Chapter 6

Connecting antennas

About this chapter

This chapter explains how to install the Rox System cabinet seal and how to connect RF and GPS antennas internally and externally. This chapter has the following sections:

Understanding the antenna installation process

This process explains all steps and procedures to follow when connecting RF and GPS antenna cables.

1. **Understanding cautions and warnings**

   Understand and follow all warnings and cautions or injury, death, or damage to equipment can occur.

   See Understanding warnings and cautions on page 99.

2. **Understanding the Rox System**

   This section explains the pre-assembled configuration in which the Rox System ships.

   See Understanding the pre-assembled Rox System on page 100.

   You can optionally assemble your own Rox System.

   See Optionally assembling your own Rox on page 102.

3. **Removing access panels**

   Remove the antenna access panel in order to install the Rox System cabinet seal. You must also remove the surge protection access panel in order to connect Rox System antenna cables internally to the surge protection bar.

   See Removing access panels on page 104

4. **Installing the Rox System cabinet seal**

   The Rox System cabinet seal must be installed into the cabinet opening created when you remove the antenna access panel on the top back of the cabinet. Installation involves routing the cables into the cabinet and screwing the Rox System cabinet seal into place.

   See Installing the Rox System cabinet seal on page 107.

5. **Connecting GPS and RF antennas**

   All antenna cables routed through the Rox System cabinet seal must be connected to the surge protection bar on the inside of the cabinet and to external antenna cables/surge protection equipment on the outside of the cabinet. The surge protection access panel must be re-installed.

   See Connecting GPS and RF antennas on page 109.

This process is complete. You must install modules. Go to Understanding the module installation process on page 116.

Understanding warnings and cautions

This section contains warnings and cautions that apply to all procedures in this chapter.

Be sure you have read and understood Understanding the antenna installation process on page 98 before continuing.

WARNING

Do not perform any of these procedures when there is a possibility of lightning strikes. Death or injury could occur if lightning strikes during installation.

WARNING

Upon installation, this product is required to comply with the requirements of Federal Communications Commission 47CFR 1.1310, Radiofrequency radiation exposure limits. Care must be taken by the installer to insure that the antenna chosen along with its installation position and orientation does not violate these limits.

WARNING

Do not perform any of these procedures if the IP-RN 8000 has not been properly grounded.

CAUTION

Wear an ESD strap () and connect the strap to the ESD jack in the Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 21.

Understanding the pre-assembled Rox System

The Rox System cabinet seal typically ships pre-assembled and is ready to install. The pre-assembled Rox System cabinet seal supports:

- Three radio sectors
- Each radio sector has two RF antenna cables. One cable carries two signals, a transmit signal and a receive signal. The second contains a single receive antenna cable.
- Two GPS antenna cables — one primary GPS antenna and one redundant GPS antenna

The pre-assembled Rox System can be used on installations with:

- One, two, or three radio sectors. See Understanding radio sectors on page 15.

  If fewer than three radio sectors are used at a particular installation, the unused RF antenna cables exiting through the Rox System cabinet seal must be connected to external surge suppression equipment to prevent equipment damage from lightning strikes.
- Redundant and non-redundant Digital Module Kits.

  Redundant installations use two GPS antennas; non-redundant installations use a single GPS antenna. (See Understanding Digital Module Kit redundancy on page 23.) In non-redundant installations, the secondary GPS antenna cable must be connected to external surge suppression equipment to prevent damage from lightning strikes.

The pre-assembled Rox System cannot be used for installations that have three separate RF antenna cables for each radio sector. In this case, you must use a specially-ordered Rox System cabinet seal with nine RF cables.

The pre-assembled Rox System is shipped fully assembled with cables that are 8 feet long, 3/8 inch or 1/2 inch in diameter, and have male N-Type connectors at both ends. See Table 18.

NOTE

If you special ordered a Rox System cabinet seal, or assembled it yourself, you might have a different number of cables and different connector types.

