

## Installing modules

### About this chapter

This chapter describes how to install all modules and contains these sections:

- [Understanding the module installation process](#) on page 104
- [Installing a Power Amplifier](#) on page 105
- [Installing a Radio Module](#) on page 108
- [Connecting the RM to the PA with the RF cable](#) on page 111
- [Connecting the Sector Radio Kit to the Antenna Interface Unit](#) on page 113
- [Installing a Timing Frequency Unit](#) on page 116
- [Installing a Base Input Output/System Controller](#) on page 119
- [Installing a 1xDOM](#) on page 122



Wear an ESD strap when handling IP-RN 8000 modules.

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## Understanding the module installation process

This process explains all steps and procedures to follow when installing modules into the cabinet.

### 1. Installing Sector Radio Kit(s)

These procedures explain how to install the two modules in a Sector Radio Kit. Repeat the procedures in this section for each sector in your installation. Typical installations support three sectors, but one or two sector installations are possible. In addition, several cable connections need to be made involving the Radio Module, the Power Amplifier module and the Antenna Interface Unit for each sector. Follow these steps for each Sector Radio Kit you install:

- a. See [Installing a Power Amplifier](#) on page 105.
- b. See [Installing a Radio Module](#) on page 108.
- c. See [Connecting the RM to the PA with the RF cable](#) on page 111.
- d. See [Connecting the Sector Radio Kit to the Antenna Interface Unit](#) on page 113.

### 2. Installing Digital Module Kit(s)

These procedures explain how to install the three modules in a Digital Module Kit.

- If you are installing a non-redundant node, follow these procedures once for the primary Digital Module Kit.
  - For redundant installations, follow these procedures twice, once for the primary Digital Module Kit and once for the redundant Digital Module Kit.
- a. See [Installing a Timing Frequency Unit](#) on page 116.
  - b. See [Installing a Base Input Output/System Controller](#) on page 119.
  - c. See [Installing a 1xDOM](#) on page 122.

This procedure is complete. You must power the system on. Go to [Powering the node](#) on page 126.

## Installing a Power Amplifier

This procedure explains how to install a Power Amplifier (PA) module.

Be sure you have read and understood [Understanding the module installation process](#) on page 104 before continuing.



The PA weighs 22 pounds (10 kg). To avoid injury, use both hands when handling. Hold the module handle with one hand and place the other hand under the bottom module slide.

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Wear an ESD strap and plug it into the ESD jack in the AIU when handling modules or equipment damage can occur. See [Figure 9](#) on page 18.

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Ensure that you install the PA module into the proper slot (either slot 1 top part, slot 5 top part, or slot 9 top part). Installation into a slot reserved for a different module type can cause equipment damage.

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### Requirements

- ESD wrist strap
- Slotted screwdriver

### Procedure

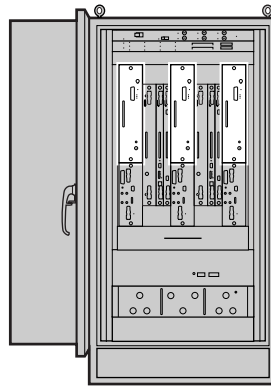
1. Locate the slot into which you will install the PA module.

The PA installs in the top part of slots 1, 5, and 9.

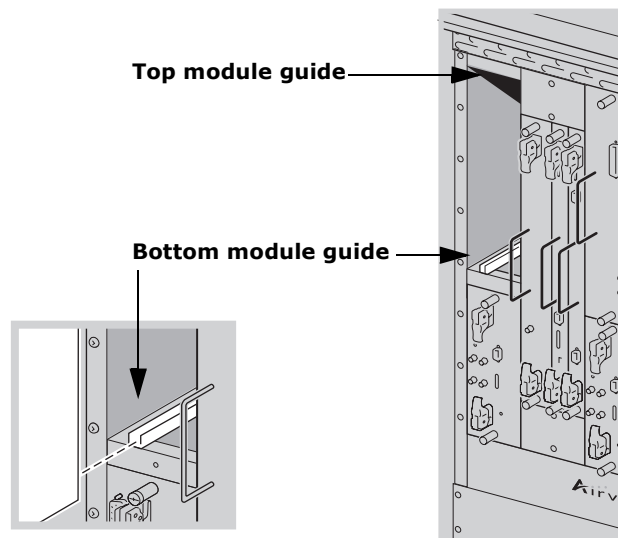


PA modules and RM modules pairs are installed in the top and bottom of the same vertical module slot.

See [Understanding module slot numbering](#) on page 11 for more information.

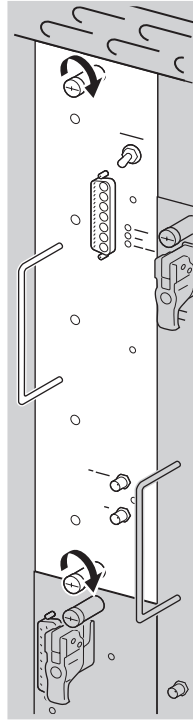


2. Align the PA with the module guides in the top and bottom of the slot of the appropriate sector.



3. Use the module handle to push the PA through the module guides and into the slot until you feel it touch the backplane.

4. Hand tighten the top and bottom captive screws.



5. Use a slotted screwdriver to tighten the two captive screws to secure the PA into the chassis.  
Tighten screws snugly, but do not overtighten them or you might strip the threads.

This procedure is complete. Go to [Installing a Radio Module](#) on page 108.

## Installing a Radio Module

This procedure explains how to install a Radio Module (RM).

Be sure you have read and understood [Understanding the module installation process](#) on page 104 before continuing.



Wear an ESD strap and plug it into the ESD jack in the AIU when handling modules or equipment damage can occur. See [Figure 9](#) on page 18.

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Ensure that you install the RM module into the proper slot (either slot 1 bottom part, slot 5 bottom part, or slot 9 bottom part). Installation into a slot reserved for a different module type can cause equipment damage.

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### Requirements

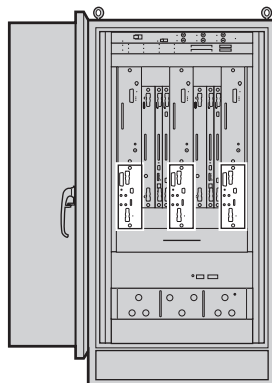
- ESD wrist strap
- Slotted screwdriver

### Procedure

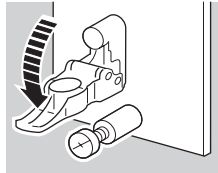
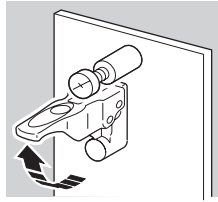
1. Locate the slot into which you will install the RM module.

The RM installs in the bottom part of slots 1, 5, and 9.

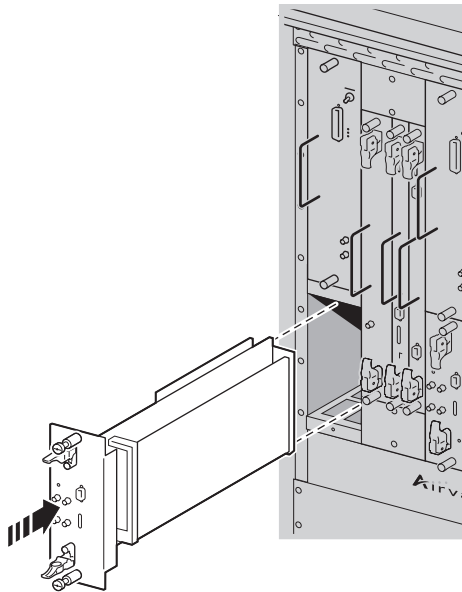
See [Understanding module slot numbering](#) on page 11 for more information.



2. Open the top and bottom latches on the RM module faceplate.



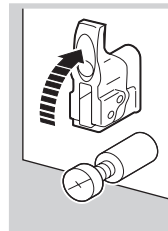
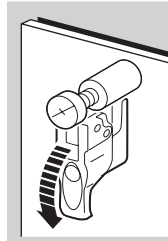
3. Align the RM with the module guides in the top and bottom of the slot of the appropriate sector.



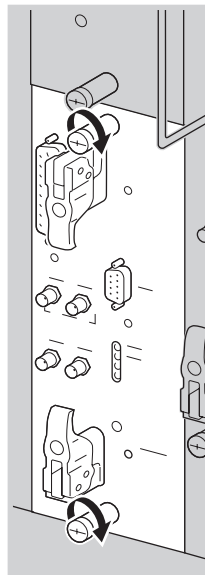
4. Push the RM into the slot until you feel it touch the backplane.

5. Simultaneously, slowly close the top and bottom latches.

As you close the latches, the RM module is drawn snugly into the chassis. Be sure the RM faceplate does not overlap the PA module. An overlap prevents proper module seating.



