Chapter 3

RPU INSTALLATION PROCEDURES

Section I. GENERAL

3.1 Scope

This Chapter provides instructions for the installation of the RPU and of the associated antennas. The information appearing in this Chapter includes:

- Unpacking.
- Preparation for installation.
- Required equipment, tools, and materials.
- Mounting options.
- Mounting procedures for towers and masts.
- Installation and connection procedures, including application of power.

3.2 Unpacking

Before unpacking, make a preliminary inspection of the shipping containers, preferably in the presence of a carrier representative. Evidence of damage should be noted and immediately reported to the carrier, and to the nearest InnoWave's representative.

- Carefully open the top side of the packing container and take out the RPU, antennas, and accessories, and place equipment on a clean, flat surface.
- Check the received items against the packing slip, and compare with your order. Immediately report any missing items or discrepancies found.
- Inspect the equipment carefully for any signs of damage. In case damage is found, contact the manufacturer for repair information, and report the damage to the freight carrier for insurance claims.
- Search the container for any additional small items that may be present.
- Check that the RPU and antennas comply with the frequency band, in accordance with your order and installation plan.

Keep the shipping carton and packaging materials for reuse.

3.3 Preparation for Installation

3.3.1 Power Considerations

The RPU is remotely fed from the RPCU, or from the MCX-R Remote Unit via the DSL lines. The feed voltage is ±80 to ±90 VDC.

3.3.2 Safety Considerations

WARNING - HIGH VOLTAGE

Dangerously high voltages, that may cause injury or death on contact, are present in this equipment and on the lines connected to the RPCU or to the MCX-R unit. In addition, personnel must be aware that under certain external fault conditions, dangerous voltages may appear on the cables connected to the RPU and antennas.

WARNING - RF RADIATION

Microwave radiation is emitted by the antennas during operation.

For your protection and to prevent possible damage to equipment when a fault condition, e.g., lightning strike or contact with high-voltage power lines, occurs on the antennas or on the lines connected to the equipment, the RPU's the antennas and the lightning rod must be properly earthed at any time. Any interruption of the protective (earthing) connection inside or outside the units or the disconnection of the protective grounding strap, or disconnection or removal of the lightning rod during equipment operation, can make that equipment dangerous. Intentional interruption is prohibited.

WARNING

Before powering this equipment, the grounding strap, must be connected to a protective earth, in accordance with the procedure given in the ***Grounding and Lightning Protection*** section (para. 2.3).

3.4 Required Equipment, Tools and Accessories

3.4.1 RPU and Antenna

The RPU and antenna kits contain the following components:

- RPU unit.
- RPU mounting kit.
- Antenna support and antenna mounting kit.
- Coaxial cables with lightning protectors.

3.4.2 Installation and Tools Accessories

The following tools and accessories are required for the installation of RPU and antennas.

- H-shaped antenna support.
- Mounting accessories for the antenna support.
- Set of metric sockets (must include a 17 mm socket).
- Flat blade screwdrivers (one with narrow blade and another with normal blade).
- Wire cutter.
- Black plastic attachment straps.
- Tape and RTV for insulating the RPU and antenna connectors.
- Two twisted-pair cables for connection of DSL lines. Use pairs with characteristics suitable for outdoor installation, in accordance with the climatical conditions at the installation site and the applicable local regulations. The pair insulation must have a minimum breakdown voltage of 500V. Use shielded pairs to improve EMI protection.
- Grounding straps and/or cables, as required.
- Safety belts and other applicable protective equipment for climbing and working on towers and masts.

Section II. OUTLINE OF INSTALLATION PROCEDURES

3.5 Scope

This Section comprises the following information:

- Safety warnings.
- General requirements (para. **Error! Reference source not found.**) - contains general mounting considerations, and information concerning site preparation for the installation of RPU stations.
- RPU station options (para. 3.7) - contains information concerning the installation options and a description of the equipment and accessories required for each installation option.
- Mounting methods (para. 3.8) - contains a description of the supports required for the various mounting options.

WARNING

Never work on roofs, poles, or masts, nor handle telephone lines or outdoor antennas during rain and/or lightning storms.

WARNING

When working on building roofs, poles, or masts, strictly observe the applicable local safety regulations. Use safety belt and other applicable personal protection devices when climbing and working on poles, masts or towers.

WARNING - HIGH VOLTAGE

Dangerously high voltages are present on the lines connected to the RPU. Before connecting the DSL lines, the remote power feed must be deactivated at the RPCU site, in accordance with the installation instructions, and a warning placed on the RPCU to prevent unauthorized application of power.

Dangerous voltages may also appear on the lines connected to the RPU as a result of external fault conditions, e.g., accidental contact with high-voltage lines, etc. Take the appropriate precautions to avoid accidents.

3.6 General Requirements

3.6.1 General

RPU stations are usually mounted on poles, masts or towers by means of various supports. To minimize signal losses, the RPU shall be located as close as possible to its antennas, taking in consideration the minimum antenna spacing requirements specified in para. 2.2.

3.6.2 Site Preparation

Refer to the installation planning guidelines presented in Chapter 2, review the information concerning the RPU and antenna versions presented in Chapter 1, and then prepare an installation plan for the intended RPU station(s) in accordance with the station installation options and mounting methods described in para. 3.7 through 3.13.

Ensure that an appropriate pole, mast or tower with a lightning protection system and a grounding conductor that meet the requirements of para. 2.3 is available for the mounting of the RPU station(s). Note that if the mast metal structure meets the requirements of para. 2.3, it can also be used as a grounding conductor.

3.6.3 Cabling Requirements

3.6.3.1 RPU Cabling Requirements

The following connections need to be made at certain stages, as defined in the installation procedures:

- Connection of DSL lines (two twisted pairs) coming from the RPCU or the MCX-R unit, as applicable. The lines enter the RPU through a grommet on the lower cover of the RPU. The connection is made by means of the DSL connector (terminal strip) provided with the installation kit.
- Connection of antenna cables to two RF connectors located on the top of the RPU.
- Connection of grounding plate to the mast or tower protective ground cable, made by means of a grounding strap.

3.6.3.2 Antenna Cabling Requirements

The following connections shall be made at certain stages, as defined in the installation procedures:

- Connection of antenna cable to the antenna RF connector.
- Connection of antenna to protective ground through the RPU/RPC grounding plate.

3.7 RPU Station Options

Usually, an RPU station includes one RPU and two antennas mounted by means of a dedicated support. The following RPU station options are recommended:

- RPU with omnidirectional antennas mounted on pole or mast - para. 3.10.
- RPU with sectorized antennas mounted on pole - para. 3.11.
- RPU with sectorized antennas mounted on tower - para. 3.12.

3.8 Mounting Methods

This section provides an overview of recommended RPU mounting methods for a variety of situations, and describes the recommended installation accessories that have especially designed by InnoWave for mounting RPU/RPC stations.

When properly applied and installed, these installation accessories ensure compliance with the recommendations of para. 2.2.3 and 2.2.4, while simplifying the installation procedures.

3.8.1 RPU Station with Omnidirectional Antennas

For this option, it is recommended to mount the RPU on a pole or mast by means of a dedicated fastener, and to mount the antennas by means of a dual-antenna support. A typical RPU station mounted on a pole is shown in Figure 3-13.

3.8.2 RPU Station with Sectorized Antennas

3.8.2.1 General

When it is necessary to cover an area that includes a significant number of subscribers from a single location, it is recommended to use sectorized antennas. Sectorized antennas are directional antennas, whose characteristics have been selected to cover a 60° sector in azimuth.

Several sectorized antennas can be mounted on the same level, or on different levels, on the same antenna tower. When a number of antennas are closely mounted on the same tower, the dimensions of the mounting supports and the distance between the antennas mounted on different supports, must comply with the spacing requirements listed in para. 2.2.3.

When the number of RPU and antennas required is relatively small, a pole can be used, instead of an antenna tower.

To organize efficiently the installation, InnoWave has designed a variety of mounting accessories based on H-supports that fit many customer scenarios and requirements. Various H-support types have been designed, in order to comply with the various sectorized antenna dimensions, with various tower types, etc.

A typical H-support is shown in Figure 3-1 (this H-support is designated ***wide H-support***, or just ***H-support***, because it is the most widely used type). The H-support is made of two metal pipes, a central beam and two rods that fasten the whole structure together. A plate attached in the front of the central beam is used for mounting two RPU's by means of dedicated fasteners. Four RPU antennas (or four RPC units) can be attached to the side pipes, either directly or by means of special tilt assemblies. The tilt assemblies are used to direct the main beam of the antenna in the horizontal direction and below (up to -18.5°).

The H-support also includes four brackets welded to the pipe ends, which are used to connect to a lightning discharge conductor and/or for mounting a lightning rod.

Several methods can be used to attach an H-support to a pole or to a tower:.

- To attach the H-support to a pole, it is sufficient to use two U-bolts, which pass through the plate attached to the rear side of the central beam.
- To attach the H-support to towers, various accessories are available, in accordance with the particular tower construction (see para.3.8.2.3):

  In most cases, an adjustable T-support, fastened to the rear side of the central beam, is used to attach the H-support to a tower structural member by means of U-bolts or other mounting accessories.

  For wide towers, short Z-adapters are used for the same purpose.

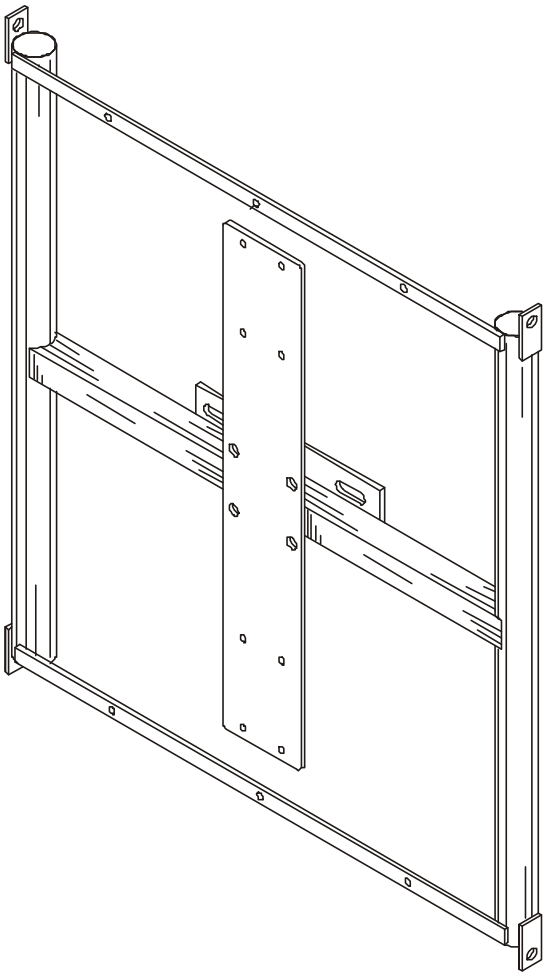


Figure 3-1. Typical Wide H-Support

The H-supports can be grouped in two main groups, in accordance with their dimensions and intended use.

One. 750 mm H-supports, referred to as ***wide H-supports,*** can be used for mounting two RPU's and the associated sectorized antennas in ***all the frequency bands*** (these H-supports can also be used to mount four RPC's). In particular, note that a wide H-support also allows the mounting of RPU stations in the 0.8, 1.5 and 1.9 GHz frequency bands that use sectorized antennas with external reflectors.

Typical installations of RPU stations mounted on typical wide H-supports are shown in Figure 3-23 and Figure 3-24.

Two. 500 mm H-supports, referred to as ***narrow H-supports,*** are used only for mounting RPU's and sectorized antennas in the 2.4 and 3.5 GHz frequency bands, or for mounting RPC's without external reflectors. Two RPU stations mounted on a narrow H-support are shown in Figure 3-26.

The following chart summarizes the types of H-supports to be used:

RPU Frequency Band	H-Support Type
0.8 GHz	750 mm (wide)
1.5 GHz	750 mm (wide)
1.9 GHz	750 mm (wide)
2.4 GHz	750 (wide) or 500 mm (narrow)
3.5 GHz	750 (wide) or 500 mm (narrow)

3.8.2.2 Installation of H-Supports on Poles

Figure 3-1 shows the wide H-support, which can be used for mounting two RPU stations and a lightning rod. Figure 3-2 shows dimensions of the H-support, including lightning rod and the accessories used for mounting the H-support on a pole.

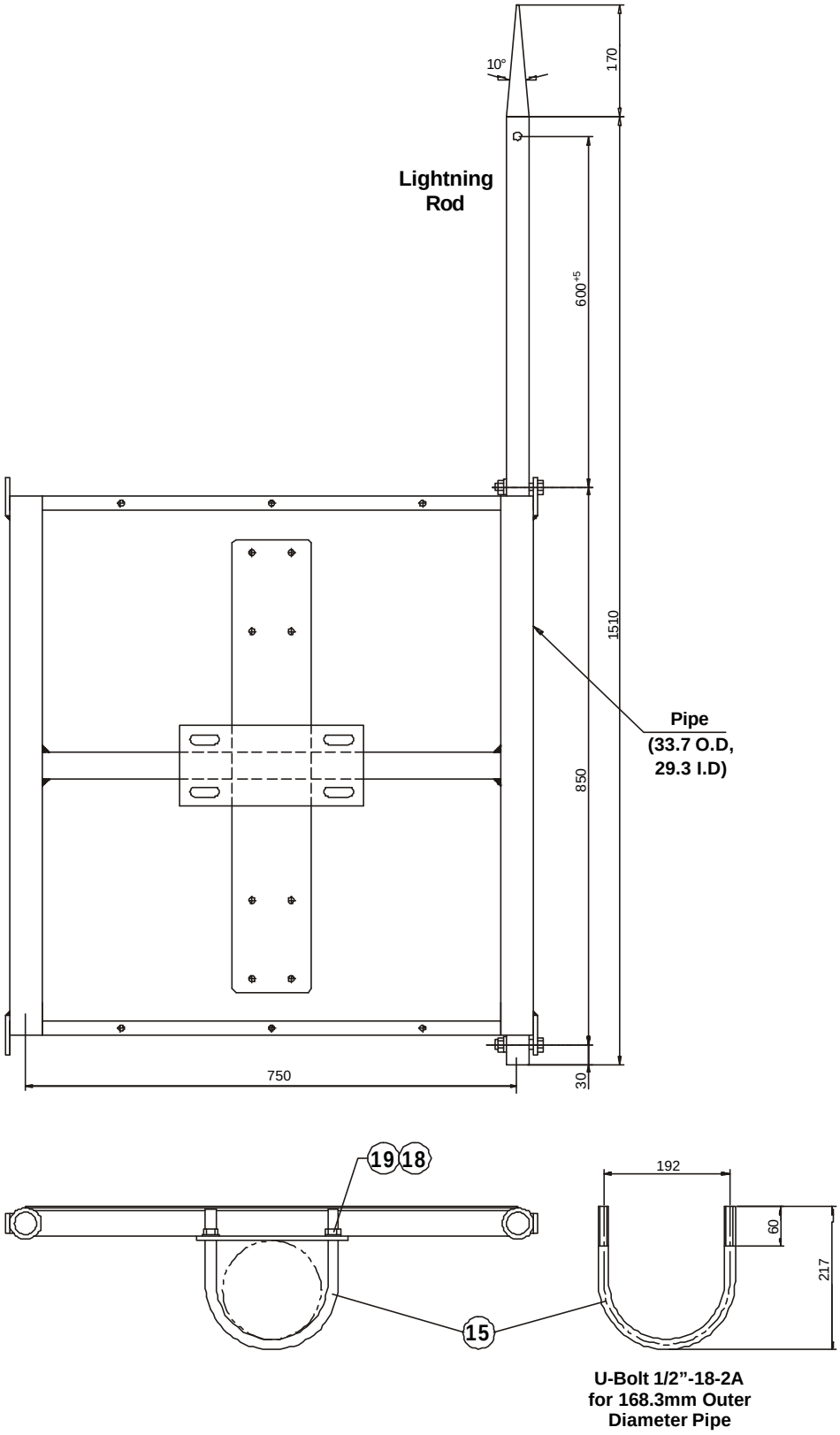


Figure 3-2. Typical H-Support (750 mm Wide) with Lightning Rod and Accessories for Pole Mounting

3.8.2.3 Tower Mounting, General

InnoWave developed several types of accessories for mounting the two types of H-supports on towers.

One. Wide H-supports. These H-supports are mounted by means of dedicated tower mounting supports, called T-supports. Typical installations are shown in Figure 3-4 through Figure 3-7.

Two. Narrow H-supports. The mounting methods depend on the dimensions and shape of the tower.

(1) Towers with Side Sections in the Range of 300 to 1200 mm. For this type of towers, the H supports are attached to the side of the tower by means of T-supports. A typical installation, that includes six RPU's and the associated antennas, is shown in Figure 2-2.

The applicable mounting accessories are shown in Figure 3-8 and Figure 3-9.