Table 18 The standard Rox System cabinet seal assembly

Type	Sector	Use	label	Connector (both ends)
RF	alpha	Receive antenna cable	α RX1	male N-type
		Transmit and receive antenna cable	α TX/RX0	male N-type
	beta	Receive antenna cable	β RX1	male N-type
		Transmit and receive antenna cable	β TX/RX0	male N-type
	gamma	Receive antenna cable	χ RX1	male N-type
		Transmit and receive antenna cable	χ TX/RX0	male N-type
GPS	not applicable	primary GPS antenna cable	GPS_P	male N-type
		secondary GPS antenna cable	GPS_R	male N-type

Optionally assembling your own Rox

You can optionally assemble your own Rox System cabinet seal. If you are not assembling your Rox System cabinet seal, you can skip this section.

With this option, Airvana provides the Rox System cabinet seal and related components, but you must provide the antenna cables and cable connectors.

CAUTION

If you assemble the Rox System cabinet seals, you are responsible for any damage resulting from improper assembly. Ensure that only qualified personnel perform the assembly.

Airvana Rox kits

This Airvana Rox Kit consists of the following:

- RoxTec Frame Kit, ES-CF-16, quantity: 1
- RoxTec Module Kit, ES-CM-20 w40, quantity: 8
- Mounting Plate with gaskets, quantity: 1

For more additional information about the Rox Kit, you can contact RoxTec. The Rox Kit is identified by part number 6000-004652-100

Assembly requirements

When assembling Rox System cabinet seals, you must adhere to the following requirements. These requirements are for installation in the top rear antenna access panel opening.

Requirements:

- Internal connectors: N-type, male, straight, hex
- External connectors: site specific, defined by customer
- Length of internal cables: 21 inches, measured from inside edge of Rox System to the end of connector
- Overall cable length: site specific, defined by customer (21 inches internal length + 1.5 inches Rox thickness + user defined external length)
- Cable size: maximum overall diameter (OD) of 14.5mm (0.571 inches) including sheath; minimum OD of 4 mm (0.157 inches) of cable screen
- Cable type: defined by customer (suggested type: Andrew Corporation Part #FSJ4-50B, 1/2 inch 50 ohm Superflex or Times Microwave LMR400DB with EZ connectors)

RF and GPS cable locations

Airvana recommends installing the RF and GPS cables into the positions in the Rox System cabinet seal that are shown in Figure 20. This enables determination of which cable serves which function after the Rox System cabinet seal has been installed even if cable labels are missing. This recommendation is for a three sector node, with two RF antennas per sector, and in a redundant configuration requiring two GPS cables.

Cables should be labeled as to their function on both the internal side and the external side of the Rox System cabinet seal.

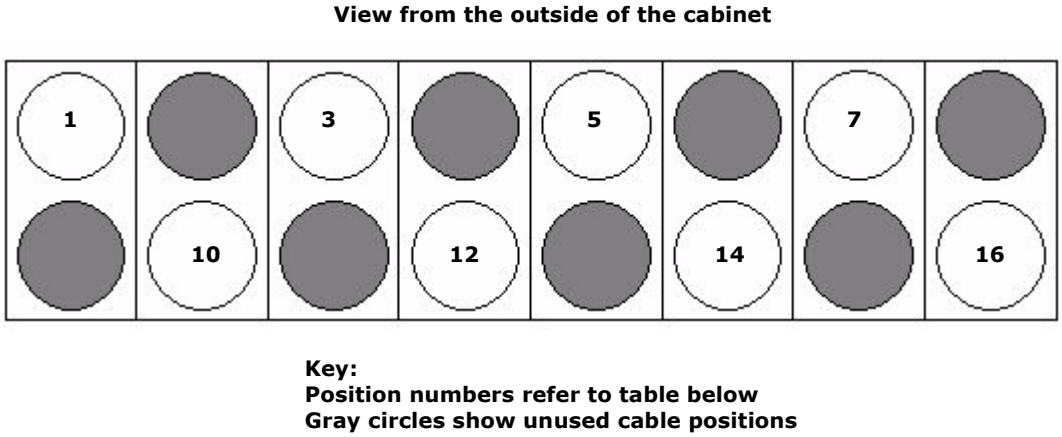


Figure 20 Recommended cable positions in Rox System viewed from the external side of the Rox