6. Hand tighten the top and bottom captive screws.



7. Use a slotted screwdriver to tighten the two captive screws to secure the RM into the chassis.  
Tighten screws snugly, but do not overtighten them or you might strip the threads.

This procedure is complete. Go to [Connecting the RM to the PA with the RF cable](#) on page 111.

## Connecting the RM to the PA with the RF cable

The transmit signal generated in the RM is sent to the PA for amplification before being transmitted. This procedure explains how to connect the RF port on the RM to the RF port on the PA module using an external cable provided by Airvana for the sector.

Be sure you have read and understood [Understanding the module installation process](#) on page 104 before continuing.



Wear an ESD strap and plug it into the ESD jack in the AIU when performing this procedure or equipment damage can occur. See [Figure 9](#) on page 18.

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### Requirements

- ESD wrist strap
- Slotted screwdriver

### Procedure

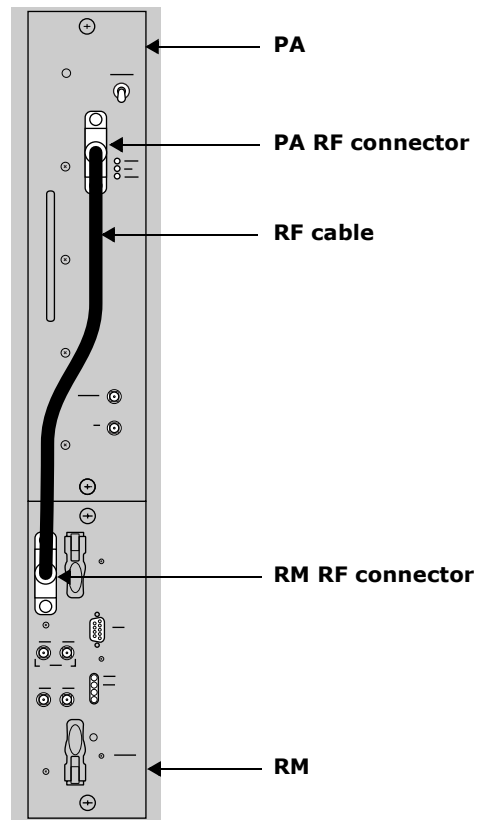
1. Retrieve the RF cable for the sector.

The cable is shipped with the modules and is labeled with its part number: 600334.

2. Examine the cable to determine which end is connected to the RM and which is connected to the PA.

The cable has a natural curve to it that makes it easy to install because it makes both connectors face the same way. However, you have to be sure the right cable ends are connected to the RM and to the PA. So, hold the cable in place and compare the cable connectors to the connectors on the RM and PA modules. If the connectors do not fit, reverse the cable 180 degrees and the connectors should fit.

3. Gently press one end of the cable to the PA's RF connector.



4. Gently press the other end of the cable to the RM RF connector.
5. Use the small slotted screwdriver to tighten both screws on both connectors to secure the ends of the cable into the module connectors.

Tighten snugly but do not over tighten or you can strip the threads.

This procedure is complete. Go to [Connecting the Sector Radio Kit to the Antenna Interface Unit](#) on page 113.

## Connecting the Sector Radio Kit to the Antenna Interface Unit

This procedure explains how to connect the transmit and receive signals on the Antenna Interface Unit (AIU) to the Radio Module (RM) and to the Power Amplifier (PA) module for a single sector. The two AIU receive signals (RX0 and RX 1) are connected to the RM module and the single AIU transmit (TX) signal is connected to the PA module.

Be sure you have read and understood [Understanding the module installation process](#) on page 104 before continuing.



Wear an ESD strap and plug it into the ESD jack in the AIU when performing this procedure or equipment damage can occur. See [Figure 9](#) on page 18.

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### Requirements

- ESD wrist strap
- Six cable ties
- 13/16 inch open ended torque wrench
- 5/16 inch open ended torque wrench

### Procedure

1. Examine the AIU.

The cabinet is shipped with nine cables attached, three cables for each the sector.

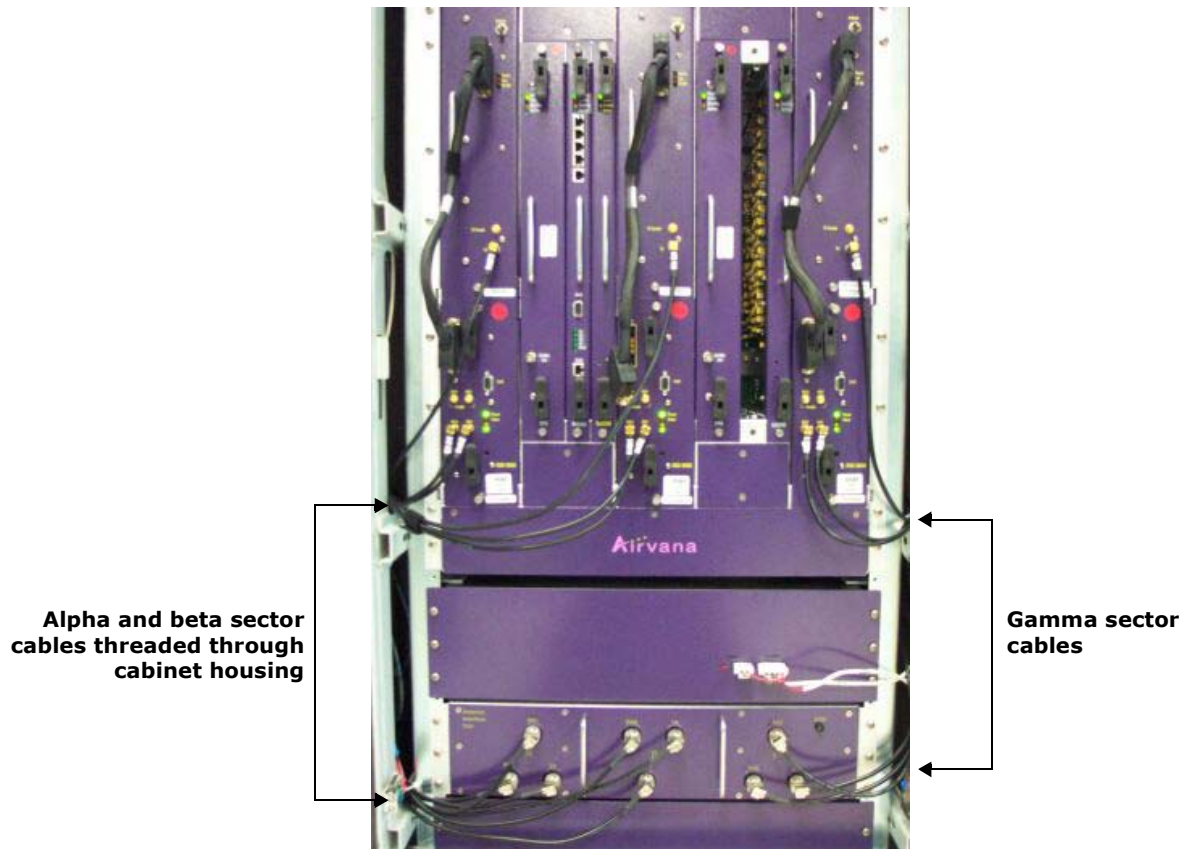
Each cable is labeled with its sector (alpha, beta, or gamma) and its use (TX, RX0, or RX1).

2. for each sector, tie the three cables into a bunch with one cable tie near the AIU, and the other cable tie about two feet short of the other end.

3. For each sector, thread the cable bunch between the cabinet housing and the chassis.

Bring the cable bunch back in front of the modules just above the horizontal cabinet frame piece.