(2) Wide Towers (Towers with Side Sections Exceeding 1200 mm). For this type of towers, dedicated mounting kits are used to attach pairs of H-supports. Side views of narrow H-support pairs installed on straight and pyramidal segments of a wide tower are shown in Figure 3-3.

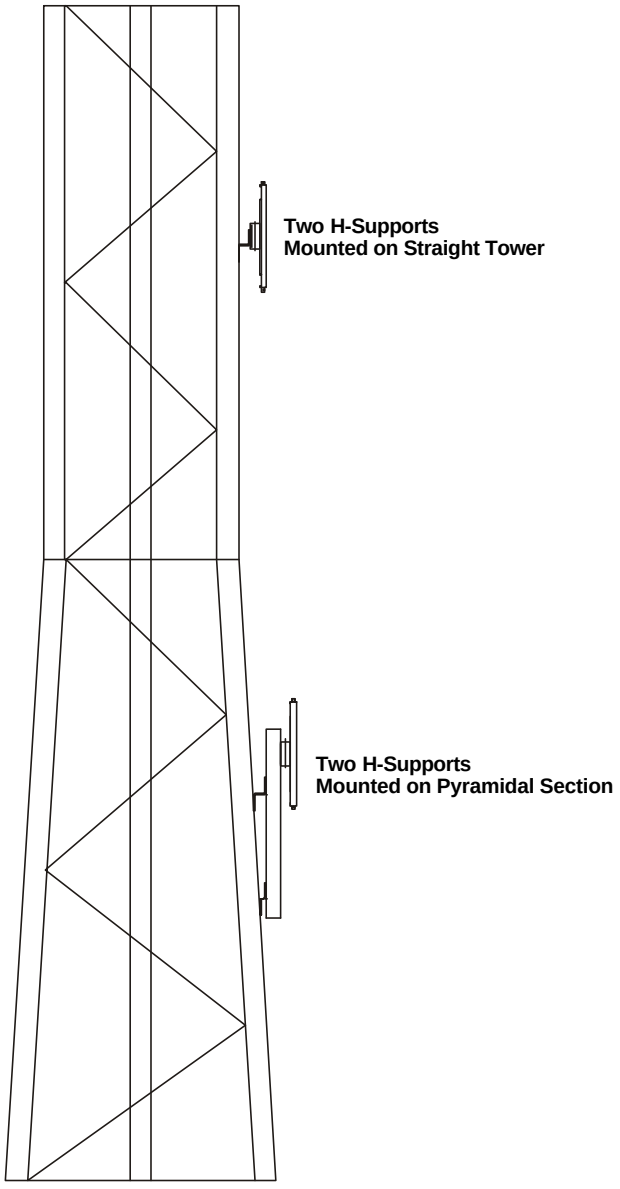


Figure 3-3. Typical H-Support Installations on Wide Towers, Side View

3.8.2.4 Wide H-Supports for Tower Mounting

Figure 3-4 through Figure 3-7 show typical wide H-supports, recommended for tower mounting. Each installation is composed of two main components:

- RPU and antenna mounting section, similar to the H-support described in para. 3.8.2.2, except that it can be attached to the tower by means of a tower mounting support and four U-bolts.
- Tower mounting support, used to attach the H-support to the tower.

Note that the RPU and antenna mounting section shown in Figure 3-4 through Figure 3-7 can be deflected by ±20° in the vertical plane, using the right-hand or left-hand attachment section, respectively, of the tower mounting support.

The H-support shown in Figure 3-6 and Figure 3-7 can be attached to the tower by means of four small or large U-bolts. Two types of U-bolts can be used, small or large, in accordance with the dimensions of the tower section.

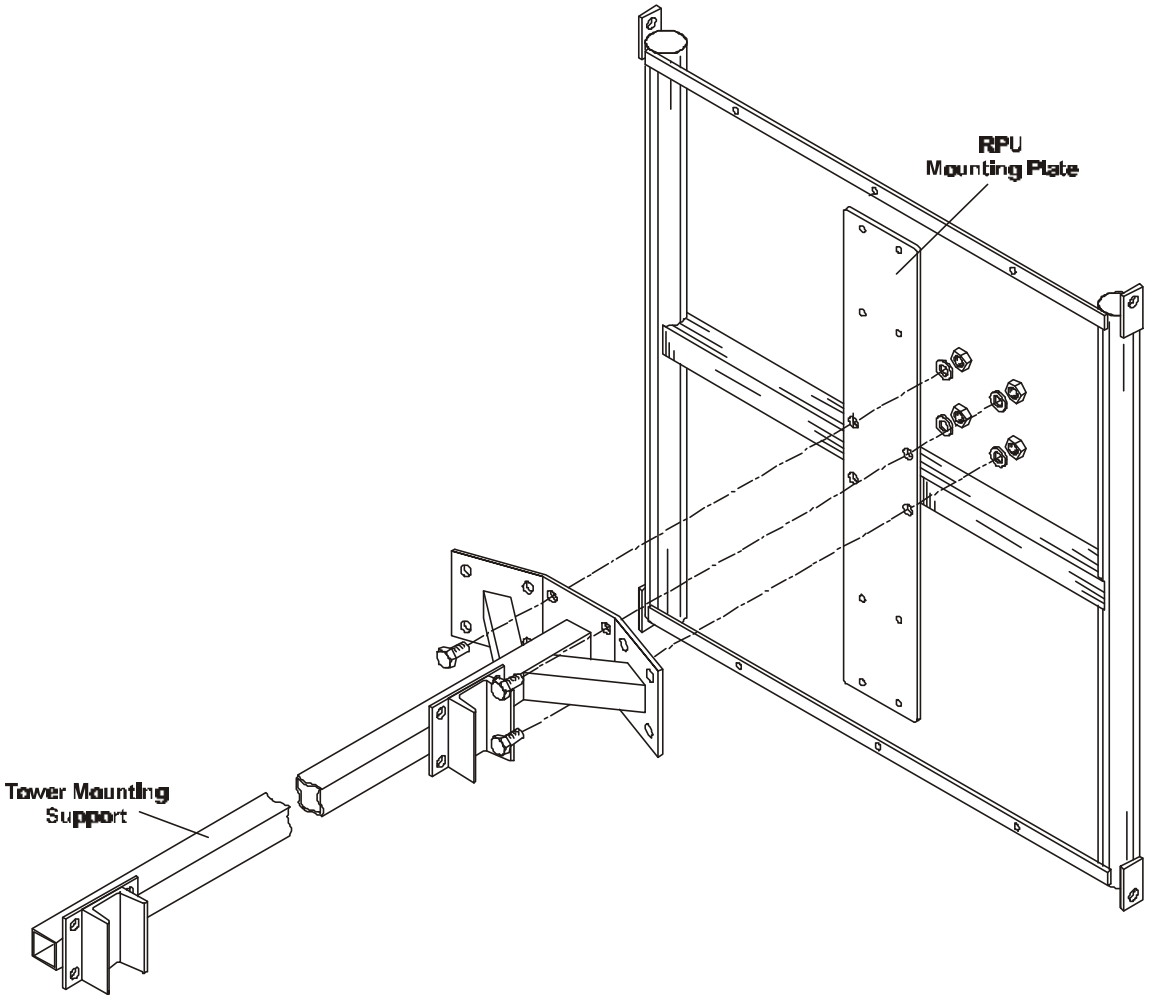


Figure 3-4. Typical Wide H-Support for Tower Mounting, Option 1, General View

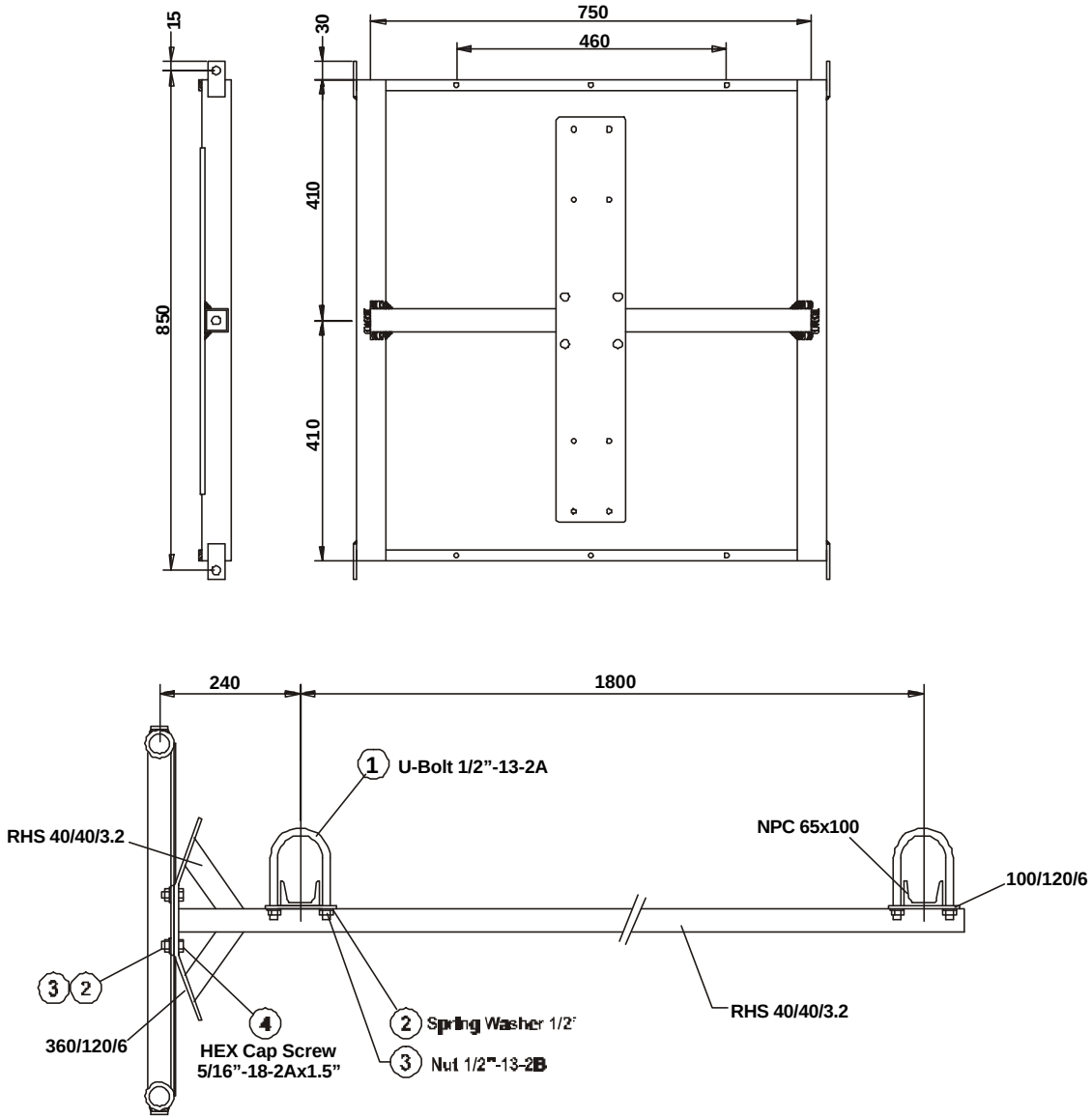


Figure 3-5. Typical Wide H-Support and Accessories for Tower Mounting, Option 1, Mechanical Details

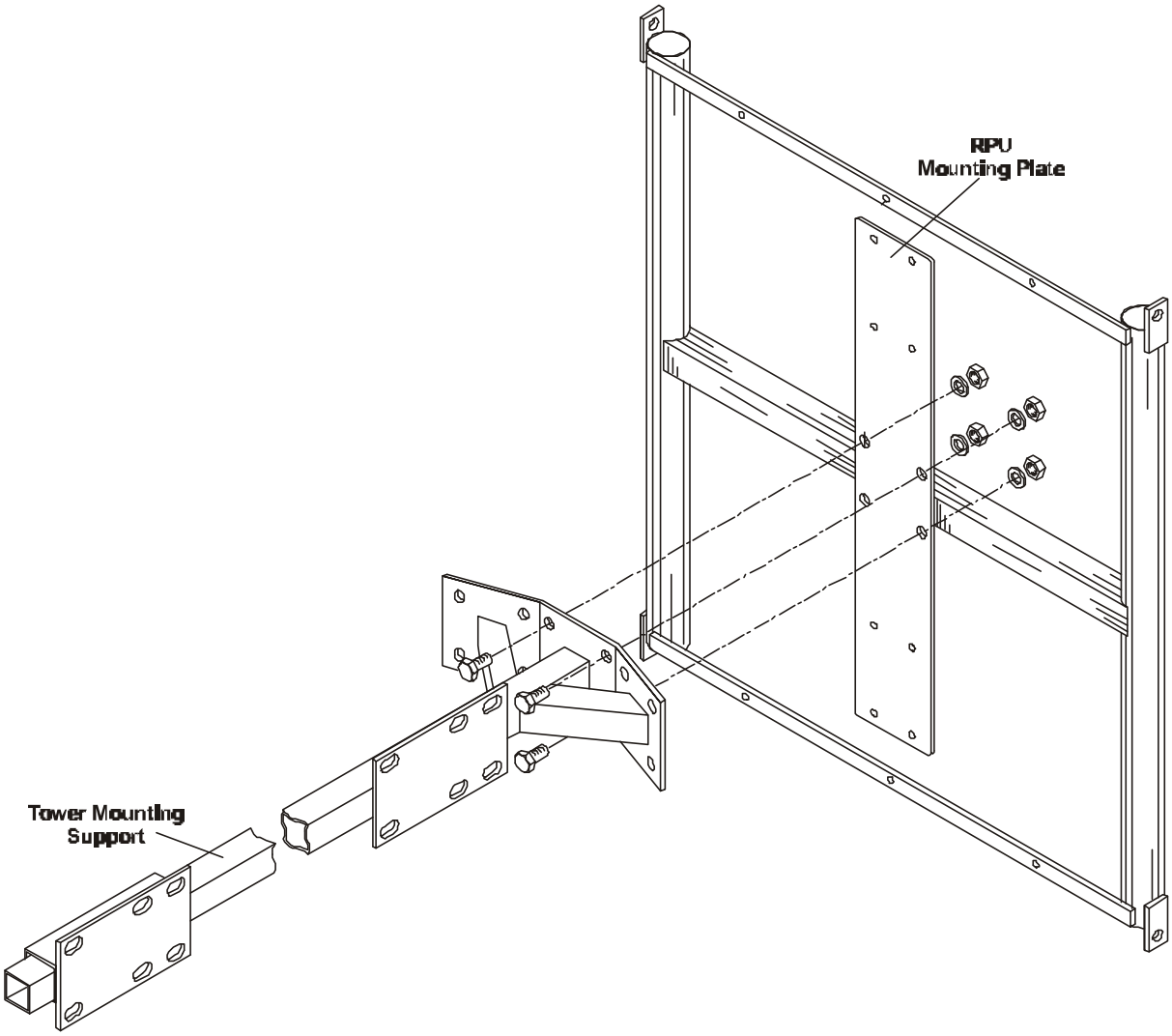


Figure 3-6. Typical Wide H-Support for Tower Mounting, Option 2, General View

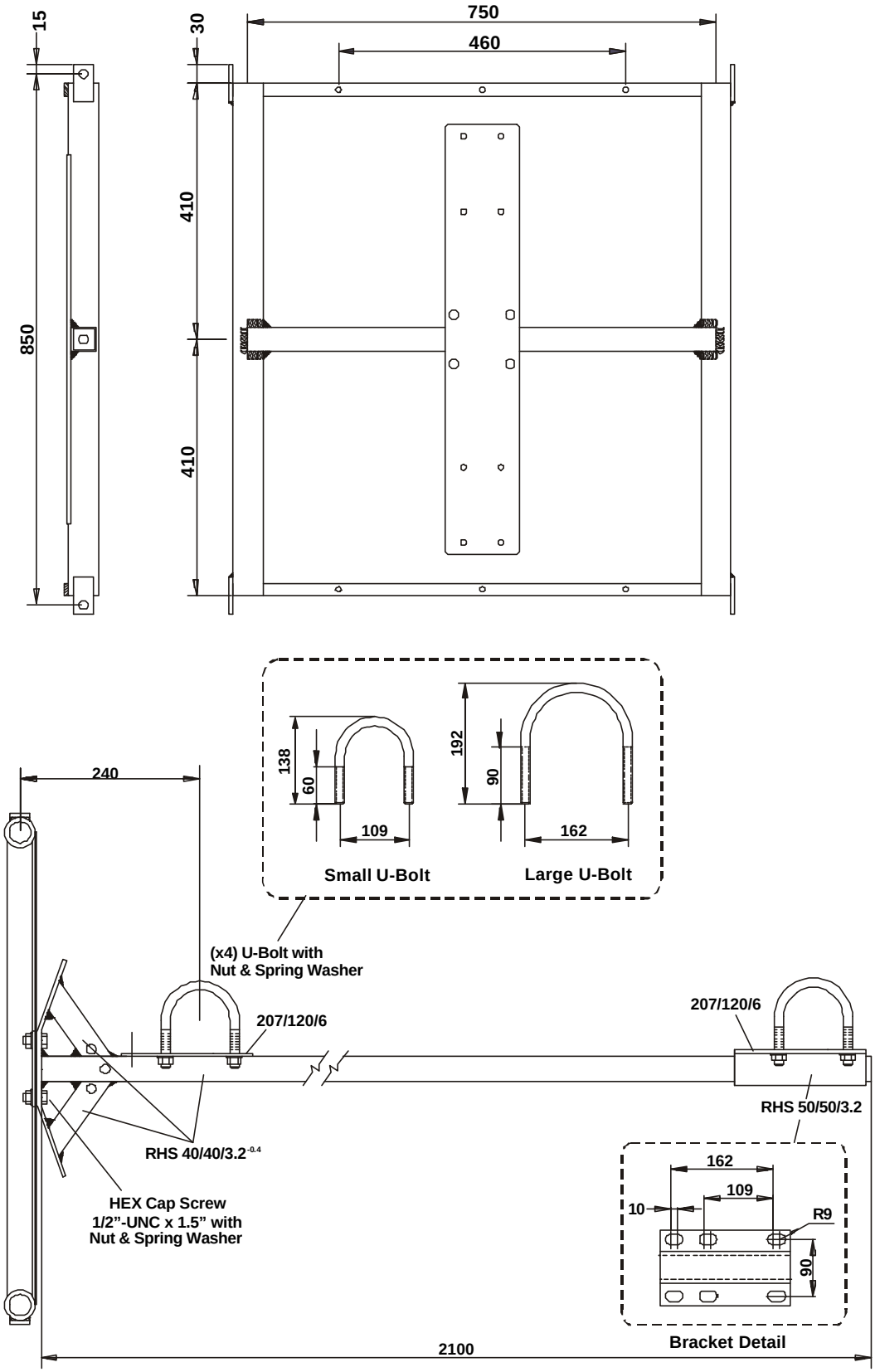


Figure 3-7. Typical Wide H-Support for Tower Mounting, Option 2, Mechanical Details

3.8.2.5 Narrow H-Supports for Tower Mounting

Figure 3-8 through Figure 3-12 show typical narrow H-supports and various mounting accessories recommended for tower mounting.