Table 19 Recommended cable positions in Rox System cabinet seal

Position	Cable description
1	Redundant GPS cable
3	TX/RX0 cable for gamma sector
5	TX/RX0 cable for beta sector
7	TX/RX0 cable for alpha sector
10	RX1 cable for gamma sector
12	RX1 cable for beta sector
14	RX1 cable for alpha sector
16	Primary GPS cable

Removing access panels

This procedure explains how to remove the two required access panels in order to install the Rox System Cabinet seal and connect all antennas.

Be sure you have read and understood Understanding the antenna installation process on page 98 before continuing.

Requirements

- 5/32 tamper-resistant screw driver
- Thread tapping kit with 1/4-20 thread bit at 3/4 inch depth

Procedure

1. Ensure that power is not being delivered to the IP-RN 8000.
   a. Ensure the Main Power switch on the Power Distribution Unit is flipped to the right.
      See Understanding the Power Distribution Unit on page 31.
   b. Ensure the external circuit breaker that controls power flow to the IP-RN 8000 is opened, eliminating power on the IP-RN 8000 circuit.

2. Locate the antenna access panel on the cabinet where you will install the Rox System.

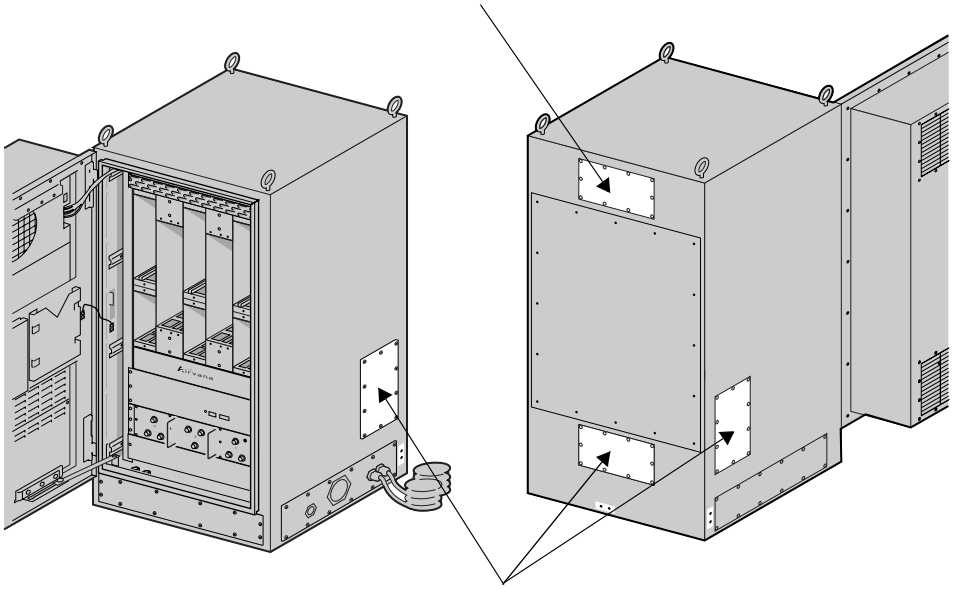
   There are four antenna access panels. The Rox System can be installed into any one of the cabinet openings created when the access panels are removed.

   The standard configuration requires installing the Rox System into the access panel on the **top of the back of the cabinet**.

NOTE

Installing the Rox System cabinet seal into any of the three non-standard access panels requires a different internal configuration of the cabinet, and it must have been specially ordered.

Standard Rox System cabinet seal installation panel



Non-standard Rox System installation panels

3. Remove the 10 screws from the antenna access panel with the tamper-proof screwdriver, being careful not to let the access panel fall when the final screw is removed.