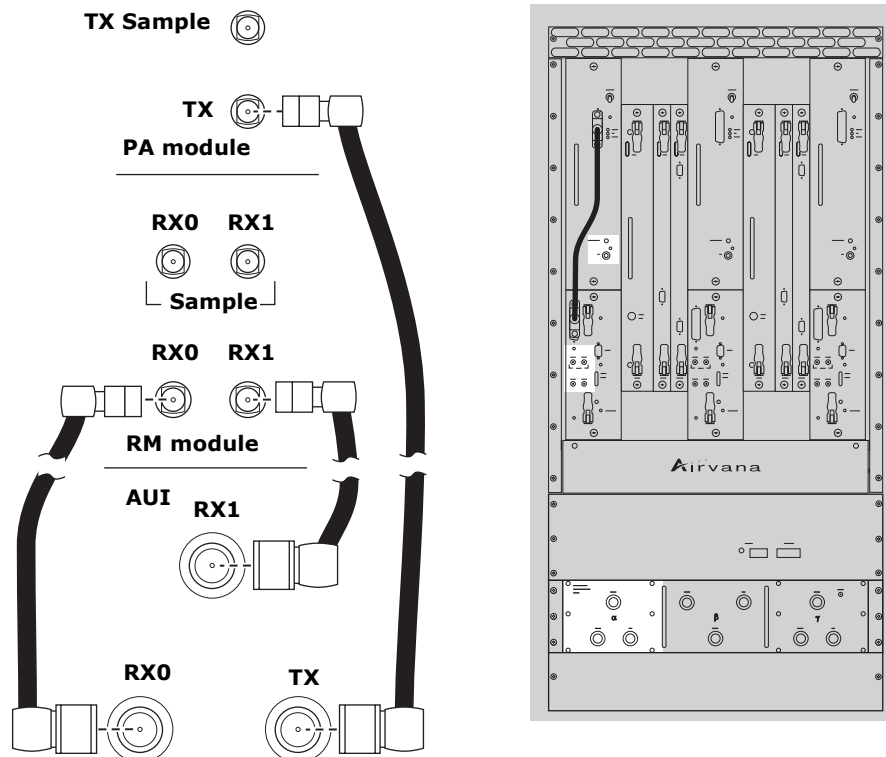
- If you are installing the alpha or beta sector, thread the cable bunch to the left.
- If you are installing the gamma sector, thread the cable bunch to the right.



4. For each sector, hand attach the three sector cables to the appropriate connectors on the RM and PA modules according to their labels.
- Connect the TX cable to the PA TX connector.
  - Connect the RX0 cable to the RM RX0 connector.
  - Connect the RX1 cable to the RM RX1 connector.



- The cables must be attached to the correct connectors of the equipment will not work. Also, the AIU's sector cables must be attached to the correct Sector Radio Kits.
- The three connectors on the beta sector are in different locations than is shown in the left half of the following figure. For the beta sector, the top left connector is RX0, the top right connector is TX, and the bottom connector is RX1.



5. For each sector, tighten all cable connections.
  - a. Using a 5/16 inch open-ended torque wrench set to seven inch-pounds, tighten the three cable connections to the RM and PA.
  - b. Using a 13/16 inch open-ended torque wrench set to seven inch-pounds, tighten the three cable connections AIU.
6. If you are not deploying any of the three sectors, remove the sector's cables from the AIU and save them or dispose of them properly.

This procedure is complete.

- If you have not completed installation of all Sector Radio Kits in this node, you must repeat these procedures for the next Sector Radio Kit. go to [Installing a Power Amplifier](#) on page 105.
- If you have completed installation of all Sector Radio Kits in this node, go to [Installing a Timing Frequency Unit](#) on page 116.

## Installing a Timing Frequency Unit

This procedure explains how to install a Timing Frequency Unit (TFU) module.

Be sure you have read and understood [Understanding the module installation process](#) on page 104 before continuing.



Wear an ESD strap and plug it into the ESD jack in the AIU when handling modules or equipment damage can occur. See [Figure 9](#) on page 18.

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Ensure that you install the TFU module into the proper slot (either slot 2 or slot 6). Installation into a slot reserved for a different module type can cause equipment damage.

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### Requirements

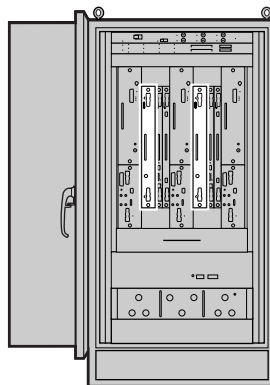
- ESD wrist strap
- Slotted screwdriver

### Procedure

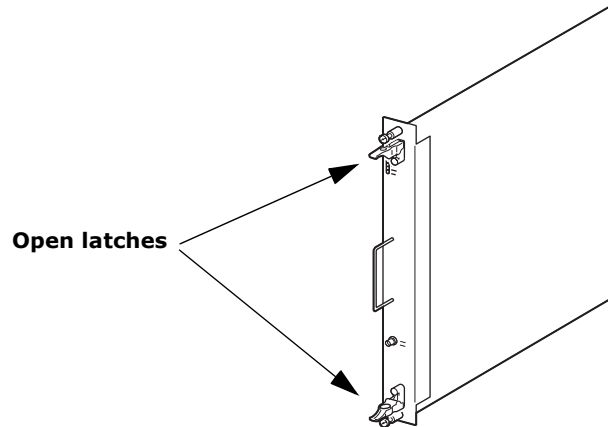
1. Locate the slot into which you will install the TFU module.

The primary TFU installs in slot 2. The redundant TFU installs in slot 6.

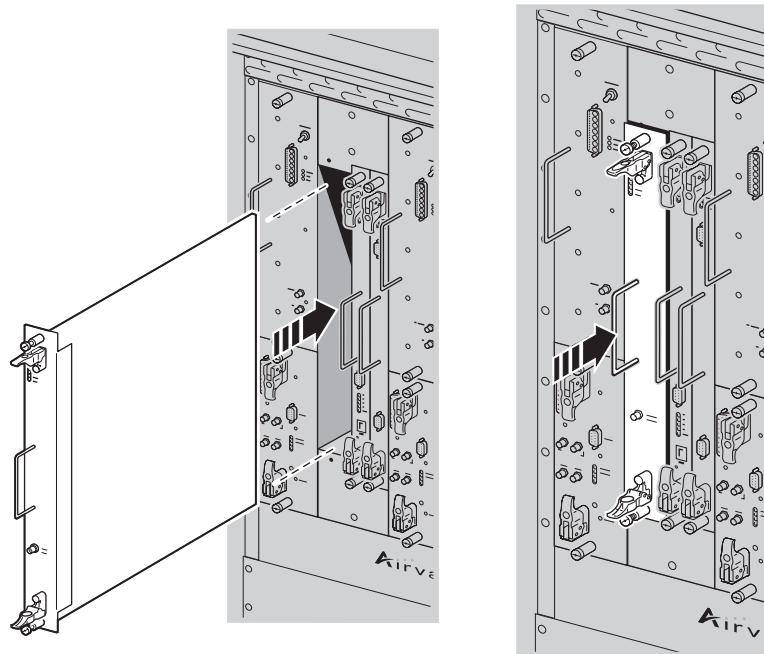
See [Understanding module slot numbering](#) on page 11 for more information.



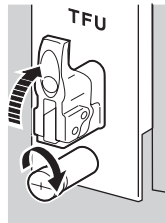
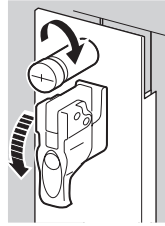
2. Open the top and bottom latches on the TFU module faceplate.



3. Align the TFU module with the module guides in the top and bottom of the appropriate slot and gently push the TFU into the slot until you feel it touch the backplane.



4. Simultaneously, close the top and bottom latches and hand tighten the top and bottom captive screws.



5. Use a slotted screwdriver to tighten the two captive screws to secure the TFU module into the chassis.  
Tighten screws snugly, but do not overtighten them or you might strip the threads.

This procedure is complete. Go to [Installing a Base Input Output/System Controller](#) on page 119.

## Installing a Base Input Output/System Controller

This procedure explains how to install a Base Input Output/System Controller (BIO/SC) module.

Be sure you have read and understood [Understanding the module installation process](#) on page 104 before continuing.



Wear an ESD strap and plug it into the ESD jack in the AIU when handling modules or equipment damage can occur. See [Figure 9](#) on page 18.

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Ensure that you install the BIO/SC module into the proper slot (either slot 3 or slot 7). Installation into a slot reserved for a different module type can cause equipment damage.

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### Requirements

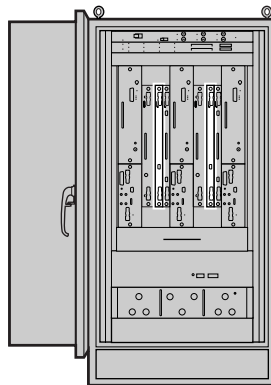
- ESD wrist strap
- Slotted screwdriver

### Procedure

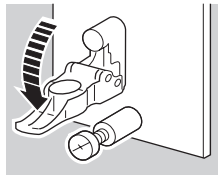
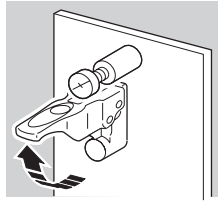
1. Identify the slot in which you will install the BIO/SC module.

The primary BIO/SC installs in slot 3. The redundant BIO/SC installs in slot 7.