Tower mounting supports are used to attach a pair of narrow H-supports to the tower. Three basic tower mounting options are available:

One. Tower Mounting Option 1. The tower mounting support used for this option is shown in Figure 3-8 and Figure 3-9. This option can be used for mounting two narrow H-supports on straight towers with side sections in the range of 300 to 1200 mm.

The support is attached to the tower using U-bolts. Many types of U-bolts are available, to fit various tower section types. The U-bolt that is close to the H-support can be moved in accordance with the dimensions of the tower section. This permits attachment to towers with different section dimensions, in the range of 300 to 1200 mm.

This option is recommended for high-density RPU installations. If many subscribers are located in one sector, it is recommended to mount supports on several levels. This option can also be used to achieve 360° radio coverage by means of six H-support arranged on one level (para. 2.3.3).

Table 3-1 lists the accessories and the materials needed for option 1. The item numbers in table identify items in Figure 3-9.

Table 3-1. Tower Mounting Option 1, Mounting Accessories and Materials

Item	Description	Qty.	Notes
1	Narrow H-Support	2	P/O RPU kit
2	Tower Mounting Support	1	P/O RPU kit
3	Arm for Attaching 2 Narrow H-Supports	1	P/O RPU kit
4	Bracket	1	P/O RPU kit
5	U-Bolt Type 1	8	P/O RPU kit
6	U-Bolt Type 2	4	P/O RPU kit
7	U-Bolt Type 3	2	P/O RPU kit
8	U-Bolt Type 4	4	P/O RPU kit
9	U-Bolt Type 5	4	P/O RPU kit
10	Hex Cap Screw M12×40, DIN 934, 8.8	4	P/O RPU kit
11	Nut M12, DIN 934, 8	24	P/O RPU kit
12	Flat Washer M12, DIN 125A	24	P/O RPU kit
13	Spring Washer M12, DIN 7980	24	P/O RPU kit
14	Hex. Cap Screw M8×40, DIN 934, 8.8	16	P/O RPU kit
15	Nut M8, DIN 934, 8	16	P/O RPU kit
16	Flat Washer M9, DIN 125A	16	P/O RPU kit
17	Spring Washer M8, DIN 7980	16	P/O RPU kit

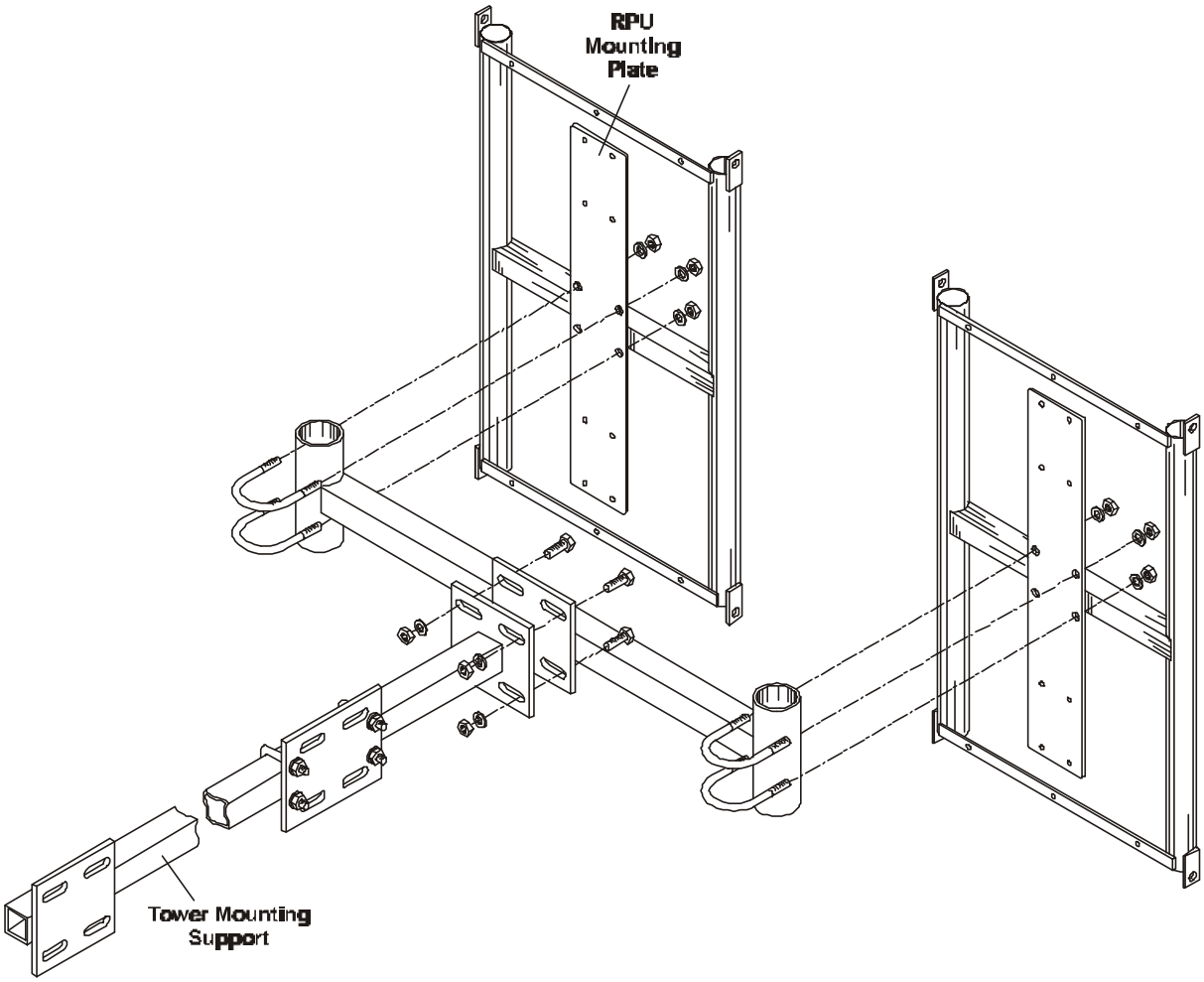


Figure 3-8. Narrow H-Supports and Accessories for Tower Mounting, Option 1, General View

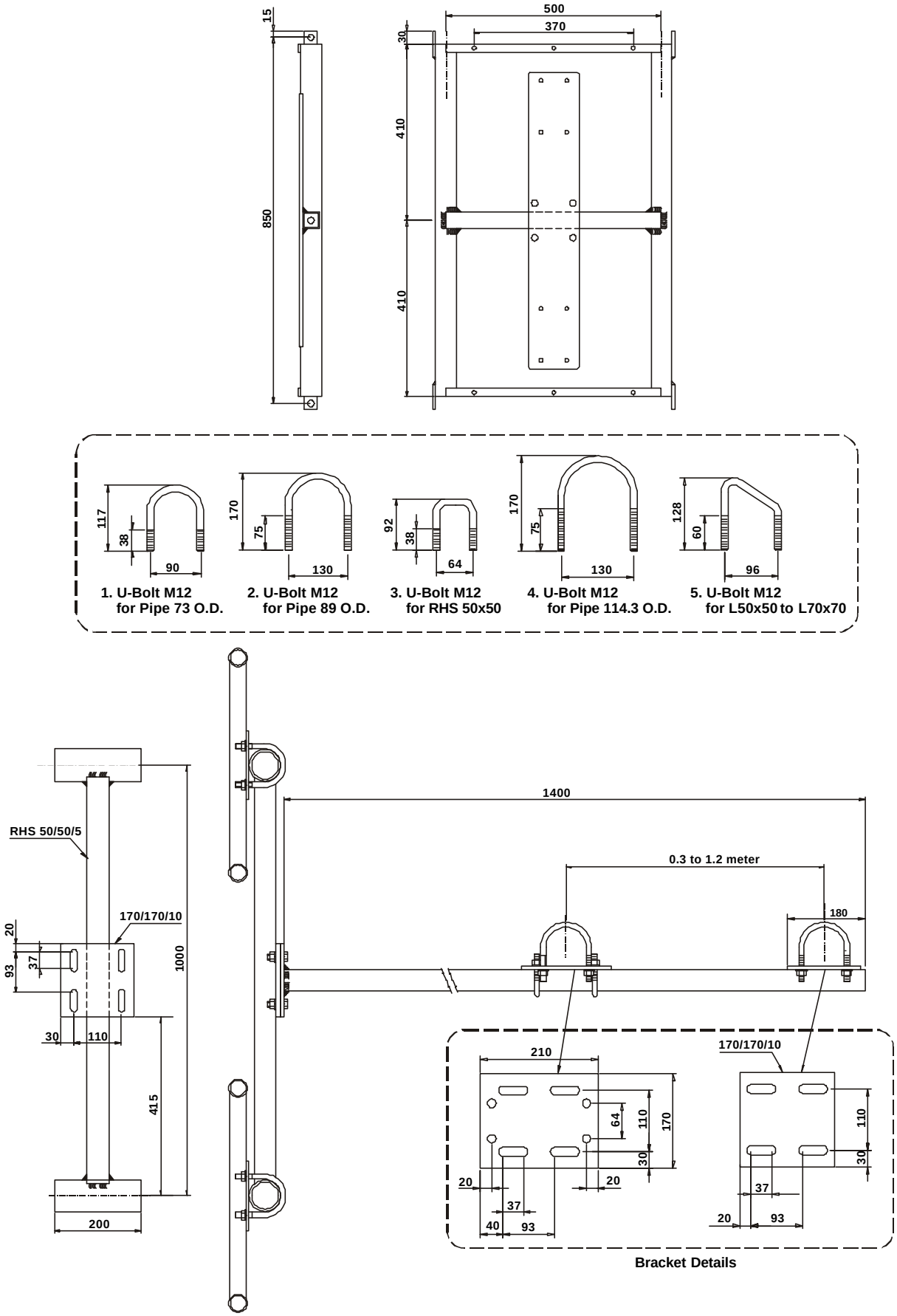


Figure 3-9. Narrow H-Supports and Accessories for Tower Mounting, Option 1, Mechanical Details

Two. Tower Mounting Option 2. The option 2 mounting support and the corresponding mounting accessories are shown in Figure 3-10 and Figure 3-11. This option can be used for mounting two narrow H-supports on straight towers with side sections wider than 1200 mm, by means of a dedicated support and Z-adapter.

Table 3-2 lists the accessories and the materials needed for this option. The item numbers in the table identify items in Figure 3-11.

Table 3-2. Tower Mounting Option 2, Mounting Accessories and Materials

Item	Description	Qty.	Notes
1	Narrow H-Support	2	P/O RPU kit
2	Mounting Support - Wide Tower	1	P/O RPU kit
3	Z-Adapter - Wide Tower	1	P/O RPU kit
4	Not Used	-	-
5	U-Bolt Type 1	4	P/O RPU kit
6	U-Bolt Type 2	2	P/O RPU kit
7	U-Bolt Type 3	2	P/O RPU kit
8	U-Bolt Type 4	2	P/O RPU kit
9	Not Used	-	-
10	Hex Cap Screw M12×40, DIN 934, 8.8	4	P/O RPU kit
11	Nut M12, DIN 934, 8	16	P/O RPU kit
12	Flat Washer M12, DIN 125A	16	P/O RPU kit
13	Spring Washer M12, DIN 7980	16	P/O RPU kit
14	Hex. Cap Screw M8×40, DIN 934, 8.8	16	P/O RPU kit
15	Nut M8, DIN 934, 8	16	P/O RPU kit
16	Flat Washer M9, DIN 125A	16	P/O RPU kit
17	Spring Washer M8, DIN 7980	16	P/O RPU kit

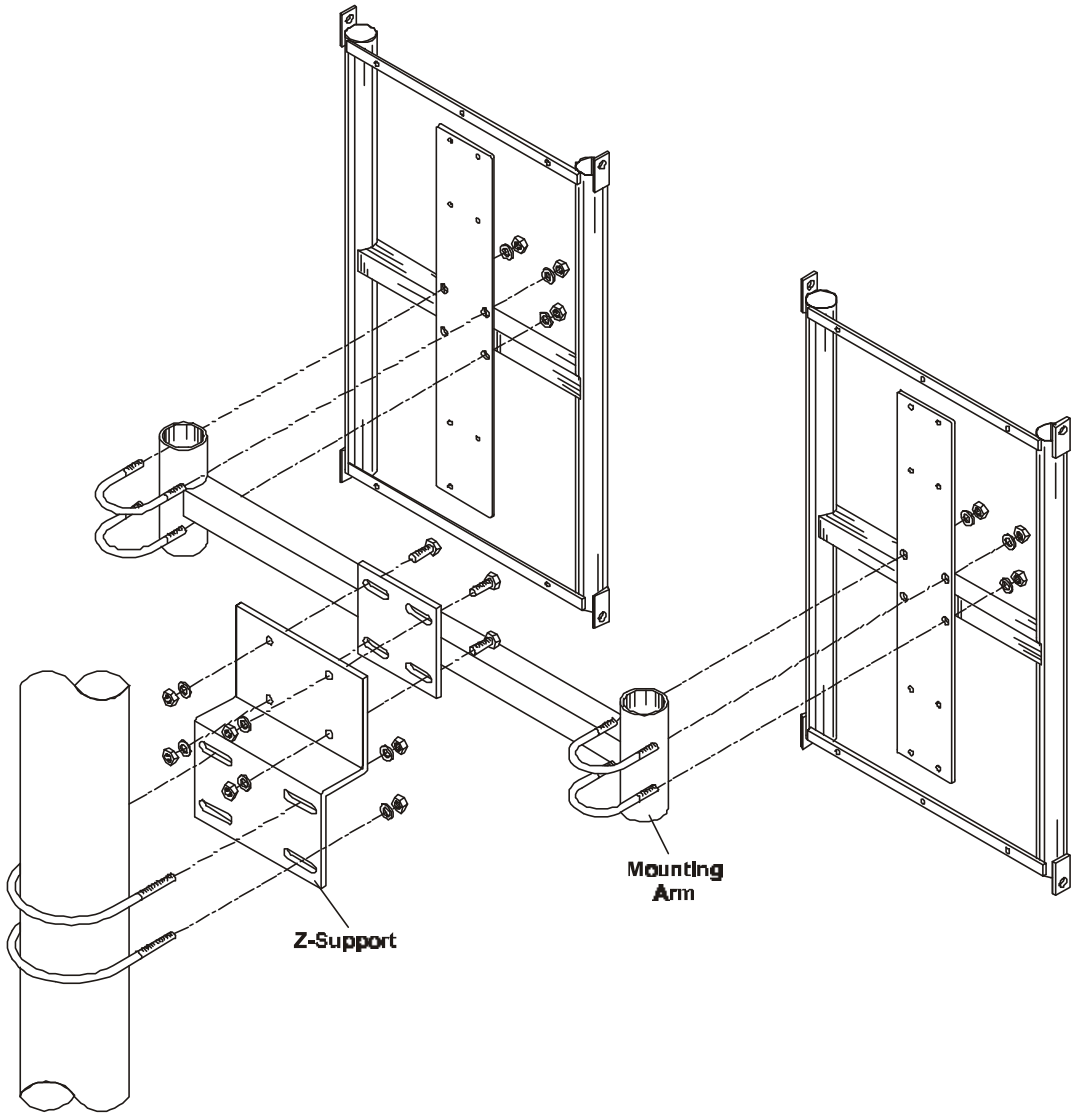


Figure 3-10. Narrow H-Supports and Accessories for Tower Mounting, Option 2, General View