CAUTION

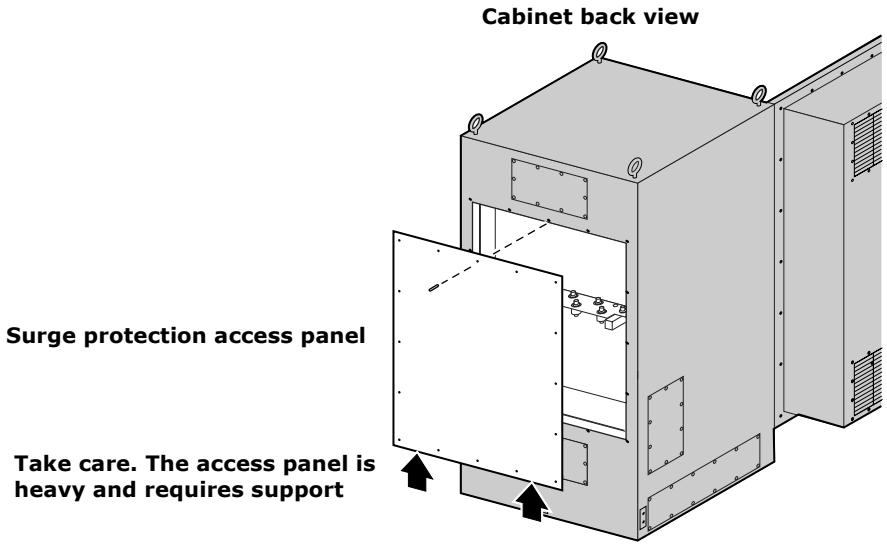
Access panels must be handled carefully. If they are bent they may not form a proper seal with the cabinet when they are re-installed. An intact seal on the inside edge of the access panel is required to ensure external environmental conditions are sealed out.

4. Set aside the 10 antenna access panel screws and washers.

   The screws and washers will be required for installing the Rox System cabinet seal.

   The antenna access panel cover that you just removed will not be required for this installation. Save it for later use as appropriate.

5. Locate the surge protection access panel.



6. Remove 15 of the 16 screws holding the surge protection access panel in place. **Leave the top middle screw in place**.

7. Hold the surge protection access panel firmly in place and remove the final screw using the tamper resistant screw driver.

WARNING

The surge protection access panel is heavy. Take all necessary precautions to avoid injury and to avoid damaging the access panel. Do not allow it to be bent. Do not allow the seal around the inside edge to be damaged.

8. Set aside all 16 screws and washers from the surge protection access panel.

   These screws will be used to re-install the access panel after all antennas are connected.

This procedure is complete. Go to Installing the Rox System cabinet seal on page 107.

Installing the Rox System cabinet seal

This procedure explains how to install the Rox System cabinet seal. This procedure assumes that the power supply has been turned off and that power is not flowing to the cabinet.

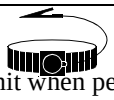
Be sure you have read and understood Understanding the antenna installation process on page 98 before continuing.

Requirements

- 5/32 inch tamper-resistant screw driver
- Torque wrench with bit for 5/32 inch tamper-resistant screw driver
- Thread tapping kit with 1/4-20 thread bit at 3/4 inch depth

Procedure

CAUTION

Wear an ESD strap () and connect the strap to the ESD jack in the Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 21.