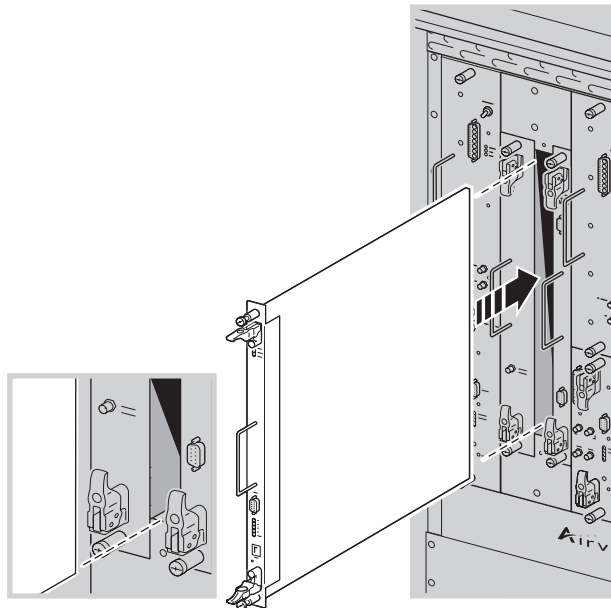
See [Understanding module slot numbering](#) on page 11 for more information.



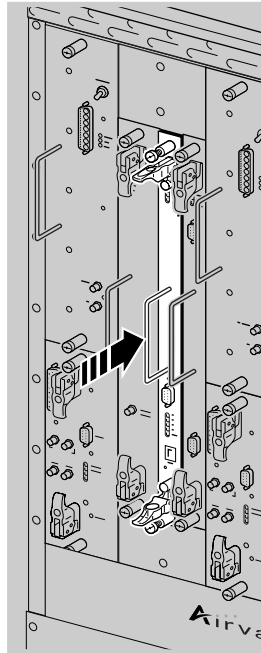
2. Open the top and bottom latches on the BIO/SC module faceplate.



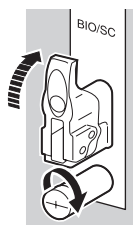
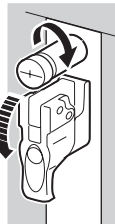
3. Align the BIO/SC with the module guides in the appropriate slot.



4. Gently push the BIO/SC until it touches the backplane.



5. Simultaneously, close the latches and hand tighten the top and bottom captive screws.



6. Use a slotted screwdriver to tighten the two captive screws to secure the BIO/SC module into the chassis.

Tighten screws snugly. Do not overtighten them or you might strip the threads.

This procedure is complete. Go to [Installing a 1xDOM](#) on page 122.

# Installing a 1xDOM

This procedure explains how to install a 1xDOM module.

Be sure you have read and understood [Understanding the module installation process](#) on page 104 before continuing.



Wear an ESD strap and plug it into the ESD jack in the AIU when handling modules or equipment damage can occur. See [Figure 9](#) on page 18.



Ensure that you install the 1xDOM module into the proper slot (either slot 4 or slot 8). Installing a 1xDOM module into a slot reserved for a different module type can cause equipment damage.

## Requirements

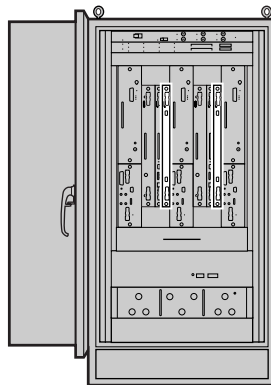
- ESD wrist strap
- Slotted screwdriver

## Procedure

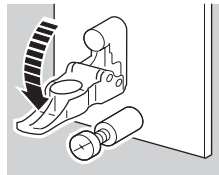
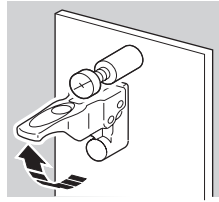
1. Identify the slot in which you will install the 1xDOM module.

The primary 1xDOM installs in slot 4. The redundant 1xDOM installs in slot 8.

See [Understanding module slot numbering](#) on page 11 for more information.



2. Open the top and bottom latches on the 1xDOM module faceplate.

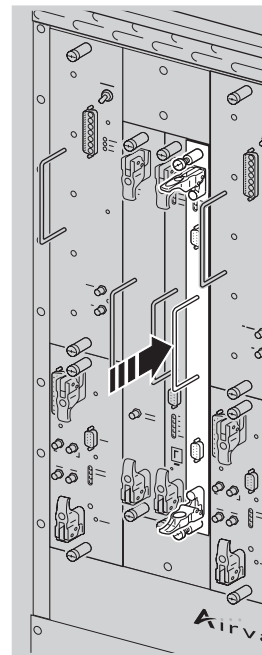
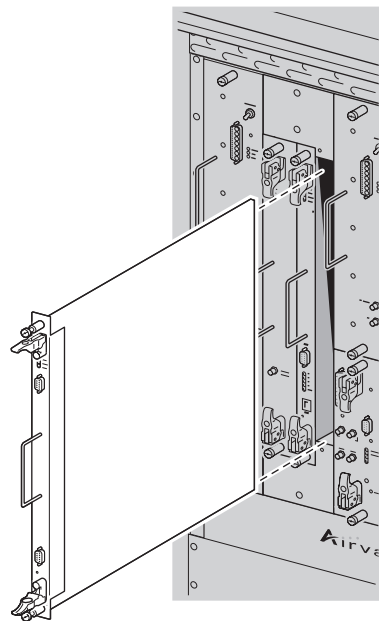


3. Align the 1xDOM with the module guides in the appropriate slot and gently push the module into the chassis until it touches the backplane.

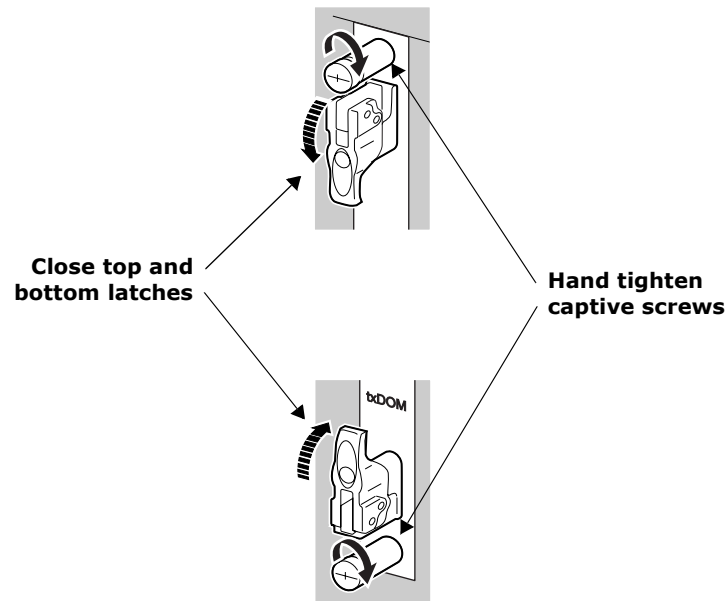


**NOTE**

Be careful inserting this module. Take care to avoid collisions with neighboring modules that could damage either module.



4. Simultaneously, close the latches and hand tighten the top and bottom captive screws.



5. Use a slotted screwdriver to tighten the two captive screws to secure the TFU module into the chassis. Tighten screws snugly, but do not overtighten them or you might strip the threads.

This procedure is complete.

- If you still have a Digital Module Kit to install, go to [Installing a Timing Frequency Unit](#) on page 116.
- Otherwise, go to [Powering the node](#) on page 126.

# Applying primary power

## About this chapter

Now that physical installation is complete, this chapter explains how to power on the IP-RN 8000. This chapter contains a single section:

- [Powering the node](#) on page 126.

# Powering the node

This procedure explains how to power on the IP-RN 8000.

## Requirements

None

## Procedure

1. Ensure all switches on the Power Distribution Unit (PDU) are flipped to the right and are set to the **OFF** position.

For information about the switches on the power distribution unit, see [Understanding the Power Distribution Unit](#) on page 27.

2. Ensure the external circuit breaker controlling power flow on the cabinet's circuit is closed, enabling power flow.
3. Flip the *Main Power* switch to the left to turn power *ON*.

The *Main Power* LED lights green.



At this point main power is on but you have not turned on power to the heat exchanger or the fans. Do not leave the IP-RN 8000 in this condition for more than a few minutes or over heating could result. Be sure you continue with the power on procedure without delay.

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4. Flip the *ALRM* switch to the left to power *ON* the alarm panel.
5. Flip the *HXCH* switch to the left to turn power *ON* for the heat exchanger.  
As the heat exchanger initializes, LEDs on the heat exchanger on the inside front door blink.
6. Flip the *FANS* switch to the left to power *ON* power for the fans.
7. On each PA installed, flip the *Power* switch up to turn on power for the PA.
8. Flip the *CHAS* switch to the left to power *ON* the chassis.  
This switch controls power flow to all modules.  
Each module's *Power* LED illuminates green.  
If any of the LEDs do not illuminate as expected, contact Airvana.

This procedure is complete. Go to [Understanding the commissioning process](#) on page 128.