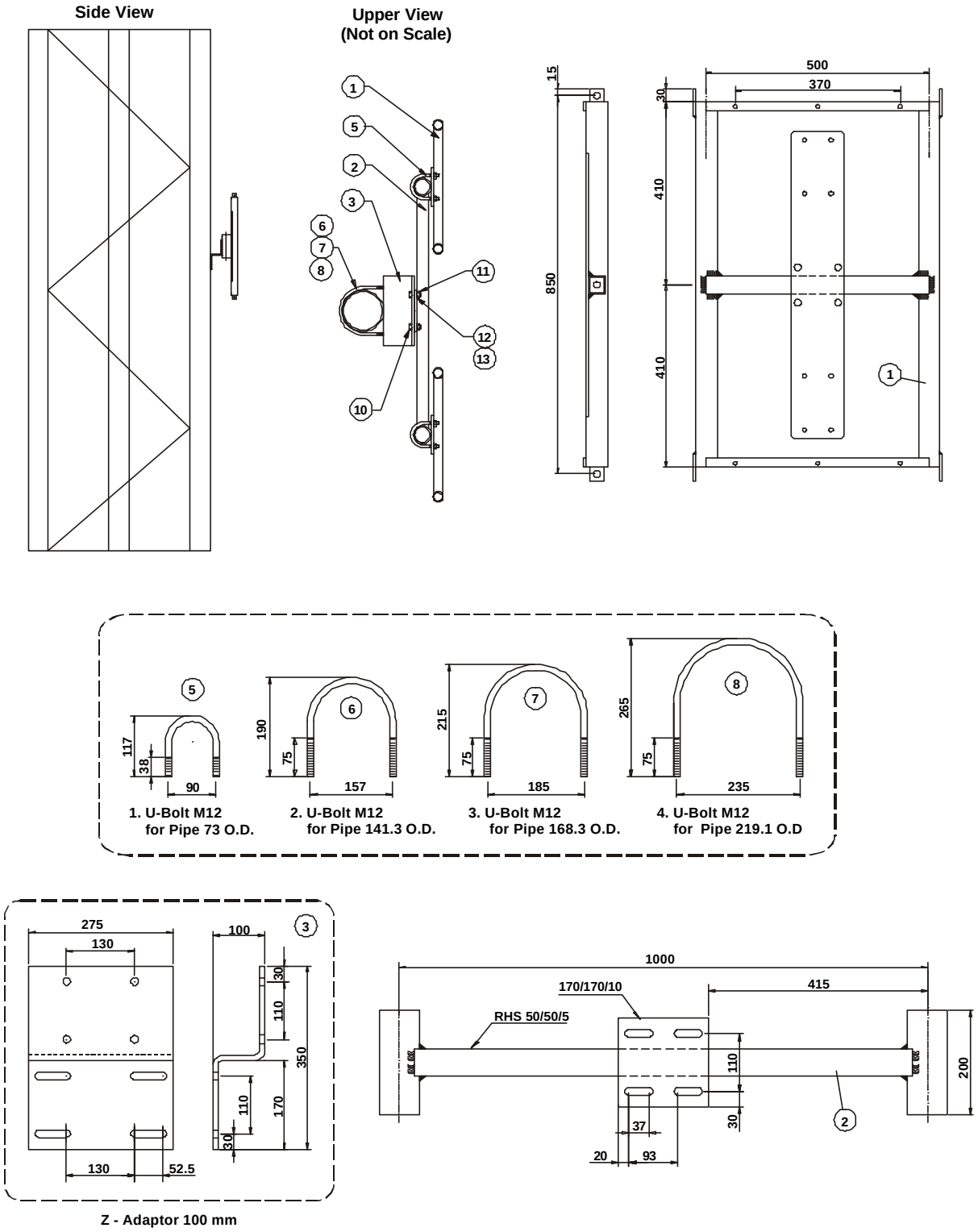


Figure 3-11. Narrow H-Supports and Accessories for Tower Mounting, Option 2, Mechanical Details

Three. Tower Mounting Option 3. The option 3 mounting support and the corresponding mounting accessories are used to mount two narrow H-supports on pyramidal towers with side sections in the range of 300 to 1200 mm.

Option 3 requires the accessories and materials listed in Table 3-2, and in addition requires the special mounting kit listed in Table 3-3.

Table 3-3. Tower Mounting Option 3, Additional Mounting Kit

Item	Description	Qty.	Notes
1	Pipe (141.3 mm Outer Diameter)	1	P/O RPU kit
2	U-Bolt	4	P/O RPU kit
3	Z-Adapter (50 mm)	1	P/O RPU kit
4	Nut M12, DIN 934, 8	8	P/O RPU kit
5	Flat Washer M12, DIN 125A	8	P/O RPU kit
6	Spring Washer M12, DIN 7980	8	P/O RPU kit
7	Spring Washer M8, DIN 7980	16	P/O RPU kit

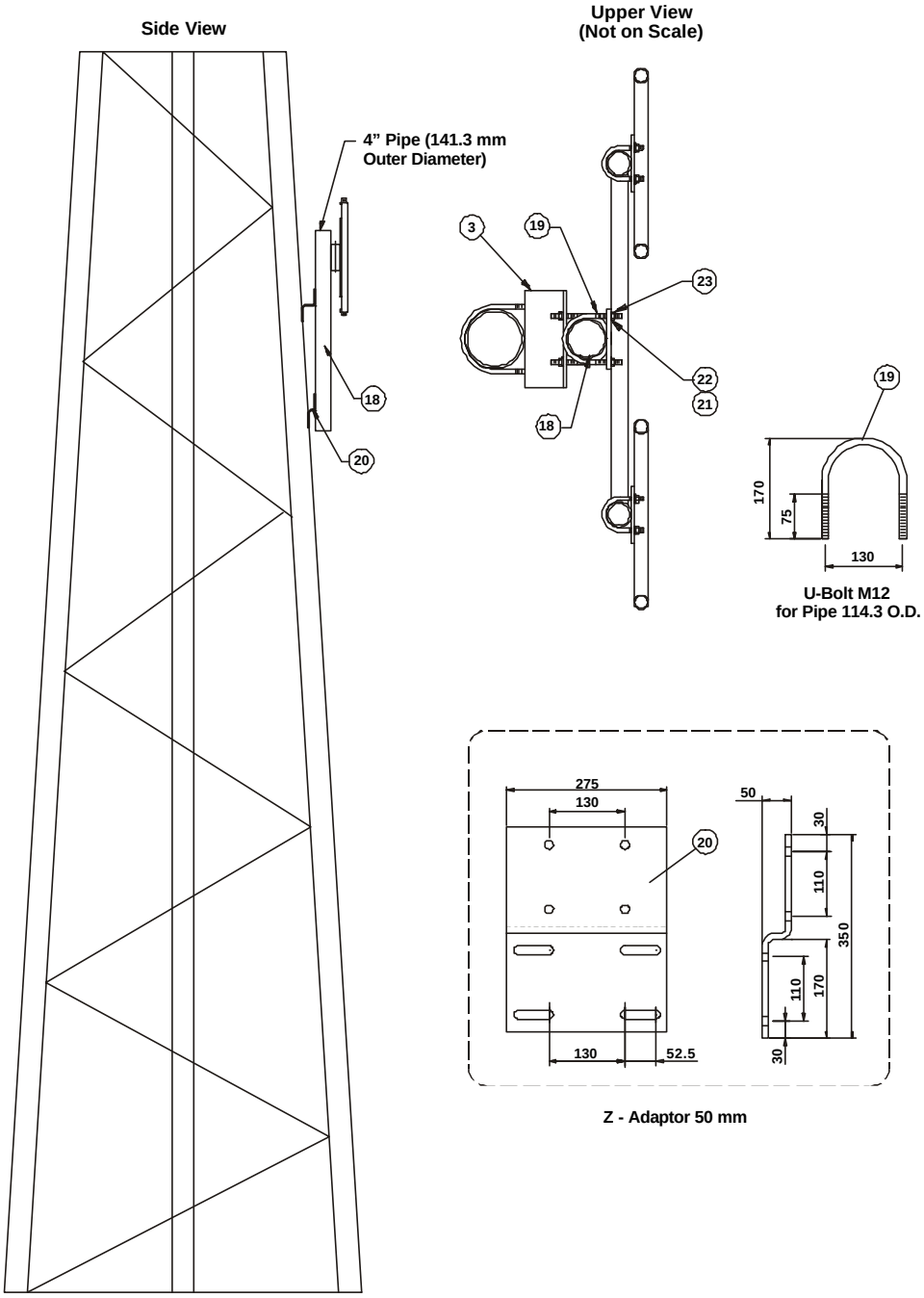


Figure 3-12. Additional Mounting Kit for Pyramidal Towers

Section III. MOUNTING INSTRUCTIONS

WARNING

Before starting the mounting procedure, check the surroundings of the intended RPU location. Make sure the intended location does not present any hazards, in particular accidental contact of antennas and/or mounting accessories with power lines, or exposure to radiation from other nearby antennas during the mounting process.

Do not install equipment during lightning storms.

3.9 Scope

In most locations, it is necessary to perform the installation procedure in three main stages:

1. Assembly of station equipment on the selected mounting support.
2. Connection of DSL lines to the equipment.
3. Installation of the assembly in its final position on the tower or pole.

Stage 1 is usually performed on the ground, but the order of execution of stages 2 and 3 must be determined by the installation team, in accordance with the specific conditions at each station site:

- When it is possible to work safely on the tower, first install the station assembly in its final position on the tower or pole, and then connect the DSL lines.
- Alternately, connect the DSL lines on the ground, and then mount the whole station assembly, with cables already attached, in its final position on the tower or pole.

This Section contains the following information:

- Instructions for mounting RPU stations with omnidirectional antennas - para. 3.10.
- Instructions for mounting RPU stations with sectorized antennas on poles - para. 3.11.
- Instructions for mounting RPU stations with sectorized antennas on towers - para. 3.12.

Each paragraph listed above contains the list of equipment and accessories required for the corresponding installation option, and provides specific instructions for equipment preparation and mounting.

Section IV provides instructions for completing the installation procedure, mainly the connection of DSL lines and final inspection instructions.

3.10 RPU Station with Omnidirectional Antennas

3.10.1 General

Figure 3-13 shows an RPU station with two omnidirectional antennas and a lightning rod mounted on a pole. The RPU is attached to the mast by means of a fastener. The antennas are attached to the mast by means of a dual-antenna support. The antenna support is attached to the pole by means of clamps.

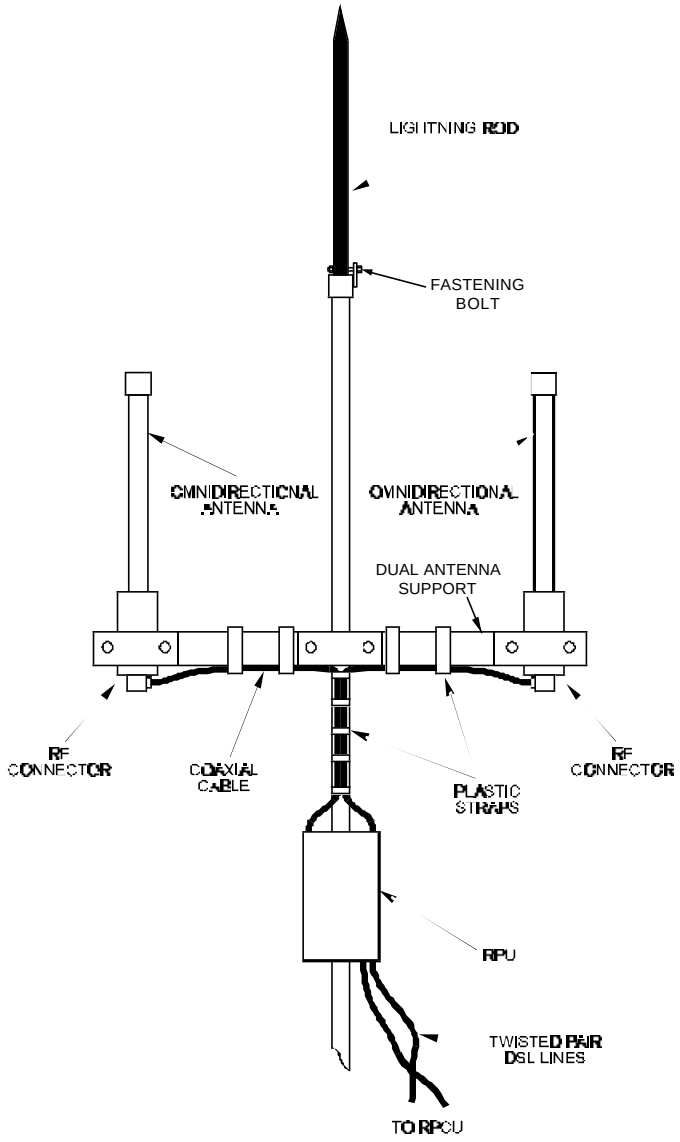


Figure 3-13. Typical RPU Station with Omnidirectional Antennas and Lightning Rod

Table 3-4 lists the equipment and materials required for mounting an RPU station with two omnidirectional antennas and a lightning rod.

Table 3-4. Required Equipment and Materials for RPU Station with Omnidirectional Antennas

No.	Mfg. Cat. No.	Description	Additional Cat. No.	Qty.
1	-	RPU	-	1
2	86264000100	Fastener	8626-40001-00-0D	2
3	86975210350	Screw M10×35	BN622 A2 M10×35	4
4	86975310020	Washer, Spring M10	BN672 A2 M10	4

Table 3-4. Required Equipment and Materials for RPU Station with Omnidirectional Antennas (Cont'd)

No.	Mfg. Cat. No.	Description	Additional Cat. No.	Qty.
5	86975310060	Washer, Flat M10	BN670 A2 M10	6
6	86975110600	Nut M10	BN628 A2 M10	4
7	-	Steel Band	-	6
8	Not used		-	
9	-	Omnidirectional Antennas	-	2
10	-	Lightning Rod	-	1
11	-	Fastening Bolt for Lightning Rod	-	2
12	-	Dual Antenna Support	-	1

3.10.2 Mounting Instructions

The mounting procedure for a RPU station with two omnidirectional antennas and a lightning rod comprises the following steps:

- Mounting of RPU on mast - para. 3.10.2.1.
- Mounting of lightning rod - para. 3.10.2.2.
- Mounting of antenna - para. 3.10.2.3.
- Antenna connector sealing - para. 3.10.2.4.
- Preliminary inspection - para. 3.10.2.5.
- Mounting of dual-antenna support - para. 3.10.2.6.

3.10.2.1 RPU Preparation and Mounting on Mast

Figure 3-14 shows the RPU attached to a pole by means of a fastener. Numbers in brackets indicate item numbers in Figure 3-14.

One. Attach a grounding strap to the RPU grounding plate as shown in Figure 2-6.

Two. Connect the DSL lines in accordance with the procedure of para. 3.14.

Three. Attach the fastener (2) to the RPU (1) by means of screws (3) spring washers (4), flat washers (5) and nuts (6) as shown in Figure 3-8. Note that two flat washers are used around the lower screw.

Do not tighten the nuts completely at this phase.

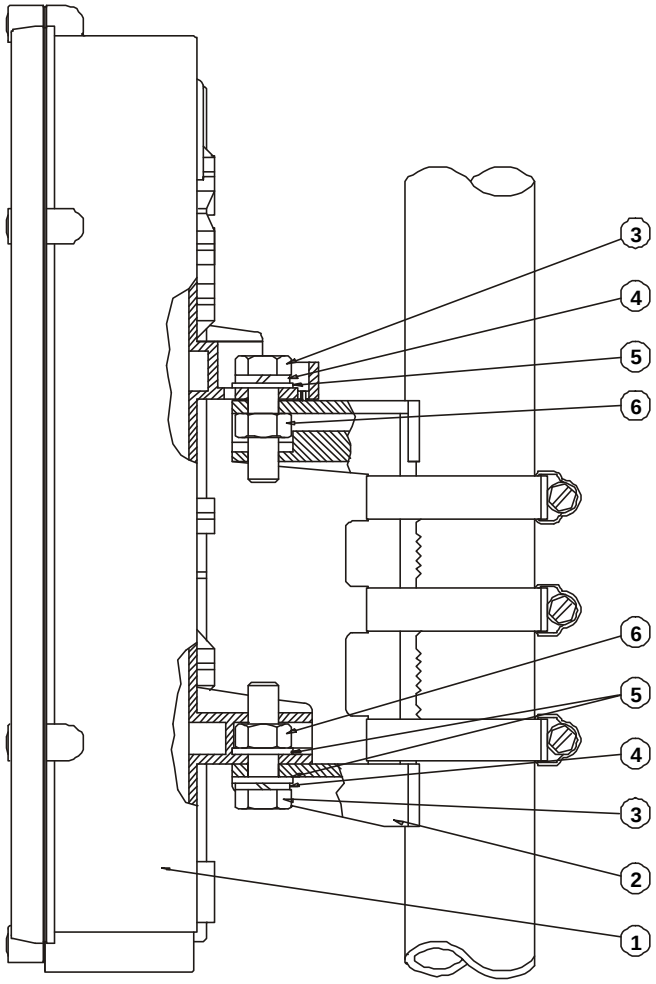
Four. If the RPU is located near the top of the pole, release the steel bands (7) as necessary, and then slide the RPU over the pole, to its prescribed location.