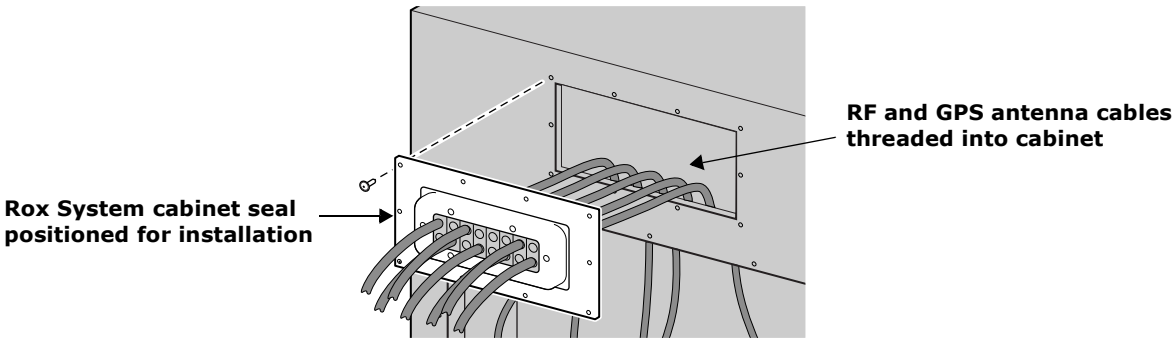
1. Remove the Rox System cabinet seal from its box and remove all packing materials.
2. Retrieve the 10 access panel screws and the corresponding rubber washers that you set aside when you removed the antenna access panel.
3. Examine the back side of the Rox System cabinet seal.
   - The gasket along the edge must be undamaged to ensure a proper seal.
   - A spacing washer must be embedded in the gasket for each screw. See Connectors, screws, nuts, washers on page 221.
4. Examine all cable labels. Each cable should be labeled at both ends.

   If any label is not present, trace the cable through the Rox System cabinet seal and attach a label to both ends of the cable. You must be able to determine which cable on the outside of the Rox System cabinet seal is associated with which cable on the inside of the Rox System cabinet seal.
5. Hold the Rox System cabinet seal near the open antenna access panel so that its back side faces the cabinet and thread the 21 inch internal ends of the antenna cables into the top back cabinet hole.

NOTE

Be sure not to knock any of the spacer washers off the gasket on the inside edge of the Rox system cabinet seal. These spacer washers are required to ensure proper installation and EMI/RF shielding.

Cabinet back view



6. Gently push the Rox System cabinet seal against the cabinet and position it for final attachment.
7. Screw in the one of the top middle screws by hand.

   Be sure to thread the rubber sealing washer on the screw shank before inserting it in the Rox System screw hole. Check to ensure each screw shank has a spacing washer as well.

WARNING

Screws should be started by hand. It is possible to damage the thread in the cabinet if you use a hand tool or a power tool. Damaged threads must be repaired or the cabinet will be improperly sealed and the IP-RN 8000 can be damaged. **Use a thread tapping set to fixed damaged threads**.

8. Start all screws with rubbers washers in by hand. Install them all loosely before tightening any one of them.
9. Use a torque wrench with a 5/32 inch tamper-resistant hex drive bit set to 18 inch-pounds to tighten all screws evenly.

WARNING

If access panels screws are not tightened with the correct torque, electronic interface may occur causing equipment malfunction.

This procedure is complete. Go to Connecting GPS and RF antennas on page 109.

Connecting GPS and RF antennas

This procedure explains how to:

- Connect the GPS and the RF antenna cables to the surge protection bar on the inside of the cabinet and to a required surge protection system/antenna cables system on the outside of the cabinet
- Re-install the surge protection access panel.

This procedure assumes that the power supply has been turned off and that power is not flowing to the cabinet.

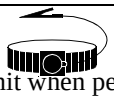
Be sure you have read and understood Understanding the antenna installation process on page 98 before continuing.

Requirements

- 13/16 inch open ended wrench
- Torque wrench with 13/16 inch open ended bit
- 5/32 tamper-resistant screw driver
- Thread tapping kit with 1/4-20 thread bit at 3/4 inch depth

Procedure

CAUTION

Wear an ESD strap () and connect the strap to the ESD jack in the Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 21.

WARNING

Do not touch or connect antennas when there is any chance of a lightning strike. Injury or death can occur if lightning strikes an antenna during installation.

WARNING

Antenna cables emit radio frequency energy. Exposure to radio frequency energy can cause burns or other health problems. Take all appropriate precautions to avoid risk and danger.

WARNING

Power to the IP-RN 8000 must be turned off

WARNING

The IP-RN 8000 must be properly grounded before antennas are installed. Failure to properly ground the IP-RN 8000 can result in danger to nearby persons and damage to equipment. See Understanding surge protection and grounding on page 39.

CAUTION

The IP-RN 8000 has a secondary surge suppression system. A primary external surge suppression system is required to protect nearby persons from danger should a surge occur and to protect the IP-RN 8000 from damage. See Understanding surge protection and grounding on page 39.