## Commissioning process

### About this chapter

This chapter explains the main steps to follow when commissioning the IP-RN 8000. This chapter contains the following sections:

- [Understanding the commissioning process](#) on page 128
- [Understanding commissioning requirements](#) on page 129

## Understanding the commissioning process

This process explains the steps to follow when commissioning the IP-RN 8000. Each step consists of one or more procedures that must be performed in order and to completion before proceeding with the next step.

### 1. Understanding commissioning

A list of the materials, scripts, and information you need to commission the node.

See [Understanding commissioning requirements](#) on page 129.

See [Understanding the scripting process](#) on page 146 in [Chapter 12, Running the commissioning script](#).

### 2. Establishing a serial CLI link to the node

Create a CLI/serial connection from the laptop and the node.

See [Understanding the CLI connection process](#) on page 132 in [Chapter 10, Establishing CLI connections](#).

### 3. Optionally updating node software

Ensure the node is running the correct software release and, if necessary, update the software release.

See [Understanding the software update process](#) on page 140 in [Chapter 11, Updating node software](#).

### 4. Running the commissioning script

Configure the node to the normal operating configuration by running the commissioning script provided by the network planner.

See [Running the commissioning script](#) on page 145 in [Chapter 12, Running the commissioning script](#).

### 5. Performing backhaul loopback tests

Reboot the node to enter diagnostics mode and perform backhaul loopback tests.

See [Chapter 13, Loopback testing backhaul links](#)

### 6. Measuring and calibrating transmit power

See [Understanding the transmit power calibration process](#) on page 170 in [Chapter 14, Calibrating transmit power](#).

### 7. Completing commissioning

Ensure the node is operational and prepare the cell site for the technician's departure.

See [Understanding the commissioning completion process](#) on page 188 in [Chapter 15, Completing commissioning](#).

This procedure is complete. Commissioning is complete. This is the end of the installation and commissioning process.

## Understanding commissioning requirements

### Requirements

Installation must be complete

Commissioning cannot be performed until installation is complete. See [Understanding installation and commissioning](#) on page 40.

### Other requirements

Commissioning requires the following:

- A laptop running at least Microsoft Windows 98
- Terminal emulation software, such as HyperTerminal
- Serial cable with male DB-9 connector for attaching to the female DB-9 on the BIO/SC side and a connector on the laptop side that is correct or the laptop's serial port  
For information on the DB-9 pin-out, see [Table 35](#) on page 196.
- The commissioning script must have been created by network planning personnel and must have been provided to the field technician.  
The commissioning script comprehensively configures the node for normal operations.
- Power meter to test and set RF transmission power during commissioning with connector/adaptor appropriate for the antenna cables exiting the Rox System cabinet seal.
- 30 dB attenuator pad 30 dB attenuator pad with connector appropriate for antenna jumper cable rated for a maximum of 50 watts
- A power splitter to split the transmit signal for use by the power meter and the AT, with appropriate cables and connector adapters
- 1xEV-DO access terminal (AT)

### Software update requirements

If the field technician is going to change the software release running on the node, the following are also required:

- FTP client software (included with Windows 98 and later operating systems) to transfer the software release to the node.  
The BIO/SC software contains an FTP server that is also used to transfer the release.
- The laptop must have an Ethernet network interface card (NIC).  
The software is transferred to the node over the Ethernet.
- A cross-over ethernet cable with standard RJ-45 connectors.  
The cross over cable is required to connect the laptop Ethernet port directly to the BIO/SC craft Ethernet port without going through an Ethernet switch. If you bring an Ethernet switch, then two straight-through Ethernet cables are also required (laptop to switch, and switch to BIO/SC).
- The technician must know how to configure the IP address of the laptop Ethernet NIC.  
IP must be configured on the laptop Ethernet NIC and on the BIO/SC craft Ethernet port in order to use FTP to transfer the software release from the laptop to the BIO/SC.
- The software release that is transferred on to the node



## Establishing CLI connections

### About this chapter

This chapter explains how to establish CLI connections with node and contains the following:

- [Understanding the CLI connection process](#) on page 132
- [Understanding CLI/serial connections](#) on page 132
- [Establishing the CLI/serial connection](#) on page 135
- [Understanding craft Ethernet connection to the node](#) on page 133
- [Configuring IP on the craft Ethernet and laptop](#) on page 137
- [Establishing the CLI/telnet/Ethernet connection](#) on page 138

## Understanding the CLI connection process

This section explains the process for making a CLI connection.

### 1. Understanding CLI options

See [Understanding CLI/serial connections](#) on page 132.

### 2. Establishing a CLI /serial link with the node

A serial link for CLI node management is created from the laptop to the node.

See [Establishing the CLI/serial connection](#) on page 135.

### 3. Optionally establishing a CLI/telnet/craft Ethernet session with the node.

CLI/telnet/craft Ethernet is required when you need multiple simultaneous CLI sessions with the node.

a. [Configuring IP on the craft Ethernet and laptop](#) on page 137

b. [Establishing the CLI/telnet/Ethernet connection](#) on page 138

This procedure is complete.

## Understanding CLI/serial connections

The command line interface (CLI) enables text-based, command-oriented management of the IP-RN 8000. The CLI can be accessed in three ways:

- CLI/serial — Direct connection to the craft serial port on the BIO/SC, RM, and TFU module serial craft ports
- CLI/telnet/craft Ethernet — A laptop's Ethernet adapter is connected to the craft Ethernet port on the BIO/SC module, IP is configured on the laptop on the craft Ethernet, and a telnet session provides CLI access.
- CLI/telnet/backhaul — When the node is fully configured and functional backhaul links, you can telnet to the node's node IP address from anyplace on the IP network.

### CLI/serial

CLI/serial is the simplest form of CLI connection. It is only available when you are local to the serial port. This form of CLI connection is required during initial phases of commissioning. For example, you must use CLI/serial to set the craft Ethernet IP address if you then want to use CLI/telnet/craft Ethernet. You can only have a single CLI/serial connection to a node at a time when using CLI/serial. CLI/serial connection requires a cable to link the serial craft port on the network element to a serial port (typically a COM port) on a laptop or other device. Launch a terminal emulation program on the laptop (such as Hyperterminal) and configure the communications settings appropriately (see [Establishing the CLI/serial connection](#) on page 135).

### CLI/serial on redundant systems

CLI/serial connection is made by connecting a laptop running terminal emulation software to the serial port on the BIO/SC module. Redundant systems have two BIO/SC modules. In almost all cases, you should plug the serial cable into the *active* BIO/SC module.

You can tell which BIO/SC module is active by examining the LEDs on the BIO/SC modules. See [Understanding the Base Input Output/System Controller module](#) on page 22.

When configuring the node from the active BIO/SC module, all configurations apply to the entire node.

However, there are some cases where you need to plug the serial cable into the serial port on the *inactive* BIO/SC module. For example, if the node uses Ethernet backhauls, the only way to loopback test the Ethernet link associated with the inactive module is to plug the serial cable into the serial port on the inactive BIO/SC module.

### **CLI/telnet/craft Ethernet**

CLI/telnet/craft Ethernet is made by connecting an Ethernet adapter on your laptop to the Ethernet craft port on the BIO/SC module, either directly using a cross over cable or through a switch or hub using straight through cables. You must configure appropriate IP addresses and masks on the BIO/SC Ethernet port (using CLI/serial) and on the laptop Ethernet port. Then you launch telnet and open a CLI session with the node using the node IP address or the craft Ethernet IP address.

Because you can open multiple CLI sessions at a time using telnet, this method is required during certain phases of the commissioning procedure.

### **CLI/telnet/backhaul**

CLI/telnet/backhaul is made through the existing backhaul network. This assumes a normally operating network with backhaul links that are up and running and IP addressing that is fully configured and correct. You can open a telnet session with the node's node IP address from any location support by the IP network design.