If sliding the RPU along the pole is not possible, completely open the bands, hold the RPU unit at the prescribed location on the pole, and then wrap the mounting straps around the pole.

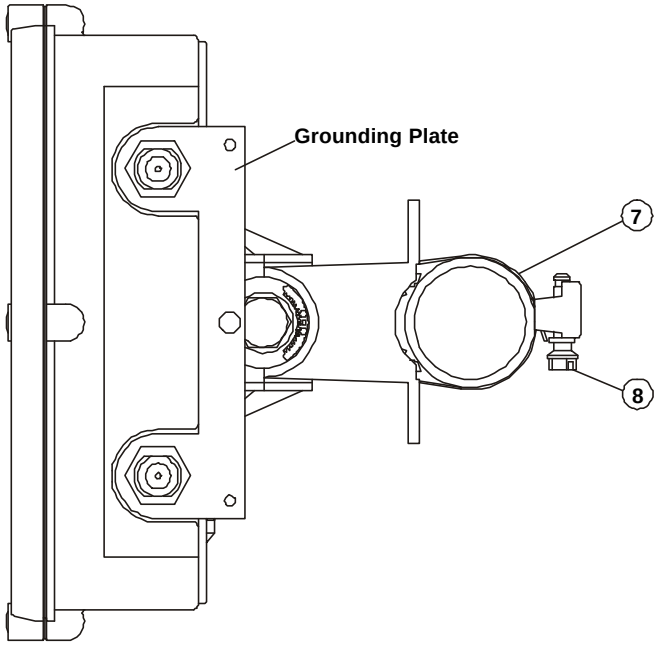
Five. Use a screwdriver to tighten the bands over the pole by turning the tightening screws (8) clockwise. Tighten alternately each strap screw. Do not exert excessive torque.

Six. Determine the final direction of the RPU and align the RPU as required.

Seven. Tighten the nuts (6). Tighten alternatively each nut. Do not exert excessive force.



Side View



Top View

Figure 3-14. RPU Mounted on Pole by Means of Fastener

3.10.2.2 Lightning Rod Mounting

> **☞ NOTE**
>
> If a lightning rod is already installed at the top of the pole or mast, skip this procedure and continue to para. 3.10.2.3.

One. Mounting of Lightning Rod on Metal Mast. Refer to Figure 3-13. The lightning rod must be tightly secured inside the pipe, and the pipe itself must be connected to a grounding bar that is connected to ground.

Install the lightning rod on a metal mast in accordance with the following procedure:

(1) Ensure that the lightning rod and the contacting pipe are made of electro-chemically compatible materials.

(2) Check that the contact areas between the lightning rod and the metal pipe are clean.

(3) Mount the lightning rod inside the metal pipe and attach it to the metal pipe by means of a bolt, spring washer, and nut.

(4) Tighten the nut and measure the connection resistance between the lightning rod and the metal mast structure: it should not exceed 2.5 milliohm. If the resistance exceeds the allowed value, clean again the contact areas and tighten the securing bolt until the required contact resistance is achieved.

Two. Mounting of Lightning Rod on Wooden Pole. When a wooden pole is used, the lightning rod shall be installed on the top of the pole by means of a metal support. The lightning rod must be tightly secured to the metal support, and the support itself must be connected to a grounding bar that is connected to the ground at the base of the pole.

Two or more grounding bars must be provided and mounted in accordance with requirements of para. 2.3.3. The connection resistance between the lightning rod and the metal support shall not exceed 2.5 milliohm, and the connection resistance between the metal support and the grounding bar shall not exceed 5 milliohm.

3.10.2.3 Mounting of Antenna on Antenna Support

One. Attach the two omnidirectional antennas to the dual antenna support by means of clamps, bolts nuts and washers.

Two. Connect the RF cable connectors to the RF connectors on the two antennas.

Three. Attach the RF cables to the dual antenna support by means of plastic straps as shown in Figure 3-13.

3.10.2.4 Antenna Connector Sealing

Seal the connections of the RF cables to the antenna and RPU RF connectors in accordance with para. 3.15.

3.10.2.5 Preliminary Inspection

Before lifting the dual antenna support, perform the procedure of para. 3.16.

3.10.2.6 Dual-Antenna Support Mounting

One. Ensure that the procedures of para. 3.10.2.1, 3.10.2.2 (if applicable), 3.10.2.3, 3.14 and 3.15 have been already performed.

Two. Carefully lift the dual-antenna support with the mounted equipment to the intended location on the mast.

Three. Attach the dual-antenna support to the mast by means of clamps, bolts and washers.

Four. Perform the final inspection (para. 3.17).

3.11 RPU Station with Sectorized Antennas Mounted on Pole

This paragraph presents instructions for mounting of two RPU's and four sectorized antennas on a pole by means of the H-support described in para. 3.8.2.2. The antennas are attached to the H-support by means of a tilt assembly.

3.11.1 Required Equipment and Materials

3.11.1.1 Antenna and Tilt Assembly Accessories

Table 3-5 lists the equipment and accessories required for attaching one sectorized antenna to the H-support by means of a special tilt assembly.

Table 3-5. Sectorized Antenna and Tilt Assembly

No.	Mfg. Cat. No.	Description	Additional Cat. No.	Qty.
1		Sectorized Antenna		1
2	86264015300	Tilt Holder	8626-40153-00-0D	1
3	86264015200	Tilt Bracket	8626-40152-00-0D	1
4	86264000400	Tilt Clamp	8626-40004-00-0B	2
5	869752XXX00	Screw M10×25	BN622 A2 M10×25	2
6	86975310020	Washer, Spring M10	BN672 A2 M10	2
7	86975310060	Washer, Flat M10	BN670 A2 M10	3
8	86975110600	Nut M10	BN628 A2 M10	2
9	86962368510	Ground Cable	8696-23685-10-0B	1
10	86975306060	Washer, Flat M6	BN670 A2 M6	4
11	86975306070	Washer, Spring M6	BN672 A2 M6	4
12	86975206120	Screw M6×12	BN622 A2 M6×12	4
13	86975308200	Washer, Flat M8	BN1356 A2 M8	4
14	86975308080	Washer, Spring M8	BN672 A2 M8	4
15	86975108030	Nut M8	BN628 A2 M8	4
16	86264291010	Outside Reflector for 1.9 GHz Sectorized Antenna	8626-42910-10-0D	1
	86264295000	Outside Reflector for 1.5 GHz Sectorized Antenna	8626-42950-00-0D	1
17	86975204080	Screw M4×8	BN652 A2 M4×8	11
18	86975304080	Washer, Spring M4	BN672 A2 M4	11
19	86975304060	Washer, Flat M4	BN670 A2 M4	11
20	86975832320	Split Pin	DIN94 A2 ϕ3.2 L32	1
21	8697508160	Screw M8×16	BN622 A2 M8×16	1
22	86975308060	Washer, Flat M8	BN670 A2 M8	1

3.11.1.2 Mounting Accessories for Lightning Rod and H-Support

Table 3-6 lists the equipment and materials required for lightning rod attachment and for mounting the H-support on pole.

Table 3-6. H-Support and Lighting Rod Mounting Kit

No.	Mfg. Cat. No.	Description	Qty.
1	-	Washer, Spring ½	6
2	-	Nut ½-13-2B	6
3	-	U-Bolt	2
4	-	Hex. Cap Screw ½-13-2A×2.5”	2
5	-	Hex. Cap Screw 5/16”-18-2A×1.5”	TBD
6	-	Nut 5/16”-18-2B	TBD
7	-	Washer, Spring 5/16”	TBD

3.11.2 Mounting Instructions

The instructions for mounting of two RPU stations including two RPU’s and four sectorized antennas on a pole, by means of a H-support comprises the following steps:

- Site preparation - para. 3.11.2.1.
- Equipment unpacking and preparation - para. 3.11.2.2.
- Mounting of lightning rod - para. 3.11.2.3.
- Preparation and mounting of RPU on H-support - para. 3.11.2.4.
- Preparation and mounting of sectorized antennas on H-support - para. 3.11.2.5.
- Connection of grounding strap and RF cables - para. 3.11.2.6.
- Antenna connector sealing - para. 3.11.2.7.
- Preliminary inspection - para. 3.11.2.8.
- Mounting on pole - para. 3.11.2.9.

3.11.2.1 Site Preparation

Prepare the site(s) intended for the installation of the RPU station(s) on pole in accordance with the requirements of para. 3.6.2.

3.11.2.2 Equipment Unpacking and Preparation

One. Open the packing containers and take out the equipment and the materials.

Two. Inspect the equipment for any signs of damage.

Three. Refer to the installation plan. Check the received items against the following list and your installation plan.

Four. For each RPU station including one RPU and two sectorized antennas, prepare the following equipment:

- H-support.
- RPU.
- For each sectorized antenna, prepare the equipment and materials listed in Table 3-5.
- Lightning rod (if required).
- Mounting materials listed in Table 3-6.

> **☞ NOTE**
>
> A lightning rod must be installed at the top of the pole that will support the antennas. The procedure of para. 3.11.2.3 is applicable to an H-support intended for installation at the top of the pole. For other H-support, skip to para. 3.11.2.4.

3.11.2.3 Mounting Instructions for Lightning Rod

Refer to Figure 3-2 and Figure 3-9 through Figure 3-16. Numbers in brackets indicate numbers of items in Figure 3-2 and Figure 3-16.

One. Insert the lightning rod in the H-support as shown in Figure 3-15.

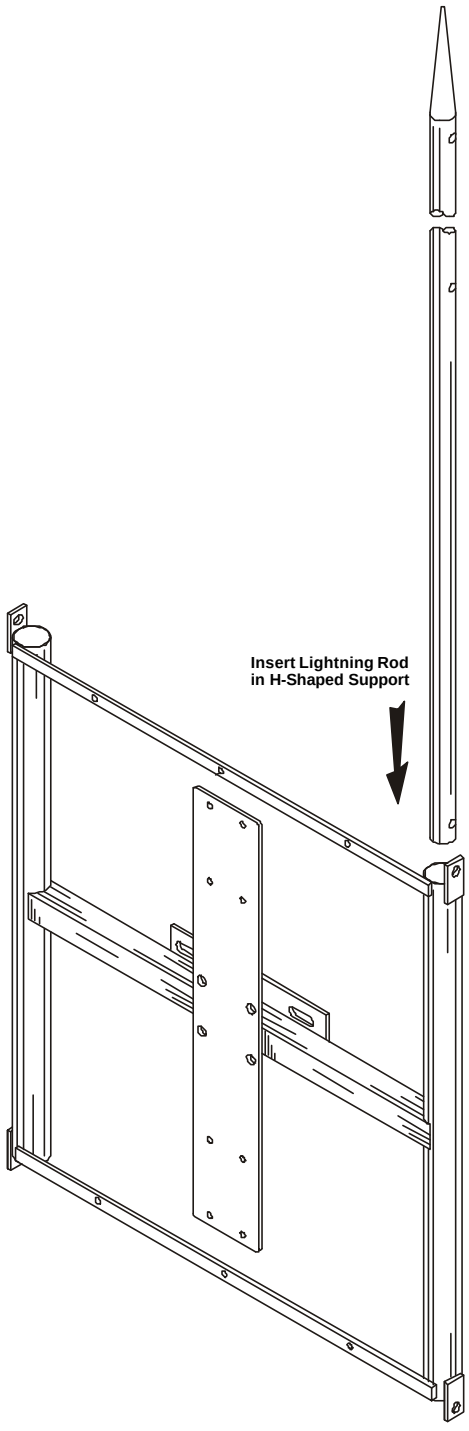


Figure 3-15. Insertion of Lightning Rod in H-Support

Two. Ensure that the contacting surfaces of the lightning rod and of the H-support connection brackets are clean.

Three. Orient the lightning rod so that the holes in the H-support pipe mate with the upper and the lower holes of the lightning rod.

Four. Insert bolts (16) through the two brackets and the lightning rod, and then attach the lightning rod with spring washers (18) and nuts (19) to the H-support.

Five. Measure the contact resistance between the lightning rod and the H-support structure: it should not exceed 2.5 milliohm.

Six. If the resistance exceeds the allowed value, clean again the contact areas and tighten the nut until the required contact resistance is achieved.

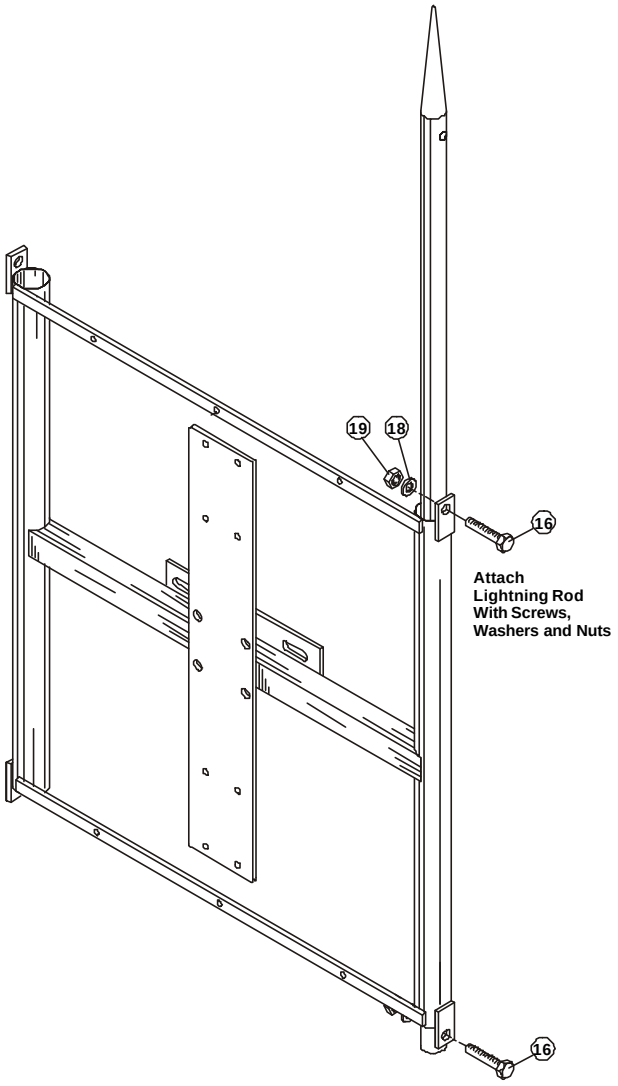


Figure 3-16. Attachment of Lightning Rod

3.11.2.4 RPU Preparation and Mounting

Refer to Figure 2-5 and Figure 3-16 through Figure 3-18. Numbers in brackets refer to Figure 3-17. For each RPU perform the following procedure.

One. Attach a grounding strap to the RPU grounding plate.

Two. Connect the DSL lines in accordance with the procedure of para. 3.14.

Three. Attach the fastener (2) to the RPU by means of screws (3), spring and flat washers and nuts (4, 5, 6) as shown in Figure 3-17. Note that two washers are used around the lower bolt. Do not tighten completely the nut at this phase.

Four. Attach the RPU's fastener (2) to the RPU mounting plate by means of screws, washers and nuts.

Five. Determine the final direction of the RPU and align it as required.

Six. Tighten the nuts (6). Tighten alternatively each nut. Do not exert excessive force.