1. Look at the surge suppression bar in the cabinet and compare it with that shown in the following figure.

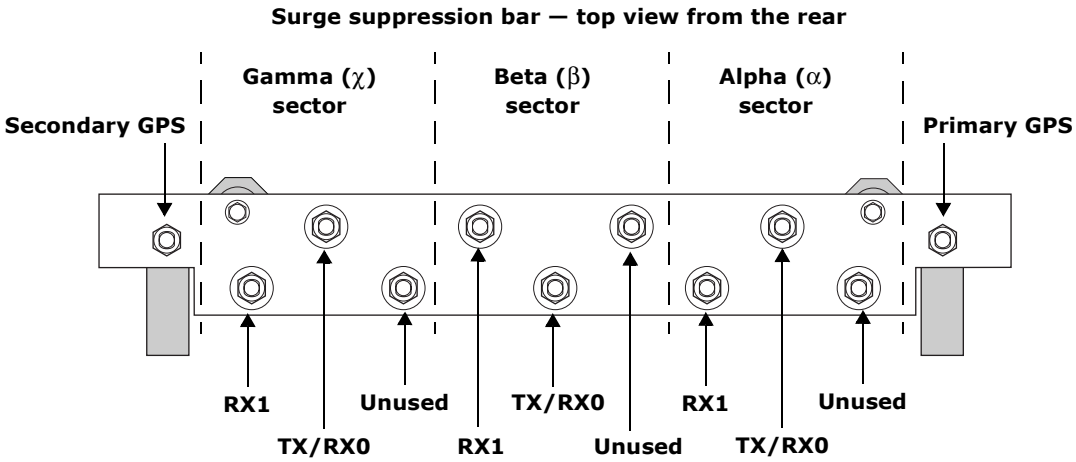
   Use the label on each cable to plan which cables dangling from the inside of the Rox System cabinet seal will connect to which connectors on the surge protection bar.

   It is essential that the proper cables are connected to the proper surge suppressors. Each cable on the Rox System cabinet seal is labeled on both ends, both the end that dangles inside the cabinet and the end that is outside the cabinet. See Understanding the antenna installation process on page 98.

WARNING

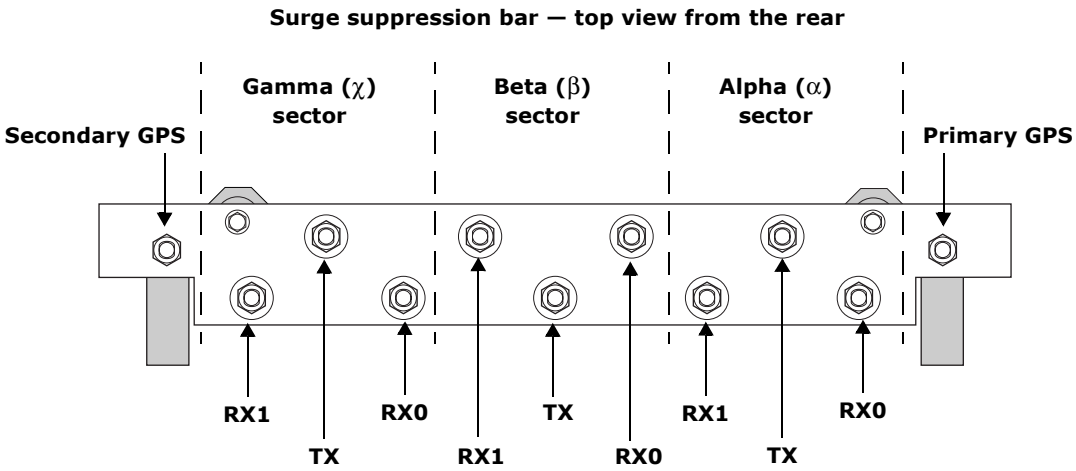
If you connect cables to the wrong surge suppressors, damage to equipment may occur and the equipment may not operate correctly.