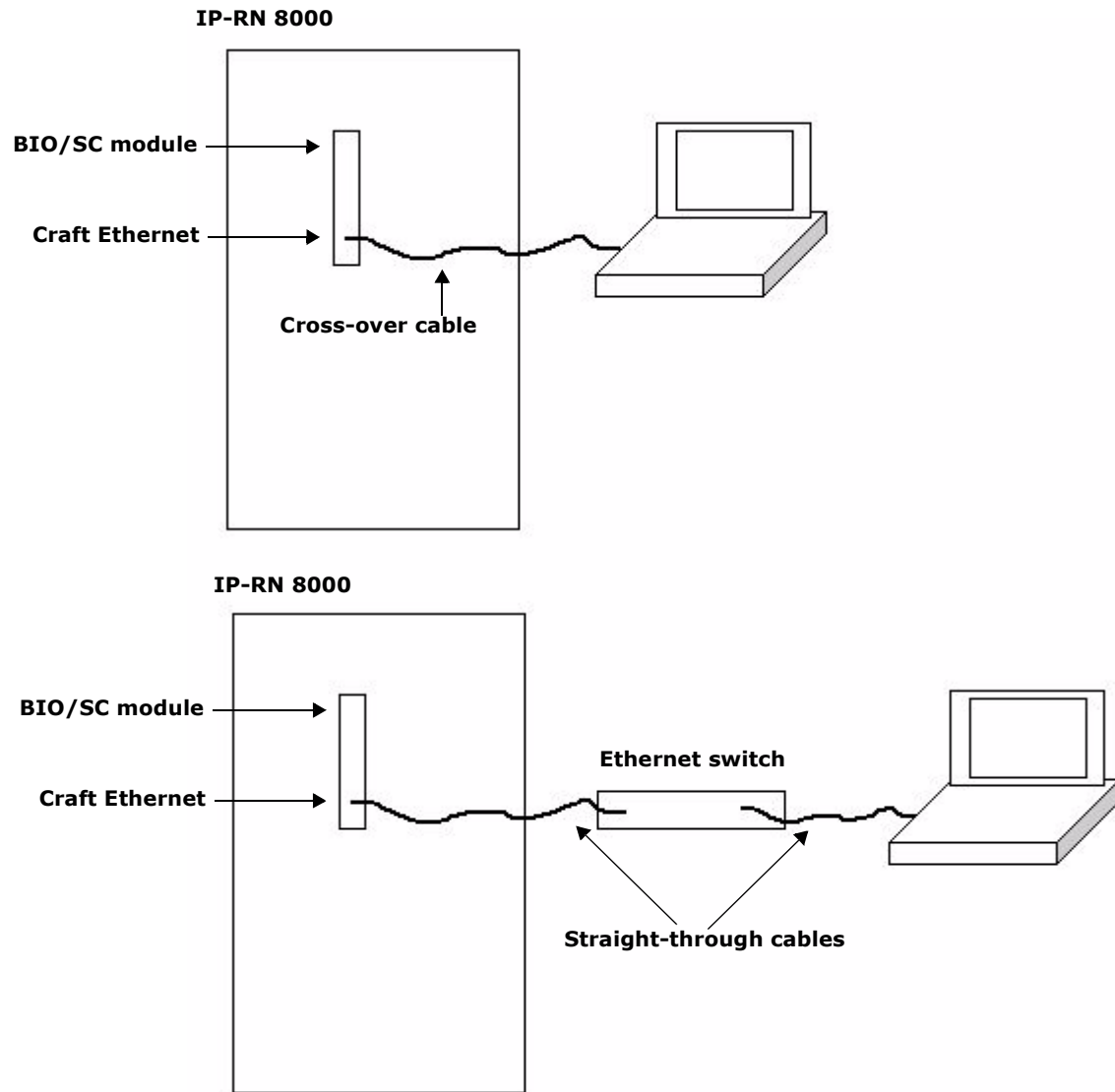
## **Understanding craft Ethernet connection to the node**

The BIO/SC module has two craft ports:

- Female DB-9 for serial connections
- RJ-45 Ethernet

For information about BIO/SC craft ports, see [Understanding the Base Input Output/System Controller module](#) on page 22. There are two ways to connect a laptop Ethernet to the BIO/SC craft Ethernet (see [Figure 21](#)):

- Directly using a cross-over cable
- Indirectly using an Ethernet switch and two straight-through cables



---

**Figure 21** Two craft Ethernet connectivity options

## Establishing the CLI/serial connection

This procedure explains how to connect the laptop's COM port to the active BIO/SC's craft serial port and how to start the CLI/serial session. It is assumed the IP-RN 8000 is powered on.

### Requirements

- A laptop running at least Microsoft Windows 98
- The laptop must have either sufficient batteries to run throughout the commissioning process or it must have a power source and appropriate power adapter
- Terminal emulation software, such as Hyperterminal, which comes with Windows
- Serial cable with male DB-9 connector for attaching to the female DB-9 on the BIO/SC side and a connector on the laptop side that is appropriate for the laptop's serial port

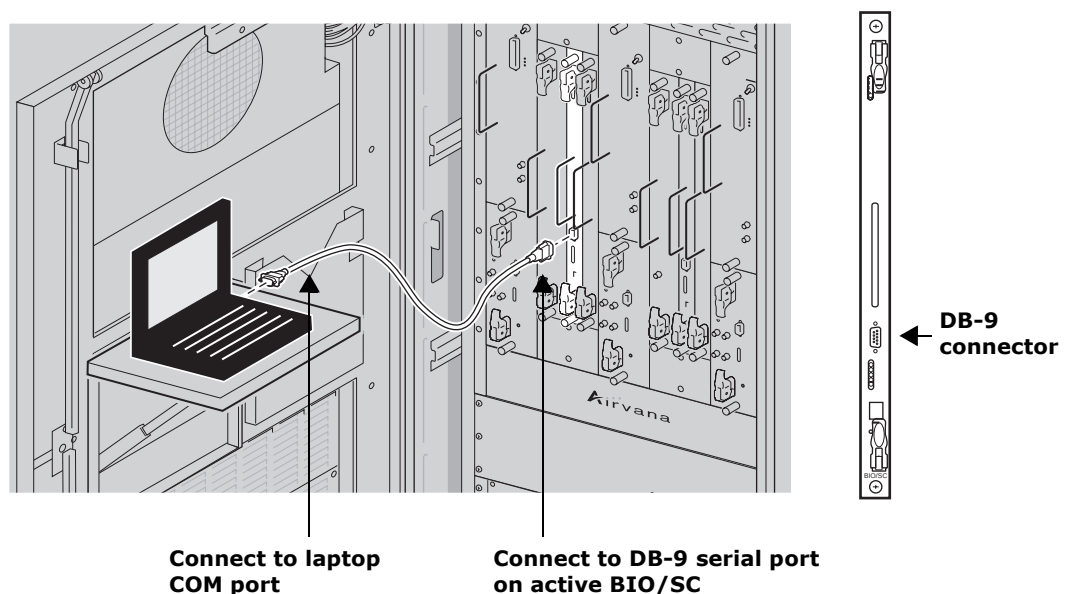
### Procedure

1. Open the PC shelf on the inside of the front door and place the laptop securely on the shelf.  
See [Opening the PC shelf](#) on page 201.
2. Boot up the laptop.
3. Retrieve the CLI cable.
4. Determine which BIO/SC module is active.

If there is only a single BIO/SC installed, it is installed in slot 3 and is active.

If there are two BIO/SC modules installed, check the *ACTIVE* LEDs to determine which one is active and which is standby. See [Understanding the Base Input Output/System Controller module](#) on page 22. Typically the *primary* BIO/SC module in slot 3 is the active module and the redundant BIO/SC module in slot 7 is the standby module.

5. Plug the male DB-9 end of the serial cable into the female DB-9 craft port on the active BIO/SC module.
6. Plug the other end of the serial cable into the COM port of the laptop.



7. Launch the terminal emulation program.

You can use HyperTerminal, which comes with windows, or any terminal emulation program of your choice.

8. Open a terminal connection as appropriate for the terminal emulation software.
9. Configure the terminal connection parameters as shown in [Table](#) .

**Table 22** Terminal settings for CLI/serial connection

| Setting                 | Value          |
|-------------------------|----------------|
| Terminal emulation type | VT220 or VT100 |
| Bits per second (BAUD)  | 38400          |
| Data bits               | 8              |
| Parity                  | None           |
| Stop bits               | 1              |
| Flow control            | None           |



If you are establishing CLI/serial connection the craft serial ports on the RM or TFU modules, you must set the Bits per second to 112500.

---

10. Press **<ENTER>** on the laptop.

The CLI command prompt displays as follows:

AIRVANA-03>

This procedure is complete.

## Configuring IP on the craft Ethernet and laptop

This procedure explains how to configure IP addressing so that you can use FTP to transfer the new release from the laptop Ethernet to the node over the active BIO/SC Ethernet craft port. This procedure requires an active CLI/serial connection to the active BIO/SC.

1. Enter the following commands to set the IP address on the Ethernet craft port of the active BIO/SC:

```
AIRVANA-03>enable
AIRVANA-03#configure
AIRVANA-03 (config) #interface ethernet1/3/2
AIRVANA-03 (config-if) #ip address 10.0.0.1/24
AIRVANA-03 (config-if) #no shutdown
AIRVANA-03 (config-if) #exit
AIRVANA-03 (config) #exit
AIRVANA-03#exit
```



**NOTE**

- ethernet1/3/2 identifies the craft Ethernet interface on the BIO/SC in slot 3 as follows: The “1” means *this node*. The “3” means *slot 3*. The “2” means *craft Ethernet*.
  - This IP address and mask and the IP address and mask configured in the next step form a subnet. You can use any two IP addresses that are in the same subnet.
- 

2. Enter the following IP configuration into the Ethernet network interface card (NIC) on your laptop:

- IP address: **10.0.0.2**
- Subnet mask: **255.255.255.0**
- Default gateway: no default gateway is required — leave it blank.