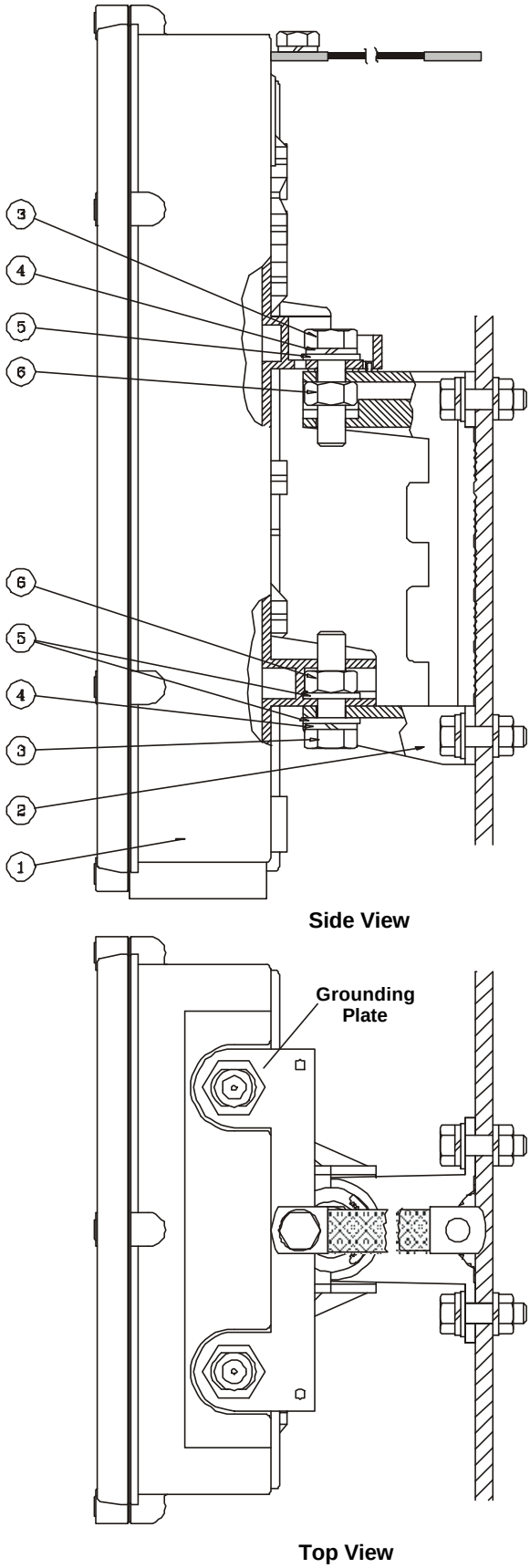


Figure 3-17. Attachment of RPU by Fastener

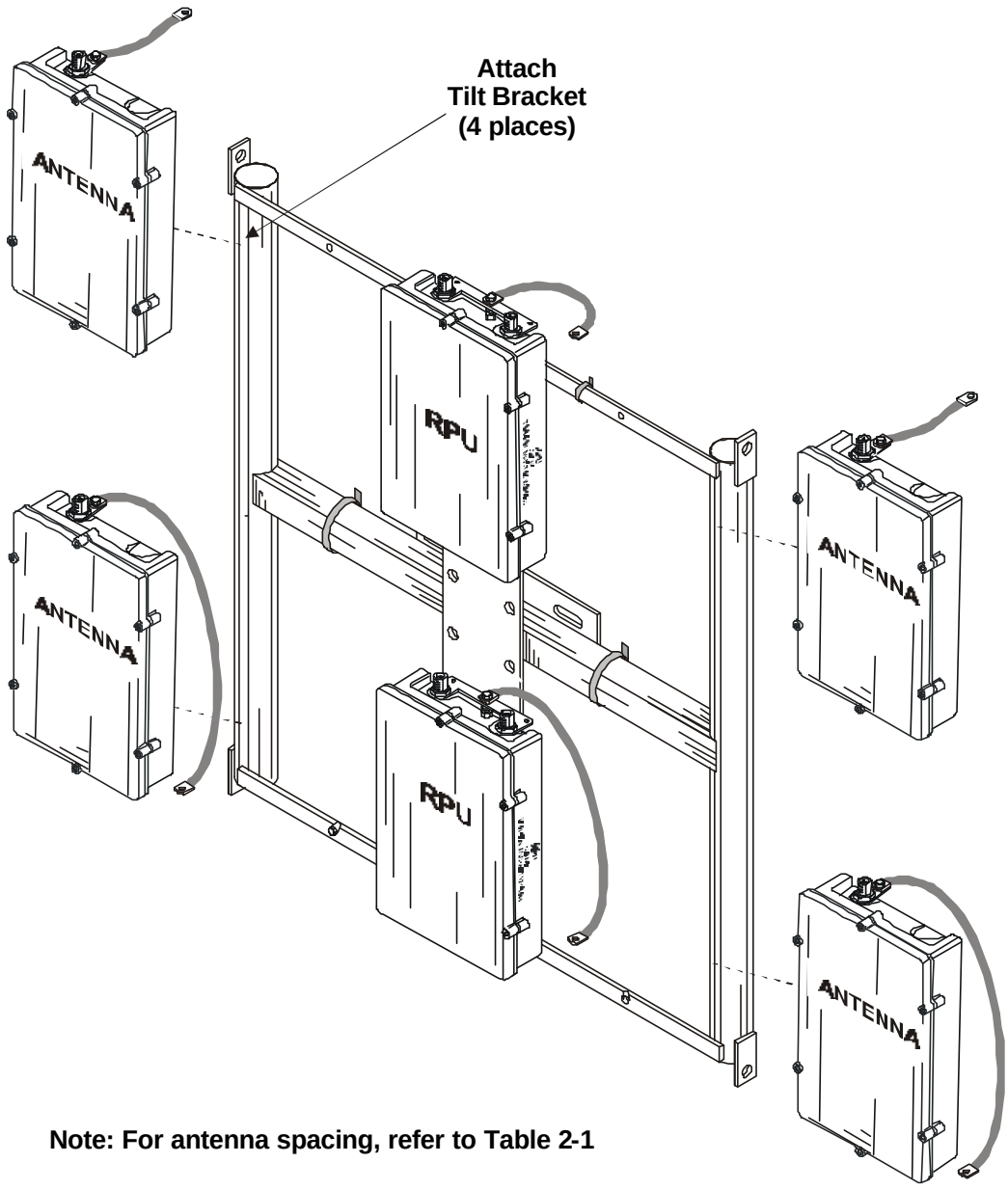


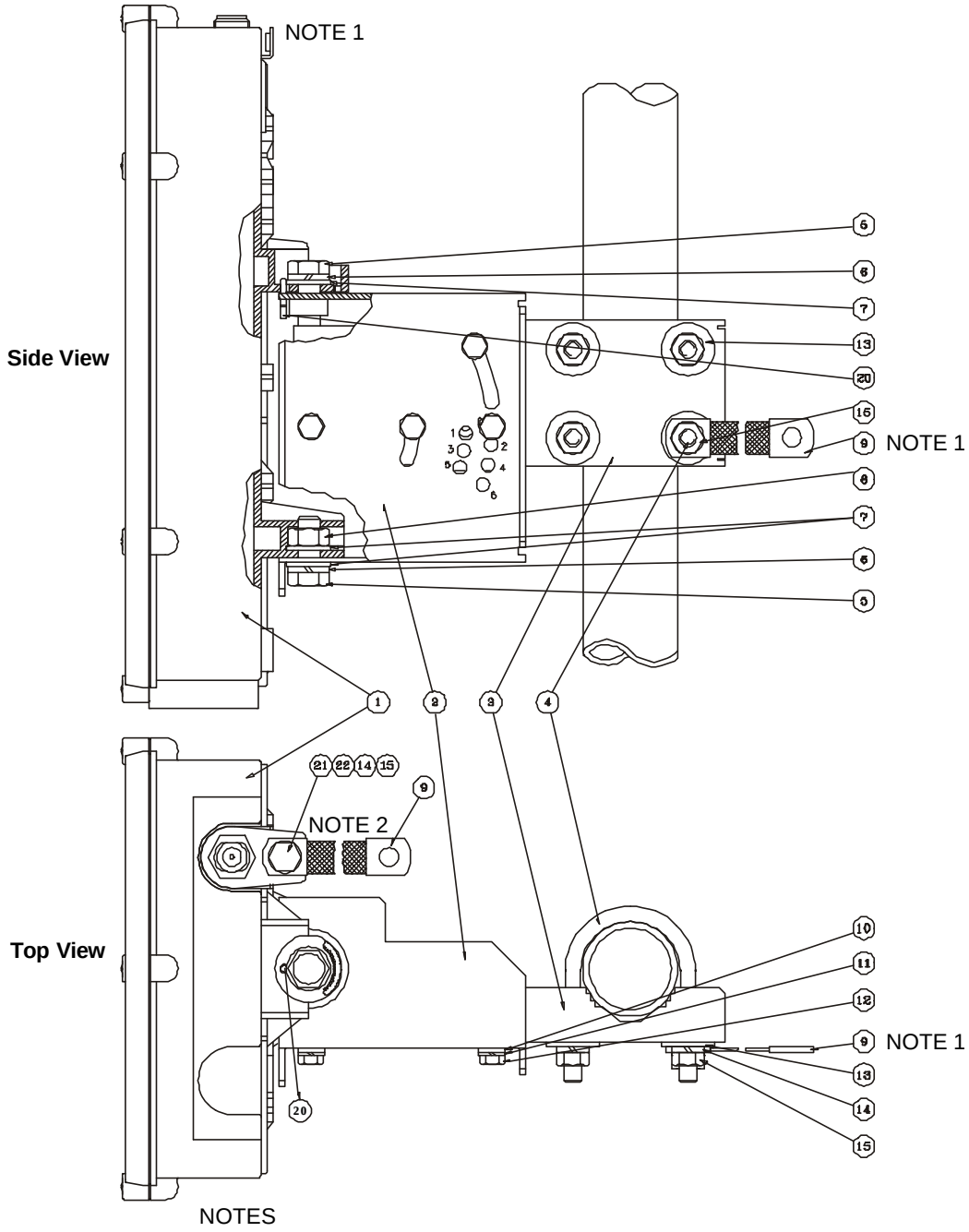
Figure 3-18. RPU's Mounted on H-Support for Pole Mounting

3.11.2.5 Preparation and Mounting of Sectorized Antennas

The following sectorized antenna types are offered:

- 60° sector antennas with external reflectors for operation in the 800 MHz, 1.5 GHz and 1.9 GHz frequency bands.
- 60° sector antennas without external reflectors, for use in the 2.4 and 3.5 GHz frequency bands.

Refer to Figure 1-5 and to Figure 3-18 through Figure 3-22. Numbers in brackets indicate items in Figure 3-19 through Figure 3-22. Para a. below is applicable to sectorized antennas with external reflector. For sectorized antennas without reflectors, skip to para. b. below.



NOTES

1. Applicable to antenna with external reflector (reflector not shown in figure)
2. Applicable to antenna without external reflector

Figure 3-19. Antenna and Tilt Accessories

One. Reflector Attachment.

(1) Prepare seven screws with flat and spring washers (17, 18, 19).

(2) Position the reflector on a clean surface with the flat section upwards.

(3) Position the antenna box under the reflector with the antenna cover face down. Orient the antenna with its upper attachment ear and RF connector near the reflector grounding screw hole.

(4) Lift the antenna, push it into position so as to insert the attachment ears through the reflector holes.

(5) Insert the attachment and grounding screws (17, 18, 19) provided with washers and tighten the seven screws by hand.

(6) Use a flat screwdriver to tighten completely the screws. Tighten the screws alternately, starting with the screws at the opposite ends of a diagonal, then those at the ends of the other diagonal. Do not tighten one screw completely and then the others: take up one turn at a time from each screw sequentially in the order described.

(7) Continue to para. b. below.

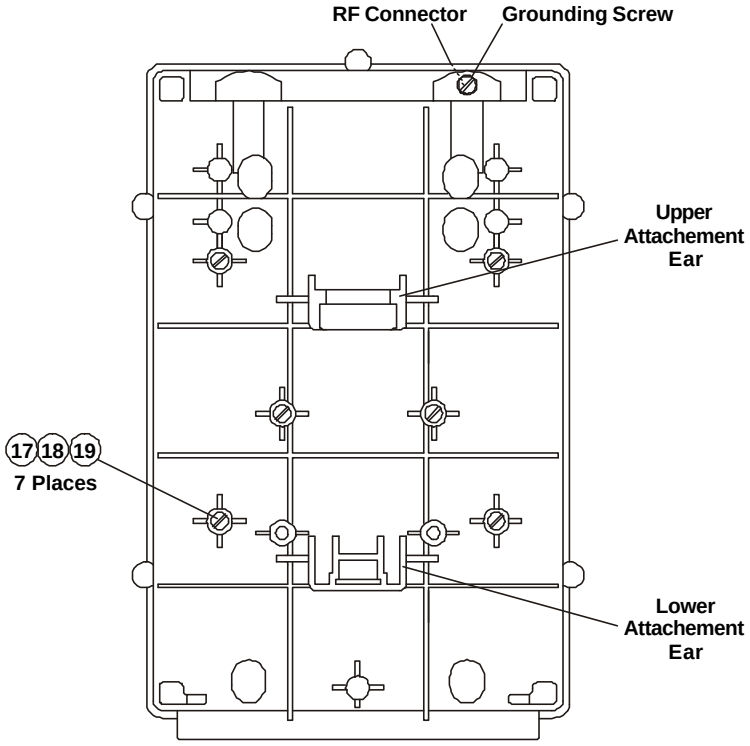


Figure 3-20. Attachment of Antenna Reflector

Two. Tilt Accessories Attachment. Refer to Figure 3-19 through Figure 3-22.

Figure 3-21 shows an upper view of a tilt holder attached to a sectorized antenna with external reflector (16).

Attach the grounding strap and the tilt accessories as follows:

(1) Skip this step for antenna without external reflector: place the tilt holder (2) on the reflector as shown in Figure 3-21 and fasten it to the reflector by means of four screws and shims (17, 18, 19).

(2) Skip this step for antenna with external reflector, place the tilt holder (2) on the rear side of the antenna as shown in Figure 3-21.

(3) Insert a screw and spring and flat washers (5, 6, 7) through the upper antenna attachment ear (as shown in Figure 3-19) and screw it by hand in the thread of the tilt holder (2).

(4) Insert a screw and spring and flat washers (5, 6, 7) through the lower antenna attachment ear. Insert a flat washer and a nut (8), and then screw the nut by hand, clockwise, on the screw that fastens the lower attachment ear.

(5) Position the tilt bracket (3) in the inner side of the tilt holder (2), fasten it to the tilt holder using the tilt axle screw (12) and spring and flat washers (10, 11). Tighten the screw by hand.

(6) Insert the split pin (20) in the dedicated holes through the upper antenna ear and the tilt holder and secure it by bending its ends.

(7) Tighten the upper and the lower screws (5) and nut (8).

(8) Position the tilt bracket to zero tilt. Insert the three tilt adjustment screws and washers and tighten them so that the tilt holder will stay in the horizontal position (i.e., zero tilt).

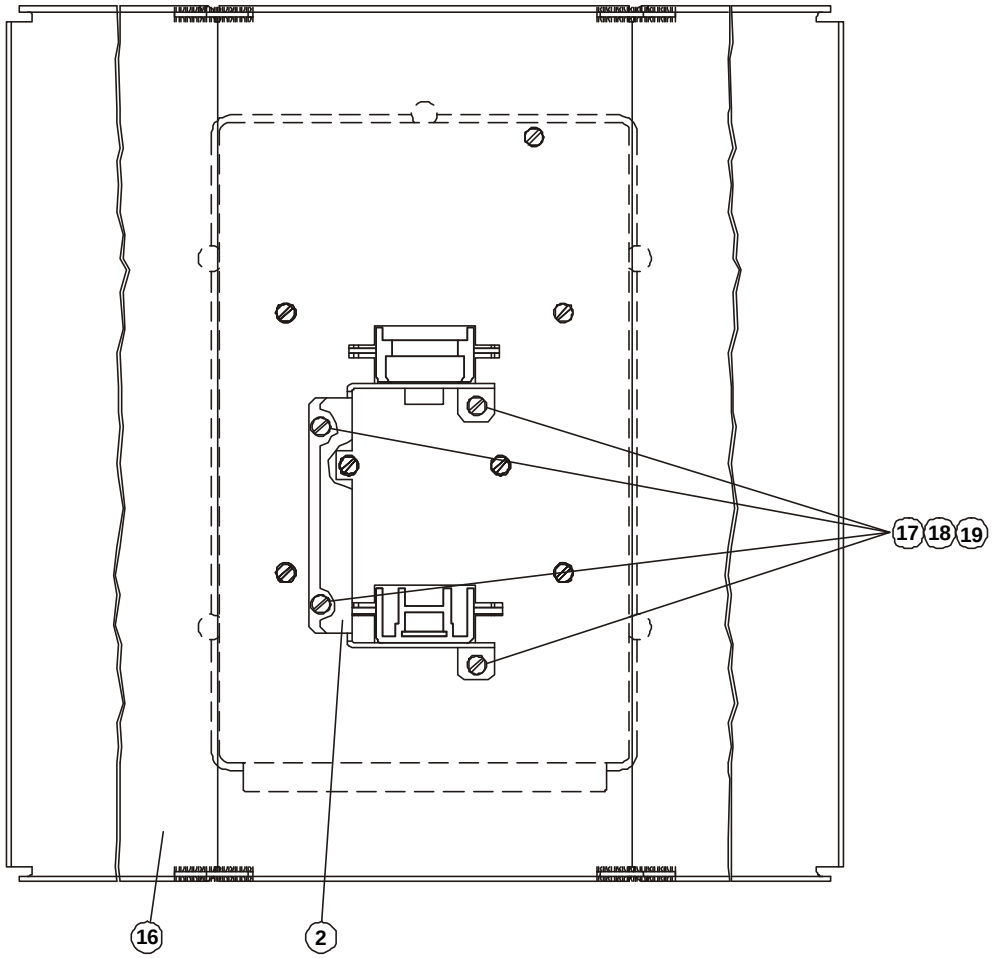


Figure 3-21. Tilt Holder Attachment

(9) Refer to Figure 3-22. The tilt assembly enables to direct the main beam of the antenna in the horizontal direction and below the horizontal up to -18.5°, as specified in Table 3-7. Adjust the antenna to the desired tilt position. Place the tilt adjustment screw in the appropriate position in accordance with the desired tilt angle and tighten the tilt axle and the tilt adjustment screws. Do not exert excessive force.