If your deployment uses two antenna cables per sector, connect the cables to the connectors as follows:



Cable connections with two RF cables per sector

If your deployment uses three antenna cables per sector, connect the cables to the connectors as follows:



Cable connections with three RF cables per sector

2. First finger tighten the RF and GPS antenna cables to the correct surge suppressor connectors on the top side of the surge protection bar inside the cabinet.

CAUTION

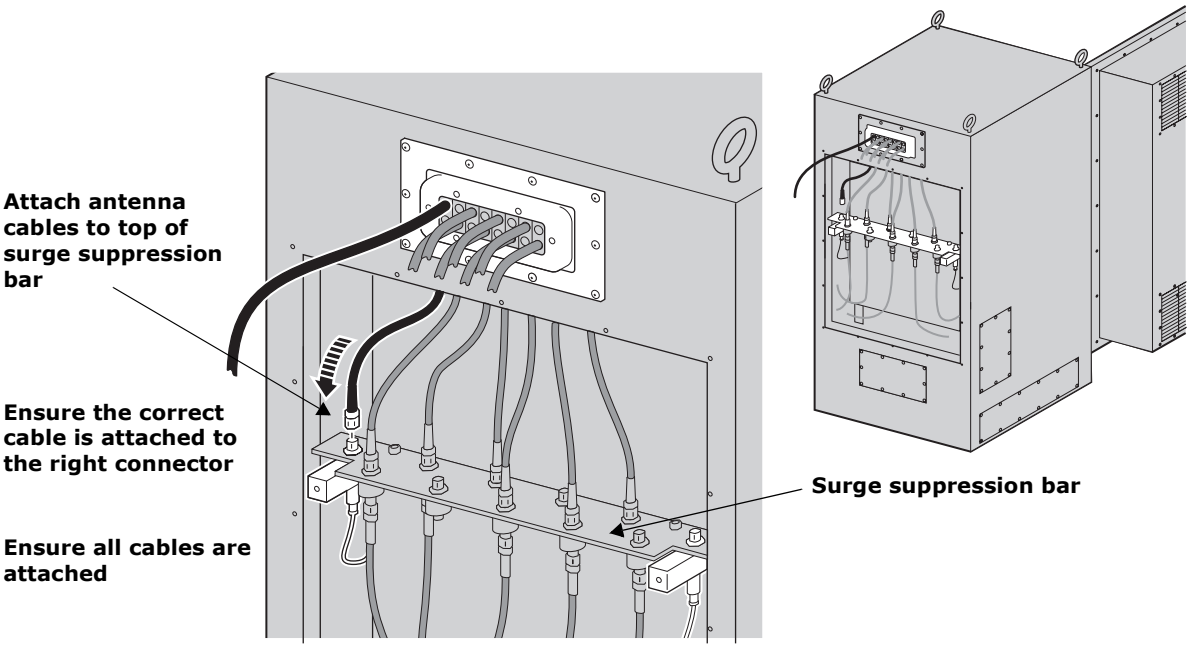
All antenna cables dangling inside the cabinet **must be connected** to the surge suppressor connectors, even if they are not connected to antennas externally. Failure to connect all cables could result in equipment damage and loss of EMI protection.

3. Use the torque wrench set to 10 inch pounds with the 13/16 inch open ended wrench bit to tighten every antenna cable connection on the surge suppression bar.