**NOTE**

Airvana does not specify the laptop operating system and cannot specify the exact steps you need to take to configure the IP information for the Ethernet NIC.

---

This procedure is complete. Go to [Establishing the CLI/telnet/Ethernet connection](#) on page 138.

## Establishing the CLI/telnet/Ethernet connection

This procedure explains how to physically connect the laptop to the node through the craft Ethernet

### Requirements

- Either a cross-over RJ-45 Ethernet cable
- Or two straight-through Ethernet RJ-45 cables and an Ethernet switch with a power supply

### Procedure

1. Plug one end of your RJ-45 cable into the craft Ethernet port on the active BIO/SC module.

The *Active* LED is lit on the BIO/SC module. (On non-redundant systems there is only a single BIO/SC module and it is always active.)

For information about the LEDs on the BIO/SC module, see [Understanding the Base Input Output/System Controller module](#) on page 22.

2. If you are using a cross-over RJ-45 cable and no Ethernet switch to connect the laptop to the node:

- a. Plug the free end of the cable into the laptop Ethernet.
- b. Skip [step 3](#) and go to [step 4](#).

3. If you are using two straight-through cables and an Ethernet switch to connect the laptop to the node:

- a. Connect the free end of the cable into a switch port
- b. Connect one end of the second cable into another switch port
- c. Connect the free end of the second cable into the laptop Ethernet port
- d. Power on the Ethernet switch.

The switch LED for the Ethernet port lights indicating an operational Ethernet link.

4. On the laptop, open a telnet session to the node using the node's craft Ethernet IP address (or to the IP address of another Airvana device, for example the IP-RNC 8500 to which this node is homed), as follows:

- a. Open a command prompt window on the laptop by clicking **Start** ⇒ **Run**, entering **CMD** and clicking **OK**.
- b. At the command prompt in the new command window, type **telnet <IPaddress>**, where **<IPaddress>** is the IP address you configured for the BIO/SC craft Ethernet using the CLI/serial connection (or the IP address of another Airvana device, such as the management IP address of an IP-RNC 8500).

The following displays indicating a CLI/telnet session is active:

```
AIRVANA-03>
```

This procedure is complete. Go to [Updating node software](#) on page 139 or [Chapter 12, Running the commissioning script](#) as appropriate.

## Updating node software

### About this chapter

This chapter describes how to check the node's software release version and optionally update it. This chapter contains the following sections:

- [Understanding the software update process](#) on page 140
- [Checking the active release and free disk space](#) on page 140
- [Transferring the node software from the laptop to the node](#) on page 142
- [Activating the release](#) on page 144

## Understanding the software update process

The process explains how to check the version of the node's currently executing software release, how to transfer a new release to the node, and how to reboot the node using the new release.

### 1. Checking the current release and free disk space

This is optional and may not need to be performed during installation for some nodes. Consult your network planner.

See [Checking the active release and free disk space](#) on page 140.

### 2. Transferring the new release to the node

The new release is transferred over the IP/Ethernet connection using FTP.

See [Transferring the node software from the laptop to the node](#) on page 142.

### 3. Activating the new release

The node is reset using the new release.

See [Activating the release](#) on page 144.

This procedure is complete. This process is complete. Go to [Running the commissioning script](#) on page 145.

## Checking the active release and free disk space

This procedure explains how to use the CLI to check the currently active software release on the node, how to check the amount of free disk space on the node, and how to delete files if more free space is needed before transferring a new release to the node. It is assumed you have an active CLI session. This procedure is unnecessary if you are not intending to update the node's software release version.



#### NOTE

The node's software release version can be updated later from a centralized location using AirVista or CLI/telnet.

---

## Requirements

A CLI/serial connection to the node.

See [Establishing CLI connections](#) on page 131.

### Procedure

1. Enter the **show version** command as follows:

```
AIRVANA-03>show version
```

The CLI output displays the currently executing release. Make note of whether you need to update the release.

2. Use the **shell** command to enter the CLI shell as follows:

```
AIRVANA-03>shell
```

The following prompt displays:

```
AIRVANA-03 (shell) (disk0:/) >
```

3. Enter the **ls** command to check how much free space there is on the node's disk as follows:

```
AIRVANA-03 (shell) (disk0:/) >ls
```

The following displays with data values as appropriate for the node. Note the "Free MBytes" at the bottom. This indicates the amount of free space on the disk.

```
size      date    time    name
-----
32768 May 23 14:43 active/
32768 May 23 14:18 images/
511 May 15 15:23 config.bin
32768 May 23 14:49 logs/
32768 May 20 12:56 backup/
32768 Apr 10 07:52 dcbackup/
524288 May 13 21:18 leofs
```

```
Free MBytes 38136
```

4. If there is less than 30 Mbytes free, use the **xrm** command as follows to delete all files in the disk0:/images directory:

```
AIRVANA-03 (shell) (disk0:/) >xrm images
```

The following displays, indicating the files being deleted from the c:\images directory.

```
deleting file images/rn8500.2.0.0.tar
deleting file images/version.txt
...
```

5. Enter the **exit** command to leave the shell and return to the normal CLI prompt.

The following prompt displays:

```
AIRVANA-03>
```

This procedure is complete.

## Transferring the node software from the laptop to the node

This procedure explains how to use FTP to transfer the new software release from the laptop to the node over the IP/Ethernet connection. The software release must be on the laptop.

### Requirements

An CLI/telnet/craft Ethernet connection from the laptop to the node of the BIO/SC craft Ethernet.

- See [Configuring IP on the craft Ethernet and laptop](#) on page 137
- See [Establishing the CLI/telnet/Ethernet connection](#) on page 138



This procedure requires a working IP connection from the laptop Ethernet to the BIO/SC craft Ethernet port. It does not actually require a CLI/telnet connection. Follow both procedures listed above with the exception of launching the talent session (the second part of the second procedure).

### Procedure

1. On the laptop, open a command line window:
  - a. Select **Start > Run**
  - b. Type **cmd** in the text box
  - c. Click the **OK** button

The command line application window opens and the command prompt displays as follows:

```
C:\>
```

2. Launch the Windows FTP client in the command line window by entering the following

```
C:\>ftp
```

The following command prompt displays:

```
ftp>
```

3. Open an FTP connection with the node by entering the following:

```
ftp>open 10.0.0.1
```

The following displays:

```
Connected to 10.0.0.1:
```

```
220 VxWorks (5.4) FTP server ready
```

```
User (<IP ADDRESS>): (none) :
```

4. Press the **<ENTER>** key.

The following displays:

```
Password required:
```

5. Press the **<Enter>** key.

The following displays:

```
ftp>
```

6. Enter the following to enable hash mark printing.

```
ftp>hash
```

7. Enter the following to change the FTP directory on the node to the *images* directory:

```
ftp>cd images
```

The following displays:

```
ftp>Hash mark printing On  ftp: (2048 bytes/hash mark).
```

Now, FTP will output a number sign (#) to the DOS FTP command prompt for every 2048 bytes transferred. This enables you to watch the progress of the file transfer.

8. Enter the following to change the FTP file transfer mode to **binary**:

```
ftp>binary
```

You are now ready to transfer the software release from the laptop to the node.

9. Enter the following to transfer the release from the laptop to the node disk0:/images directory:

```
ftp>put <path and release filename>
```

Where <path and release filename> is the complete path and filename for the release on your laptop.

For example, if the release is in the c:\releases\IPRN8000\ directory and if the release filename is rn.2.0.0.tar, enter the following

```
ftp>put c:\releases\IPRN8000\rn.2.0.0.tar
```

FTP displays a long series of hash marks ( "#####. . . ) indicating the file transfer is progressing.

The following displays to indicate a successful file transfer:

```
(line #): Transfer completed
```

The release is now on the node in the following directory: disk0:/images

This procedure is complete. Go to [Activating the release](#) on page 144

## Activating the release

This procedure explains how to use the **activate** command to make the release you just transferred to the node the current running release. This procedure assumes you have an active CLI/serial connection to the active BIO/SC module.

1. Enter the following commands to enter Global Configuration Mode in the CLI:

```
AIRVANA-03>enable
```

```
AIRVANA-03#configure
```

2. Enter the following command to reset the node using the software release you just transferred to the node:

```
AIRVANA-03 (config)#activate image <release> reboot
```

Where **<release>** is the filename of the release that was transferred to the node.

For example:

```
AIRVANA-03 (config)#activate image rn.2.0.0.tar reboot
```

This command:

- Copies the previous release (rn.2.0.0.tar) into the disk0:/backup directory
- Extracts the rn.2.0.0.0.tar release into the disk0:/active directory
- Reboots the node using the 2.0.0.0 release

This step takes about four minutes to complete.