(10) Attach a grounding wire to the antenna grounding plate by means of a screw (21) flat washer (22), spring washer (14) and nut (15).

Three. Antenna Attachment. Attach the antenna to the H-support as follows:

(1) Refer to Figure 3-18. Determine the place of the antenna on the H-support in accordance with the requirements of para. 2.2.3.

(2) Secure the tilt bracket (3) to the H-support by means of two tilt clamps (5), washers (13, 14) and nuts (15).

(3) Skip to this step for antenna without external reflector: on the lower tilt clamp, insert a grounding strap (9) between the flat and the spring washer.

(4) Adjust the antenna heading by rotating the tilt bracket around the pipe of the antenna support until the desired antenna heading is reached.

(5) Tighten the four nuts (15) that secure the tilt bracket (3) to the H-support.

Four. Perform the procedure of para. a. (if applicable), b., and c. for the other antennas to be mounted.

Table 3-7. Antenna Tilt Adjustment

Hole Number	Tilt
0	0°
1	-2.5°
2	-5.7°
3	-8.9°
4	-12.1°
5	-15.3°
6	-18.5°

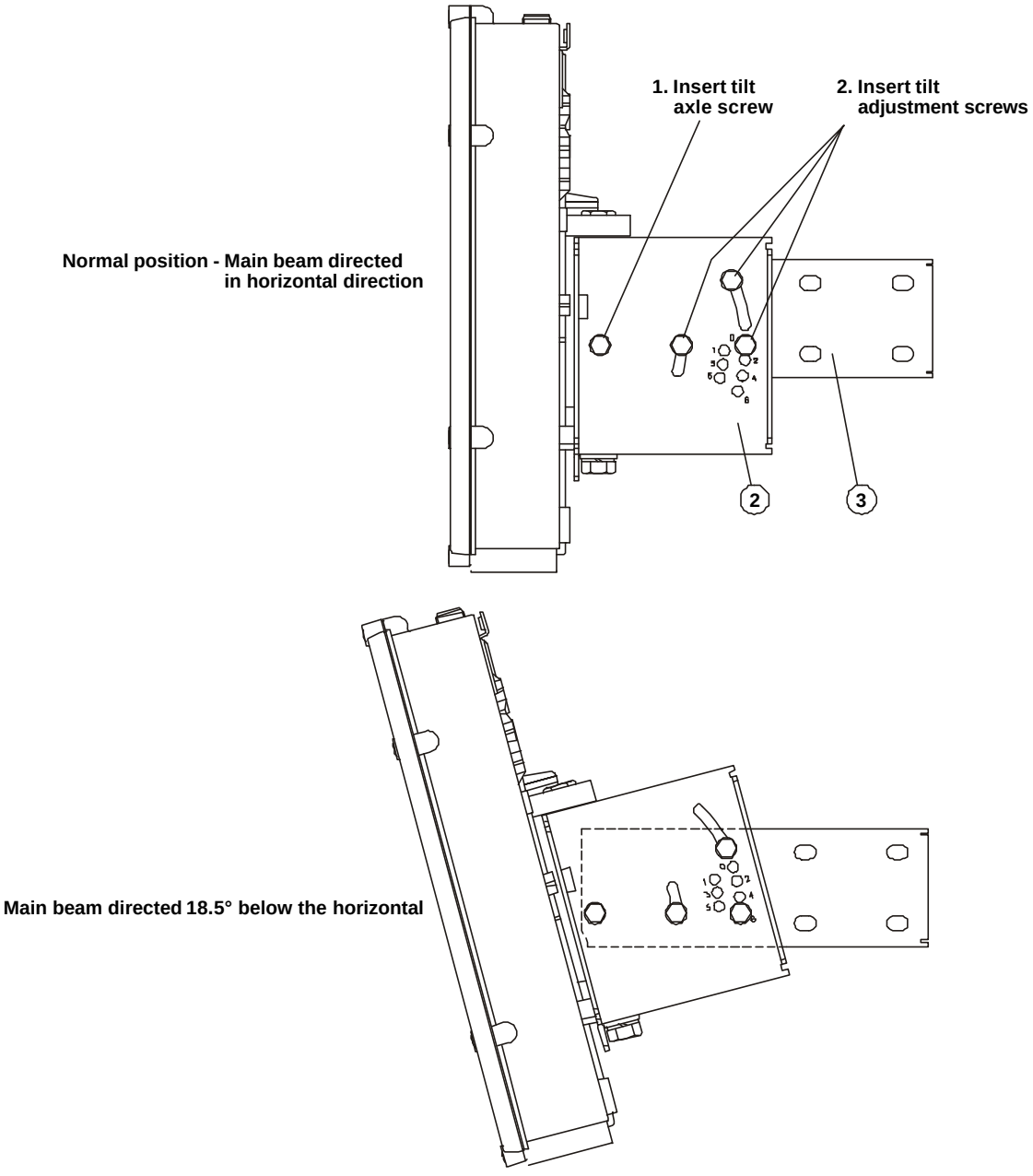


Figure 3-22. Antenna Tilt Adjustment

3.11.2.6 Connection of Grounding Straps and RF Cables

Figure 3-23 shows two RPU's and four sectorized antenna without external reflectors attached to a H-support. Figure 3-24 shows two RPU's and four sectorized antenna with external reflectors attached to a H-support.

One. Connect RF cables between each RPU and its associated antennas.

Two. Connect the grounding wires coming from antennas No. 1 and No. 2, to the RPU grounding plate, by means of screws, spring and flat washers, and nuts.

Three. Attach the RF cables and the grounding wires to the H-support by means of plastic straps. Secure the RF cable surplus to the H-support, behind the antennas.

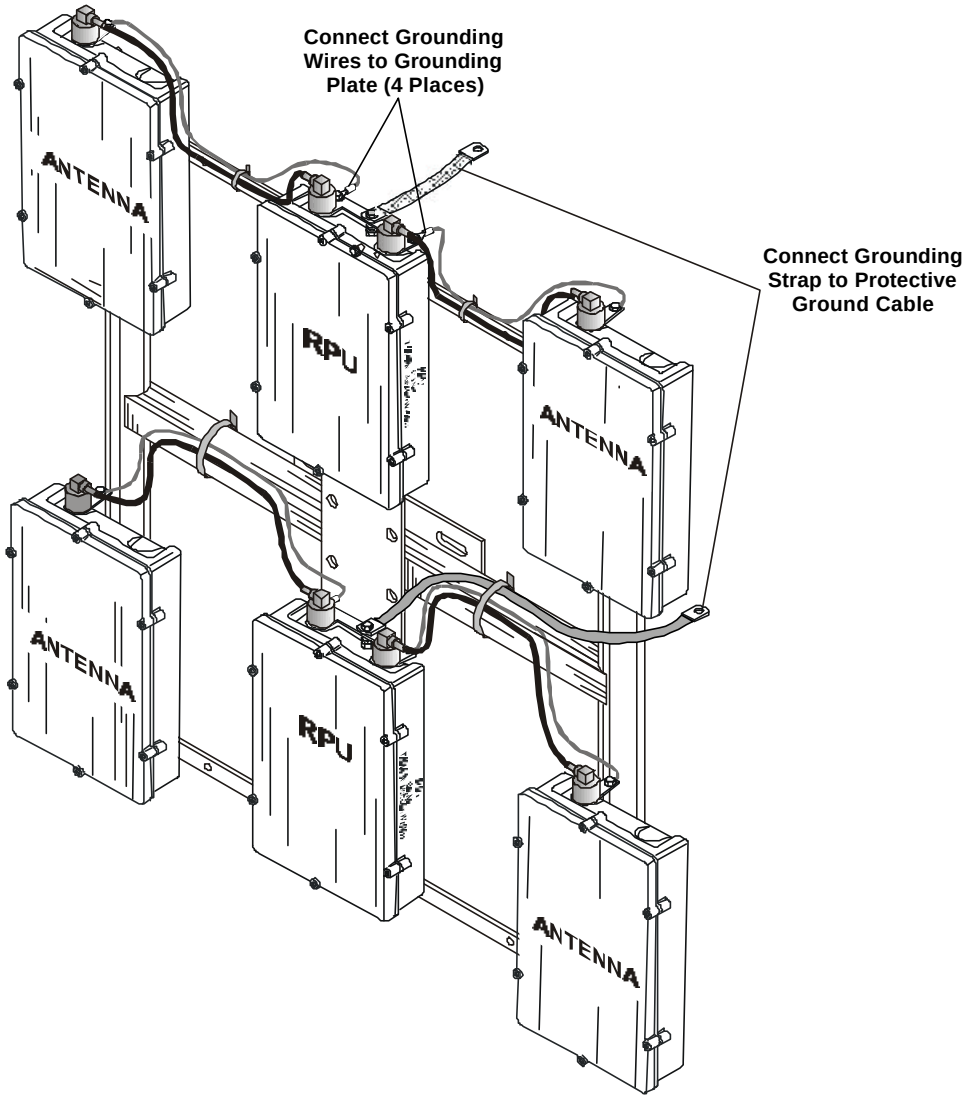


Figure 3-23. Two RPU Stations Mounted on Wide H-Support

3.11.2.7 Antenna Connector Sealing

Seal the connection of the RF cables to the antenna RF connector in accordance with para. 3.15.

3.11.2.8 Preliminary Inspection

Before mounting the assembly on the pole, perform the inspection procedure of para. 3.16.

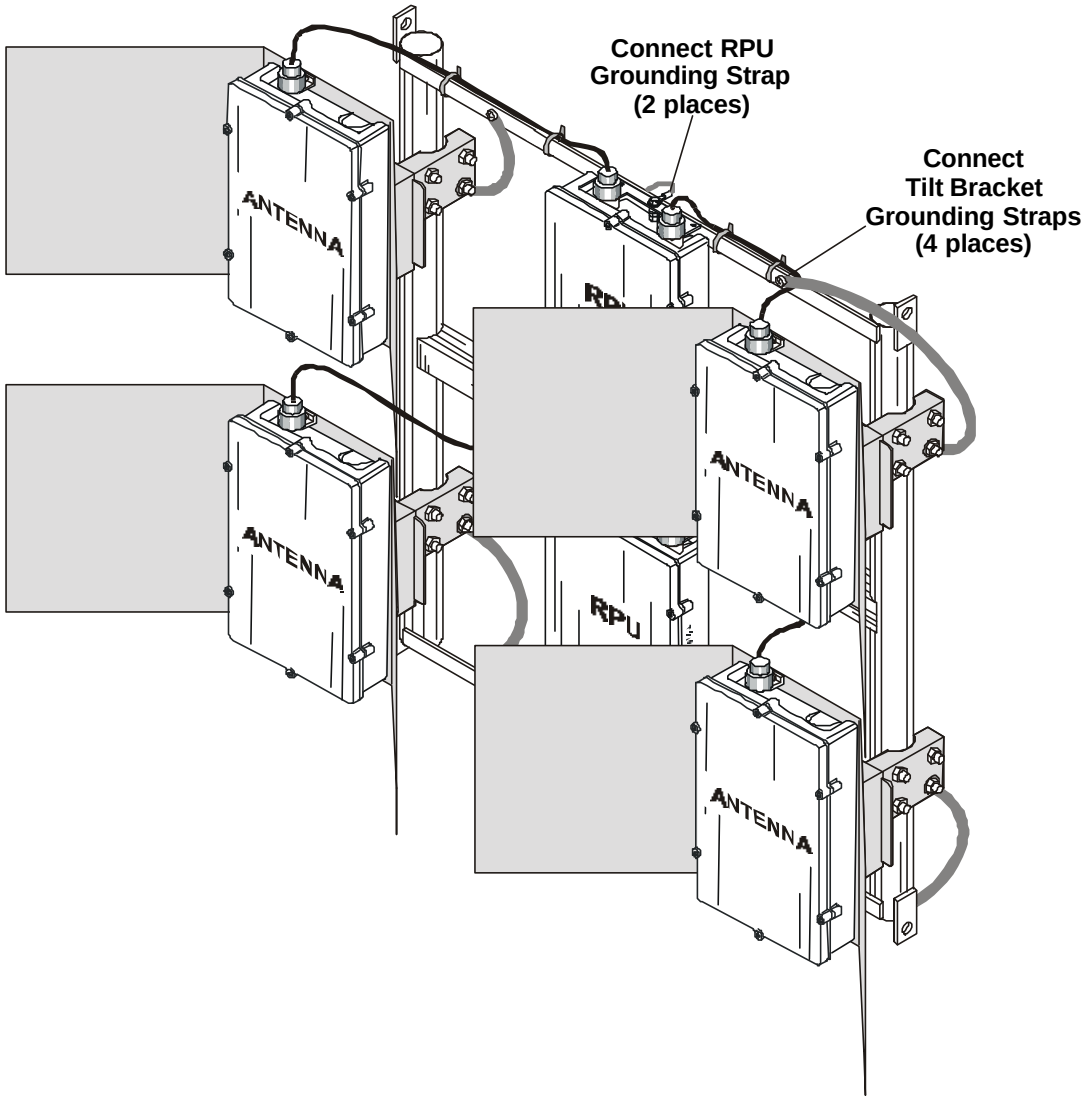


Figure 3-24. Two RPU's and Antennas with External Reflectors Mounted on H-Support

3.11.2.9 Mounting on Pole

Refer to Figure 3-2 and Figure 3-23 through Figure 3-25. Numbers in brackets indicate the numbers of items in Figure 3-2 and Figure 3-25.

One. Ensure that the procedures of para. 3.11.2.3 (if applicable), 3.11.2.4 and 3.12.2.4 through 3.12.2.8 have already been performed.

Two. Make sure that the DSL cables are secured to the support.

Three. Carefully lift the H-support to its intended place on the pole.

Four. Orient the antenna support in the center of the 60° sector to be covered.

Five. Attach the H-support by means of two U-bolts (15), flat and spring shims and nuts as shown in Figure 3-2 and Figure 3-25.

Six. Connect the H-support to the pole lightning discharge cable by means of grounding straps, bolts, flat and spring shims and nuts as shown in Figure 3-25.

Seven. Connect the RPU grounding plates to the protective ground cable by means of grounding straps, bolts, flat and spring shims and nuts.