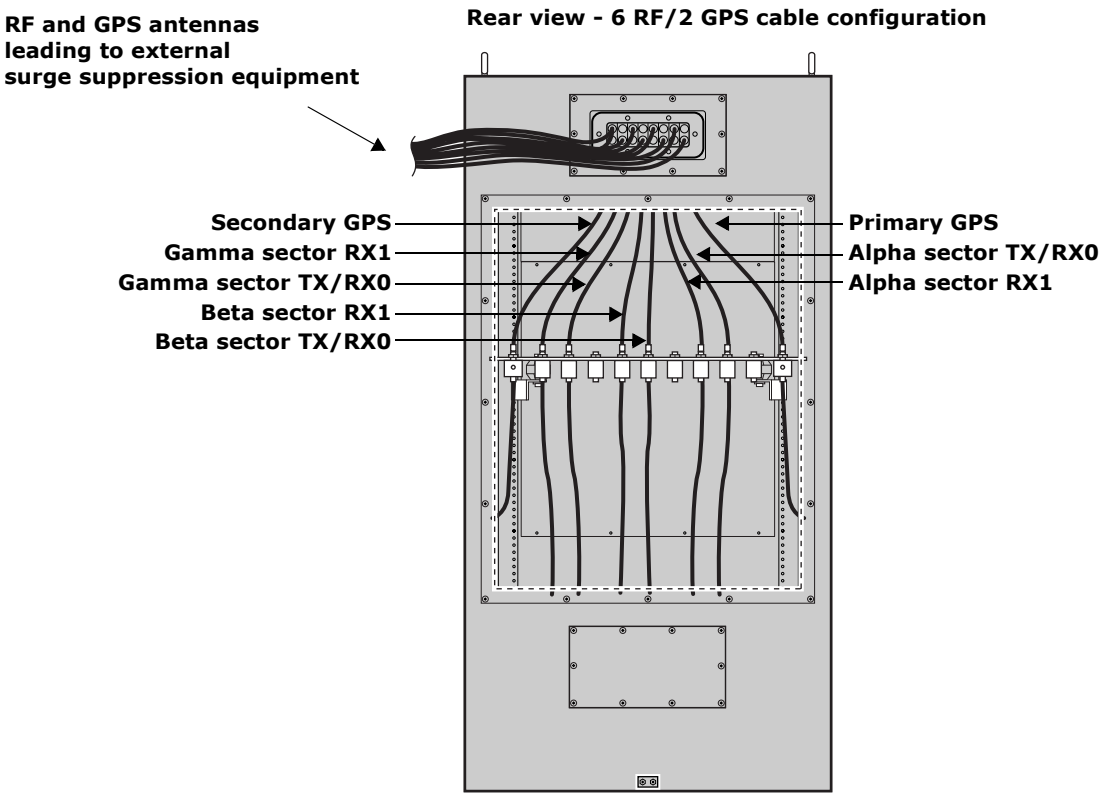
WARNING

Tightening the connectors to more than 15 inch pounds can damage the equipment.

Rear view - Attaching antenna cables internally



4. After all internal antenna cables are connected to the correct surge suppressors, the cabinet appears as shown in the following figure.



5. Retrieve the 16 tamper-proof screws and rubber washers that you set aside when removing the panel.
6. Ensure the access panel is undamaged:
   - Examine the inside edge of the access panel. The gasket on the inside edge must be intact to ensure a proper seal.
   - A spacing washer must be embedded in the gasket for each screw.
7. Position the surge protection access panel and screw in the top middle screw by hand.

   Be sure to thread the rubber sealing washer on the screw shank before inserting it in the access panel screw hole.

WARNING

Screws should be started by hand. It is possible to damage the thread in the cabinet if you use hand tool or a power tool. Damaged threads must be repaired or the cabinet will be improperly sealed and the IP-RN 8000 can be damaged. **Use a thread tapping set to fixed damaged threads**.

8. Start the remaining 15 screws (with washers) by hand. Install them loosely before tightening any one of them.

9. Use a torque wrench with a 5/32 inch tamper-resistant hex drive bit set to 18 inch-pounds to tighten all screws evenly.

WARNING

If access panels screws are not tightened with the correct torque, electronic interface may occur causing equipment malfunction.

10. Connect all antenna cables to the proper external antennas/surge protection equipment.

    The connections are typically N-type and require a 13/16 inch open ended wrench.

    Tighten connections snugly. Do not overtighten.

CAUTION

All external antenna cables exiting the Rox System cabinet seal must be connected to an external surge suppression system, even if the cables are not used. Failure to connect unused cables to a surge suppression system leaves them open to lightning strikes, which could damage the IP-RN 8000.

This procedure is complete. Go to Understanding the module installation process on page 116.