimuth bearing specified by the installation software.
2. Loosen the three 5/16-in. nuts on the bolts on the canister flange.

Figure 37 shows the location of these nuts. Loosen the nuts only enough to allow the antenna assembly to rotate.

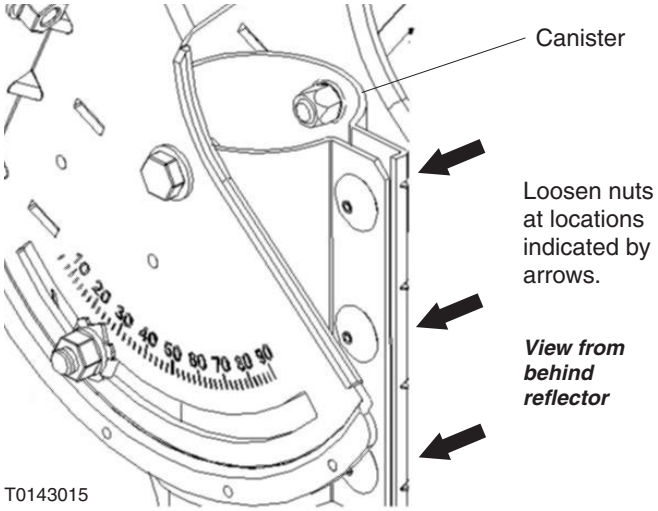



Figure 37: Loosening the canister nuts

3. *Stand behind the antenna,* grasp the outer edges of the antenna, and rotate the antenna assembly about the mast (as indicated in Figure 38) until the reflector is pointed toward the azimuth heading.
   Set the azimuth as accurately as possible.

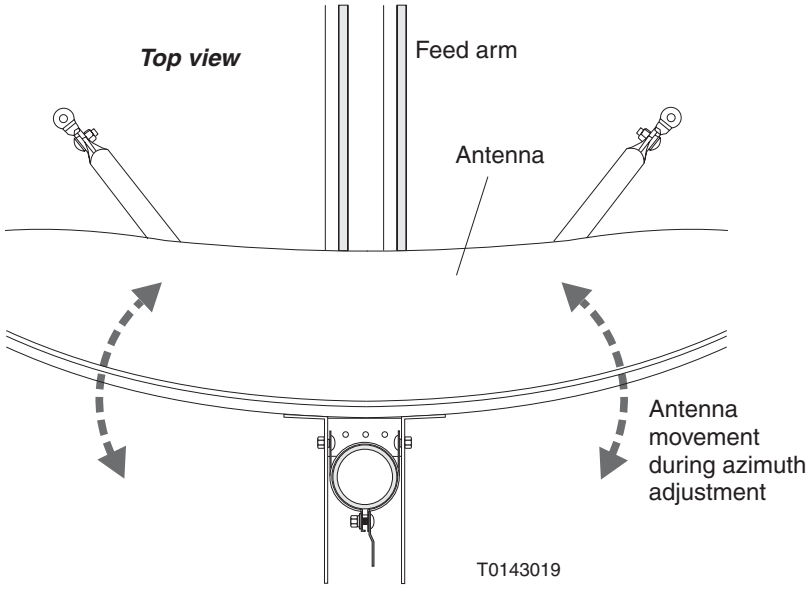



Figure 38: Rotating the antenna to adjust azimuth

Note: To minimize adjustments later, try not to move the antenna from the azimuth heading as you perform the steps in the following sections.

## Receive pointing

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

Use the installation software to check the signal strength. Then adjust the antenna to peak the signal. The installation software shows numerical and graphic indications of signal strength.

### Adjusting azimuth

Figure 30 on page 36 and Figure 37 illustrate how you adjust the antenna azimuth. To adjust the azimuth, follow these steps:

1. Loosen the three nuts on the canister, as shown in Figure 37.
   Loosen the nuts only enough to allow the reflector to rotate.
2. *Stand behind the antenna,* grasp the outer edges of the antenna, and adjust the azimuth to the right about 1/8 in.
3. Let go of the antenna and count slowly to 5 while reading the signal strength value from the OPI.
   You must allow the IDU enough time to track and register the signal strength.

Note: Make small adjustments (never more than 1/8 in. of azimuth as measured at the mast). Wait 5 sec between adjustments to give the IDU enough time to lock onto the satellite signal.

*If you are receiving a signal* and the signal strength has changed, go to *Peaking the signal* on page 33, step 1.

*If no signal is present*, return to step 2 and adjust it 1/8 in. to the right again.