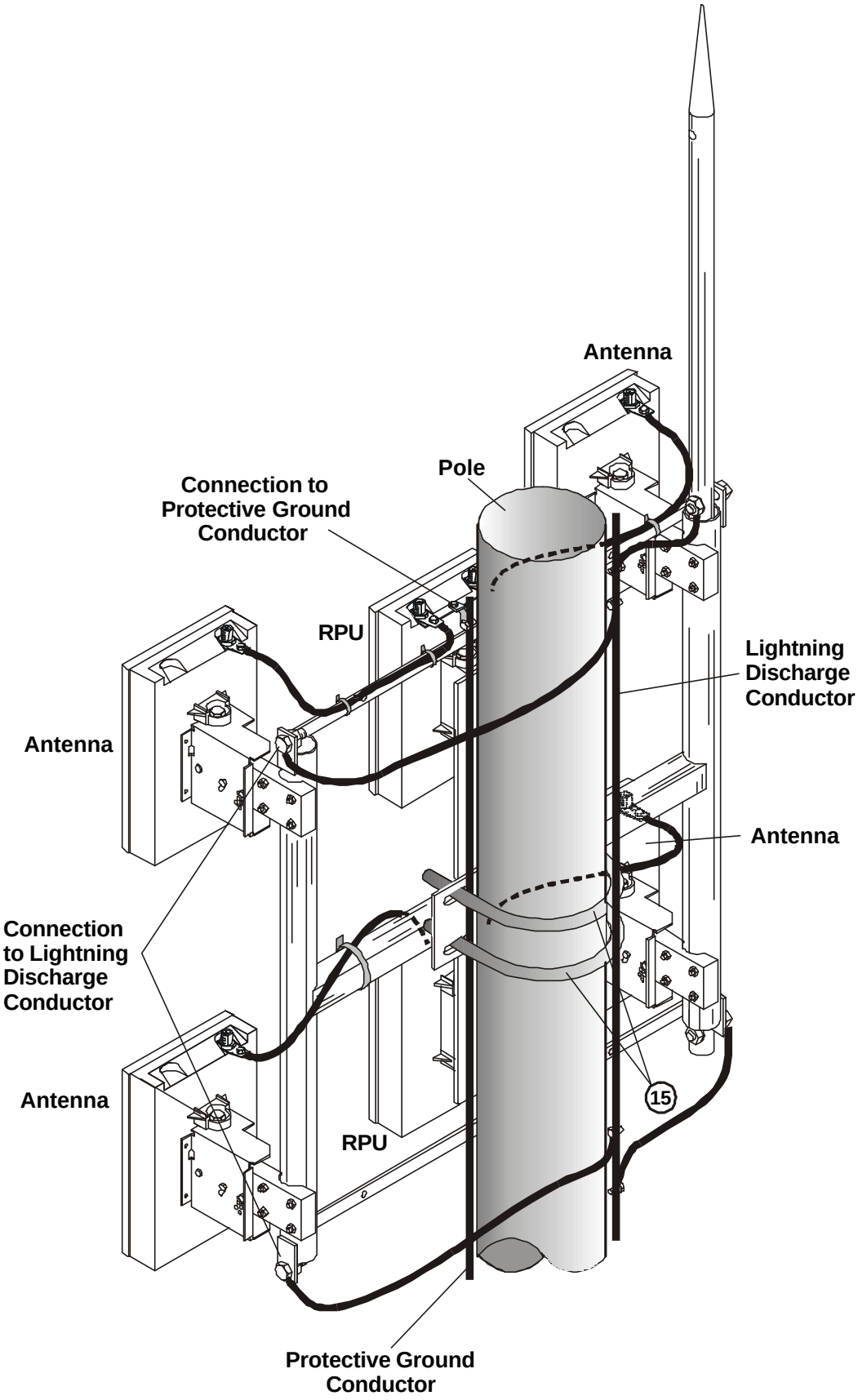


Figure 3-25. Mounting of H-Support on Pole (RF Cables Not Shown)

3.12 RPU with Sectorized Antennas Mounted on Tower

This paragraph presents instructions for mounting two RPU's and four sectorized antennas on a tower, by means of a dedicated H-support. The antennas shall be attached to the support by means of antenna tilt assemblies. Typical recommended H-supports for tower mounting are shown in Figure 3-3 through Figure 3-11.

3.12.1 Required Equipment and Materials

The equipment and materials required for mounting one sectorized antenna by means of a tilt assembly are listed in Table 3-5. The equipment and materials required for mounting narrow H-supports are listed in Table 3-1 through Table 3-3. The equipment and materials required for mounting a lightning rod are listed in Table 3-6.

3.12.2 Mounting Instructions

The mounting procedure comprises the following steps:

- Site preparation - para. 3.12.2.1.
- Equipment unpacking and preparation - para. 3.12.2.2.
- Mounting of lightning rod - para. 3.12.2.3.
- RPU preparation and mounting - para. 3.12.2.4.
- Preparation and mounting of sectorized antennas - para. 3.12.2.5.
- Connection of grounding strap and RF cables - para. 3.12.2.6.
- Antenna connector sealing - para. 3.12.2.7.
- Preliminary inspection - para. 3.12.2.8.
- Mounting on tower - para. 3.12.2.9.

3.12.2.1 Site Preparation

Prepare the site(s) intended for the installation of the RPU station(s) on tower in accordance with the requirements of para. 3.6.2.

3.12.2.2 Equipment Unpacking and Preparation

One. Open the packing containers and take out the equipment and the materials.

Two. Inspect the equipment for any signs of damage.

Three. Refer to the installation plan. Check the received items against the following list and your installation plan.

(1) H-support(s) and mounting accessories.

- For RPU stations operating in the 0.8, 1.5 or 1.9 GHz bands, use wide H-supports (Figure 3-4 through Figure 3-7).
- For RPU stations operating in the 2.4 or 3.5 GHz band, you can use either wide or narrow H-supports. However, to multiple RPU stations operating in the 2.4 or 3.5 GHz band for 360° radio coverage at one level (Figure 2-2) or on towers with sections exceeding 1200 mm, you can only use narrow H-supports (Figure 3-8 through Figure 3-12).

  Refer to para. 3.8.2 and prepare the appropriate support(s) in accordance with the intended application.

(2) RPU(s).

(3) For each sectorized antenna, prepare the equipment listed in Table 3-5.

3.12.2.3 Lightning Rod Mounting Instructions

A lightning rod must only be installed on the H-support intended for installation at the top of the pole.

The procedure for mounting the lightning rod is given in para. 3.11.2.3.

3.12.2.4 RPU Preparation and Mounting

For each RPU to be mounted, perform the procedure of para. 3.11.2.4.

3.12.2.5 Preparation and Mounting of Sectorized Antennas

For each antenna to be mounted, perform the procedure of para. 3.11.2.5.

3.12.2.6 Connection of Grounding Straps and RF Cables

Perform the procedure of para. 3.11.2.6. Refer to Figure 3-23 or Figure 3-24 for the connections to be made to equipment installed on wide H-supports, and to Figure 3-26 for the connections to be made to equipment installed on narrow H-supports.

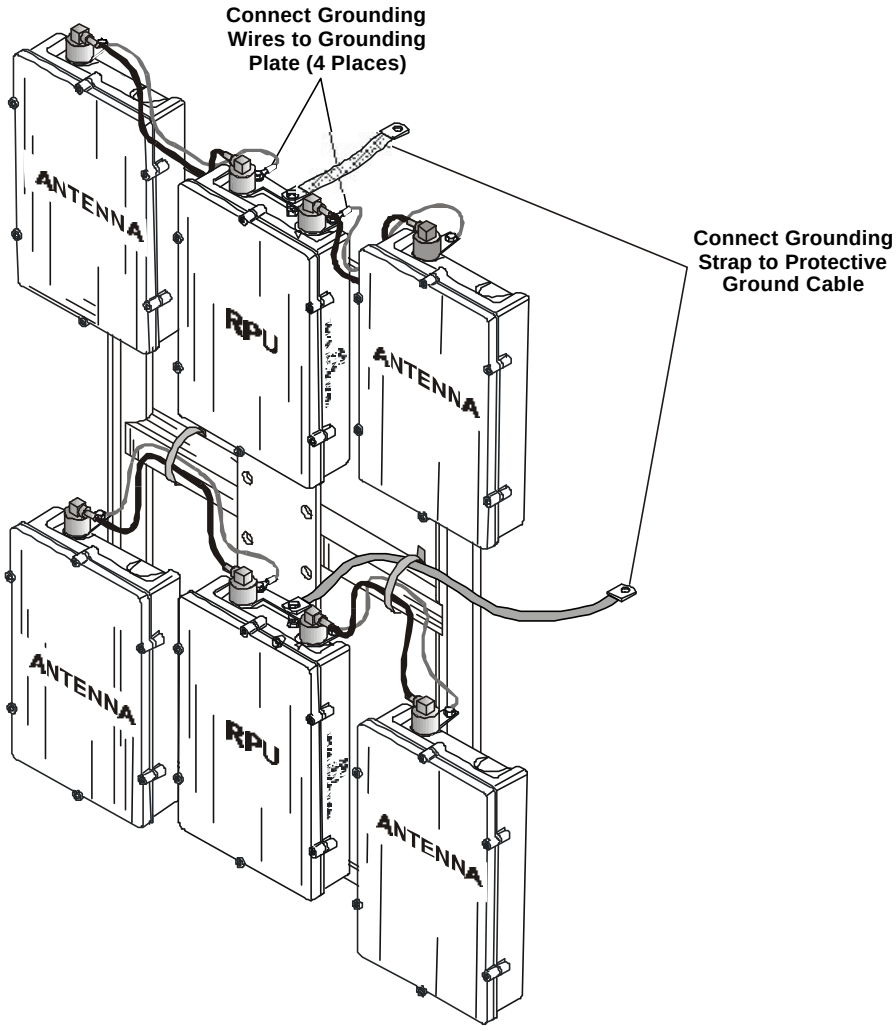


Figure 3-26. Two RPU Stations Mounted on Narrow H-Support

3.12.2.7 Antenna Connector Sealing

Seal the connection of the RF cables to the antenna RF connector in accordance with para. 3.15.

3.12.2.8 Preliminary Inspection

Before mounting the H-support on tower, perform the procedure given in para. 3.16.

3.12.2.9 Mounting on Tower

One. Ensure that the procedures of para. 3.12.2.3 (if applicable), and 3.12.2.4 through 3.12.2.8 have already been performed for all the RPU's and antennas that have to be mounted on the support.

Two. Make sure that the DSL cables are secured to the support.

Three. Attach the tower mounting support to the H-support as shown in Figure 3-4 or Figure 3-6, or Figure 3-3 and Figure 3-8 through Figure 3-11, as applicable. Note that the wide H-support can be vertically deflected by ±20° by using the right or the left attachment section of the tower mounting support and that each narrow H-support can be vertically deflected by ±30° around the right or the left attachment section of the tower mounting support.

Four. Carefully lift the H-support to its intended place on the tower.

Five. Orient the antenna support in the center of the 60° sector to be covered.

Six. Attach the tower mounting support to the tower by means of appropriate U-bolts, flat and spring shims and nuts as shown in Figure 2-2 or Figure 2-3, and Figure 3-5 or Figure 3-7, or by means of Z-adapter(s), flat and spring shims and nuts as shown in Figure 3-3 and Figure 3-10 through Figure 3-12 (as applicable). The H-support can be attached to the tower by using appropriate U-bolts, in accordance with the dimensions of the tower section.

Seven. Connect the H-support to the tower lightning discharge conductor, by means of grounding cables, as shown in Figure 3-25 and Figure 3-26.

Section IV. RPU INSTALLATION AND CONNECTION INSTRUCTIONS

WARNING - HIGH VOLTAGE

Dangerously high voltages, that may cause injury or death on contact, are present in this equipment and on the lines connected to the RPCU or to the MCX-R unit. In addition, personnel must be aware that under certain external fault conditions, dangerous voltages may appear on the cables connected to the RPU and antennas.
Before connecting the DSL lines, the remote power feed must be deactivated at the RPCU site in accordance with the DSL lines connection procedure.

WARNING - RF RADIATION

Microwave radiation is emitted by the antennas during operation.

3.13 Scope

This Section contains procedures for the connection and installation of the RPU and the associated antennas. These procedures shall be performed in conjunction with the mounting instructions given in Section III.

The RPU and antenna installation procedures, and the line connections, must be carried out only by qualified personnel.

The procedures given in para. 3.15 and 3.16 shall generally be performed before lifting the RPU and antennas or the mounting support for mounting on the pole, mast or tower.

The complete installation procedure of an RPU station comprises the preparations and the mounting instructions given in Section III for each mounting option, and the installation and connection instructions given in Section IV, that are applicable to all the mounting options.

3.14 Connection of DSL Lines

One. Establish communication with the operator of CMAP8000 or Super Office MAP management system, and with qualified personnel at the RPCU site.

Two. Ensure that the relevant RPI cards in the RPCU that interface with the RPU's to be installed have been installed, configured, and defined.

Three. Request to define the relevant MDSL as NOT EQUIPPED.

WARNING

Do not change MDSL status, unless specifically instructed to do so.

Four. Refer to Figure 3-27 and Figure 3-28 and perform the following steps:

(1) Unscrew the two screws that fasten the bottom cover of the RPU case.

(2) Insert the DSL cable through the grommet in the RPU cover and connect the DSL lines to the DSL-1 and DSL-2 terminals on the DSL line connector as shown in Figure 3-27 and Figure 3-28. Make sure that each DSL wire pair is separately connected.

⚠ CAUTION

The wire pairs must not be interchanged.

(3) Connect the DSL line connector to the RPU line connector.

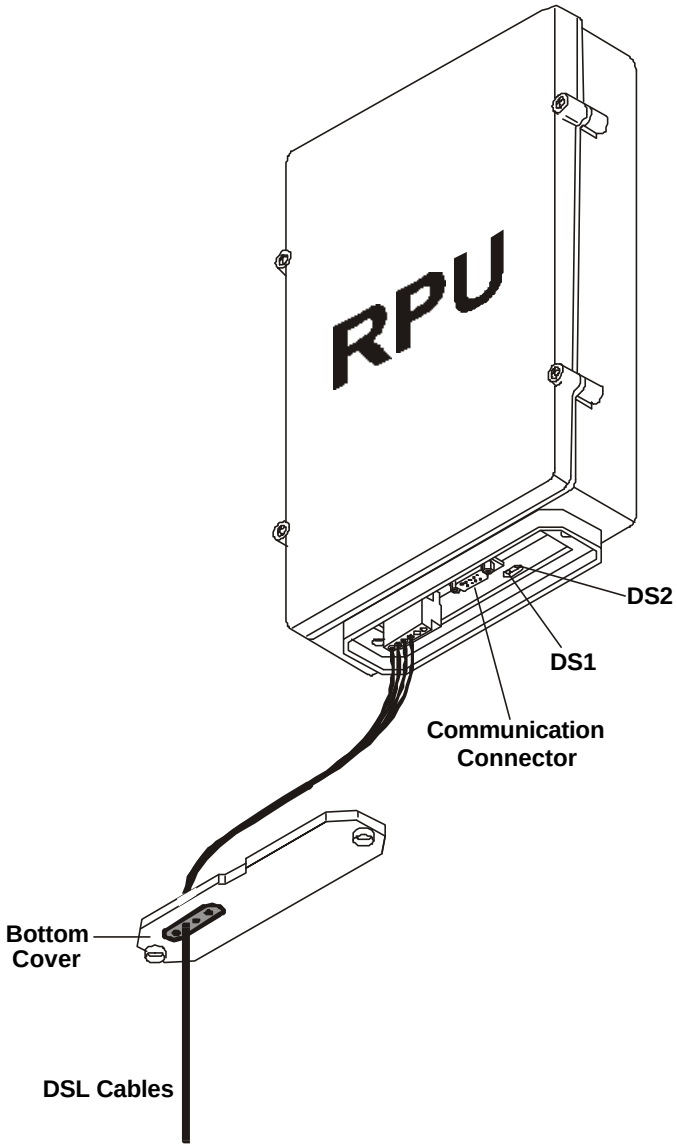


Figure 3-27. Connection of DSL Lines to the RPU

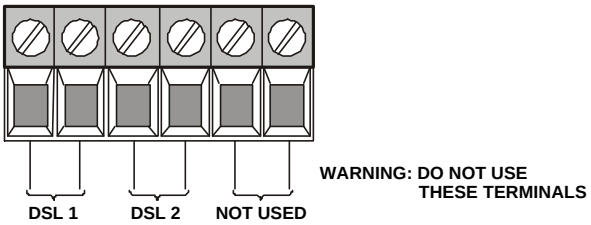


Figure 3-28. Connections to DSL Line Connector

Five. At the RPCU site, connect the DSL cable via the DSL distribution frame to RPCU1 connectors J10, J11 or J12, as applicable. When connecting to an old-generation RPCU, connect the DSL cable to connectors J9 or J14, as applicable.

☞ NOTE

The RPU does not have a power switch. Operation starts as soon as power is connected to the unit via the DSL lines (power is connected when the corresponding MDSL is defined as equipped).

WARNING - RF RADIATION

Microwave radiation is emitted by the antennas while the RPU is powered.

Six. Request the CMAP-8000 operator to define the MDSL connected to the RPU being installed as EQUIPPED.

Seven. On the RPU, verify that the DS1 and DS2 indicators turn on when the RPU is powered.

Eight. For your safety and to avoid unnecessary exposure to microwave radiation, request the CMAP-8000 operator to redefine the MDSL connected to the RPU being installed as NOT EQUIPPED, until you finish the installation of the RPU (steps i, and j and installation in the final location).

Nine. Close the RPU bottom cover and fasten it with the two captive screws. Tighten the screws. Do not use excessive force.

Ten. Repeat para. c. through i. above for each RPU to be installed on same tower or mast.

Eleven. Continue to the RPU PREPARATION AND MOUNTING section for the applicable mounting option procedure, given in Section III. When done, notify the CMAP-8000 operator that the installation has been completed, and therefore the RPU station can be put into operation by defining the MDSL connected to the RPU as EQUIPPED.

3.15 Sealing of RF Cable Connectors

The connections of the RF cables to the antenna and RPU RF connectors must be sealed by wrapping a self-adhesive tape (Cat. No. 254-61956D by ELECTRO SPEED) around the RF connectors.

3.16 Preliminary Inspection

Before mounting the H-support on a pole, mast or tower, perform the following inspection:

- Ensure that the RPU mounting, installation, connections, and the RF cable connectors sealing have already been performed in accordance with the applicable procedures.
- Ensure that all the cables and wires are properly fastened to their supports.

3.17 Final Inspection

- Ensure that the RPU mounting installation connection and RF cable connectors sealing have already been performed in accordance with the applicable procedures.
- Tighten all screws and nuts.
- Ensure that all the cables and wires are properly fastened to they supports pole, mast or tower.
- Check that the antenna heading complies with the installation plan.
- After completion of the mounting, installation and connection procedures, configure the parameters of the RPU as described in Chapter 5.