4. Keep moving the antenna reflector a little at a time until you detect a signal.

5. If there is no signal, sweep back 1/8 in. at a time to the left until you detect a signal.

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

   – Check the coaxial cable connections at the LNB, IDU, and all the connections in between.
   – Make sure there are no obstructions such as trees blocking the signal.
   – Make sure you copied and properly set the azimuth, elevation, and polarization values.
   – 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.
   – Point the front of the antenna reflector to the left of the estimated bearing.
   – Go back to step 2 and try again.

## Peaking the signal

After the satellite is detected, peak the signal as follows:

1. Mark the mast with a pencil so you can find the azimuth bearing again.
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*.
5. When you have peaked the azimuth, tighten the three canister nuts completely.

## Isolating the transmit signal

To prevent signal cross talk, you 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 software operates in two different modes—manual or automatic. Manual mode gives real-time feedback of cross polarization isolation measurements while you adjust the antenna. Automatic mode takes a snapshot of the cross polarization isolation measurement.

ACP fine pointing consists of testing using both the manual and automatic modes and adjusting the antenna by small increments (if necessary) until it passes both the manual and automatic ACP tests.

Follow the general instructions below for the ACP tests. Use the installation software screens to initiate tests and see the test results.

### Manual ACP test

First run a manual ACP test:

1. Lock down all antenna adjustment nuts and bolts.
2. Initiate the manual ACP test.
   Select the manual cross polarization test type.

*If the manual ACP test passes,* stop the test and proceed to *Automatic ACP test* on page 47.

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

1. Loosen the two elevation lockdown nuts.
2. Peak the elevation setting by making small adjustments to the nuts on the fine elevation pointing tool.
   *Do not turn the lower adjustment nut more than one-quarter of a turn at a time.*
   For all ACP test adjustments, make very small adjustments. If you adjust too much, you lose the receive signal and the test cannot continue because you are out of contact with the NOC. You then have to go back to the receive pointing instructions (*Receive pointing* on page 44) and perform that procedure again.

Note: When you adjust any one of the axes—polarization, azimuth, or elevation—you may also have to adjust one or both of the other axes.

3. Tighten the two elevation lockdown nuts.

*If the manual ACP test passes,* stop the test and proceed to *Automatic ACP test* on page 47.

*If the manual ACP test fails after you adjust the elevation,* let the test continue and follow these steps:

1. Mark the present azimuth position so you can return to it.
2. Loosen the three nuts on the canister just enough so you can change the azimuth.
3. Observe the signal strength while you make very small adjustments—1/16-in. or less movement of the elevation bracket on the mast.
4. Peak the azimuth to the highest possible signal strength value.
5. Tighten the three nuts on the canister flange to lock down the azimuth adjustment.
6. Run the automatic ACP test, as explained in *Automatic ACP test*.

## Automatic ACP test

Run the automatic ACP test:

1. Initiate the automatic ACP test.
   Select the automatic cross polarization test type.
2. Check the signal strength.

If the antenna passes the 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 fails the ACP test,* follow these steps:

1. Initiate a manual ACP test.
2. When the test starts, make small, 1° or less changes in polarization while observing the transmitter isolation.
3. Peak the polarization to the highest possible transmitter isolation.
4. Tighten the polarization 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 ACP test *and* maintains signal strength within 3 points, 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 ACP test.
3. Check the signal strength.

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

*If the antenna still does not meet both criteria,* repeat the very small polarization, 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.

## Final steps

Complete the following steps before leaving the installation site.

### Removing the fine elevation pointing tool

Be sure to remove the fine elevation pointing tool so you can use it for subsequent installations.

1. Remove the pointing tool's upper and lower brackets from the elevation bracket and canister.
2. Replace the nuts and bolts in the pointing tool's tool brackets so they will not get lost.

### Checking 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 and pointed, ready for operation.

Refer to the IDU installation or troubleshooting manual for information on how to register and configure the system.

# Acronyms and abbreviations

### *A*

ACP – Automated Cross Polarization

### *F*

ft – Foot

ft-lbf – Foot-pound force

### *H*

hr – Hour

Hughes

### *I*

IDU – Indoor unit

IFL – Inter-facility link

in. – Inch

in-lbf – Inch-pound force

### *K*

kHz – Kilohertz

### *L*

LNB – Low noise block converter

### *M*

m – Meter

mm – Millimeter

### *N*

NEC – National Electrical Code

NOC – Network Operations Center

### *O*

ODU – Outdoor unit

OPI – Outdoor pointing interface

### *P*

P/N – Part number

### *R*

RF – Radio frequency

### *S*

SBC – Satellite-based commissioning

sec – Second

### *T*

TRIA – Transmit/receive isolation assembly

### *U*

UNC – Universal naming convention

### *W*

WebACS – Web-based auto-commissioning system

### *Z*

ZIP – Zone Improvement Plan (U.S. Postal Service service code)

# Index

## U



## V



## W