If you also need to update the boot code, add the **updateboot** switch to the command as follows:

```
activate image <release> reboot updateboot.
```

---

This procedure is complete. Go to [Chapter 12, Running the commissioning script](#).

## Running the commissioning script

### About this chapter

This chapter describes how to run the commissioning script to configure the node for normal operations. This chapter contains the following sections:

- [Understanding the scripting process](#) on page 146
- [Initializing the node to receive a file with kermit](#) on page 147
- [Transmitting a script from a laptop to the network element](#) on page 148
- [Verifying the script file is on the node](#) on page 154
- [Running the script](#) on page 155

### Understanding the scripting process

This process explains all steps and procedures to follow when transferring a script to a node and running the script.

#### 1. Understanding scripts and script transfer options

This procedure explains how to use the kermit protocol over a serial link to the node to transfer the script file to the node. This is the simplest method. However, you can also use FTP to the node if you have an IP connection.

See [Understanding scripts](#) on page 146.

See [Understanding script transfer options](#) on page 147.

#### 2. Initializing the node to receive the script file with kermit

Using CLI, enter the node shell and prepare the node to receive the file from the laptop over the serial connection using the kermit protocol.

See [Initializing the node to receive a file with kermit](#) on page 147.

#### 3. Initializing the laptop and transmitting the script file with kermit

Launch HyperTerminal and send the file using the kermit protocol.

See [Transmitting a script from a laptop to the network element](#) on page 148

#### 4. Verifying the script file is on the node

Verify the script file was transferred to the node.

See [Verifying the script file is on the node](#) on page 154.

#### 5. Running the script file on the node

Run the script file on the node to update the node's operating configuration

See [Running the script](#) on page 155.

This procedure is complete.

### Understanding scripts

Scripts are collections of CLI commands stored in a text file. The script is created by centralized network planners and provided to the installer/commissioner. The script is transferred to the node using Hyperterminal (or any application that supports the kermit file transfer protocol) or FTP and executed with the CLI **copy** command to update the node's operating configuration. The **write** command should occur at the beginning of the script to copy the current configuration to disk. If there is an error during script execution and you reboot the network element, the configuration is restored.

## Understanding script transfer options

There are two ways files can be transferred to a node:

- Through the BIO/SC craft serial port using the kermit protocol
- Through the craft Ethernet or the backhaul using FTP

There are typically two types of files you need to transfer to the node:

- A software release for upgrading node operating software
- A script file for updating the operating configuration of the node

Which method is used depends on the following considerations:

### Serial link requires less configuration

The kermit over the serial connection requires less configuration than FTP. No connection to the craft Ethernet is required, and no configuration of IP addresses is required. All that is required is a serial cable connecting the laptop COM port to the BIO/SC craft serial port. However, if you already have an IP connection to the node, then FTP is a straightforward and convenient way to transfer either script files or software releases to the node.

### Remote file transfer requires FTP

The serial link can only be used if you are at the same physical location as the node. If you are not at the same physical location, you can transfer files using FTP.

### Use FTP to transfer large files such as software releases

Large files such as software releases should be transferred to the node using FTP through the craft Ethernet or through the backhaul because it can take hours to transfer such large files through the serial port.

## Initializing the node to receive a file with kermit

This procedure explains how to initialize the node to receive a file transmitted from a laptop connected over a serial connection using the kermit protocol.

The script file must be transferred to the node before it can be executed on the node.

This procedure assumes you have an operational CLI connection to the active BIO/SC module. For information, see [Establishing the CLI/serial connection](#) on page 135.

You must also have the script file on your laptop.

1. Use **shell** to change to the command line shell as follows:

```
AIRVANA-03>shell
```

The following prompt displays:

```
AIRVANA-03 (shell) (disk0:/) >
```

2. Use **ls** to check whether the `config` directory exists:

```
AIRVANA-03 (shell) (disk0:/) >ls
```

3. Examine the output from the **ls** command. If there is no **config** directory, create the **config** directory by entering the following:

```
AIRVANA-03 (shell) (disk0:/) > mkdir config
```

4. Move to the **config** directory by entering the following:

```
AIRVANA-03 (shell) (disk0:/) > cd config
```

The following displays:

```
AIRVANA-03 (shell) (disk0:config) >
```

5. Prepare the node to use kermi to receive the file by entering the following:

```
AIRVANA-03 (shell) (disk0:config) > kermi receive <filename>
```

Where **<filename>** is the name you want the script file to have after it is received on the node through kermi. This is not necessarily the same file name that the script file has on the laptop.

The CLI is now locked waiting to receive a file. Now you must prepare the laptop and transmit the script file using kermi.

This procedure is complete. Go to [Transmitting a script from a laptop to the network element](#) on page 148.

## Transmitting a script from a laptop to the network element

This procedure explains how to transmit a script file from the laptop to a node that is already initialized to receive the file using kermi over the serial connection using kermi.

1. Launch HyperTerminal.

On the laptop on, click Windows **Start** ⇒ **Programs** ⇒ **Accessories** ⇒ **Communications** ⇒ **HyperTerminal**.



The click sequence to launch Hyperterminal is different on different versions of Windows.

---

The following splash screen displays while HyperTerminal launches:



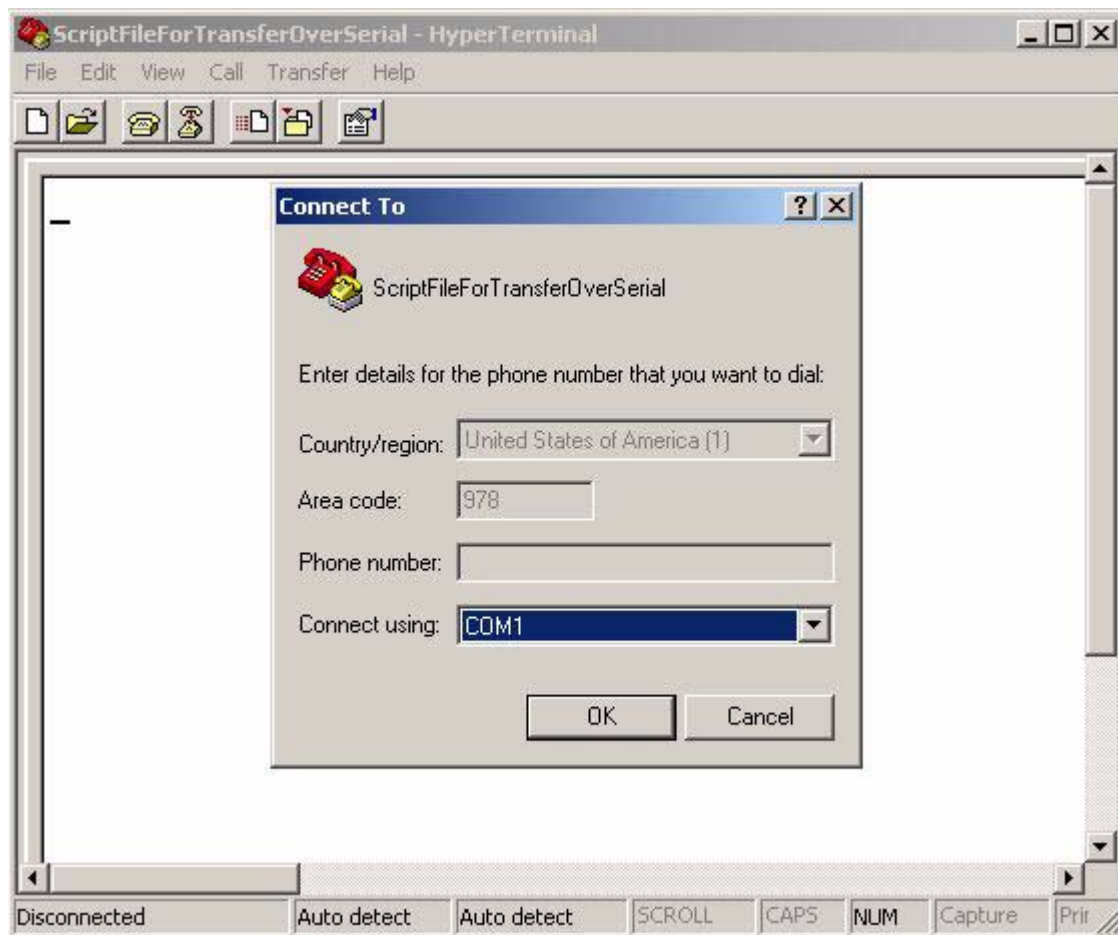
After a few seconds, the splash screen is replaced by the following:



2. Enter a name for the connection, for example: **ScriptFileTransferOverSerial** and click **OK**.

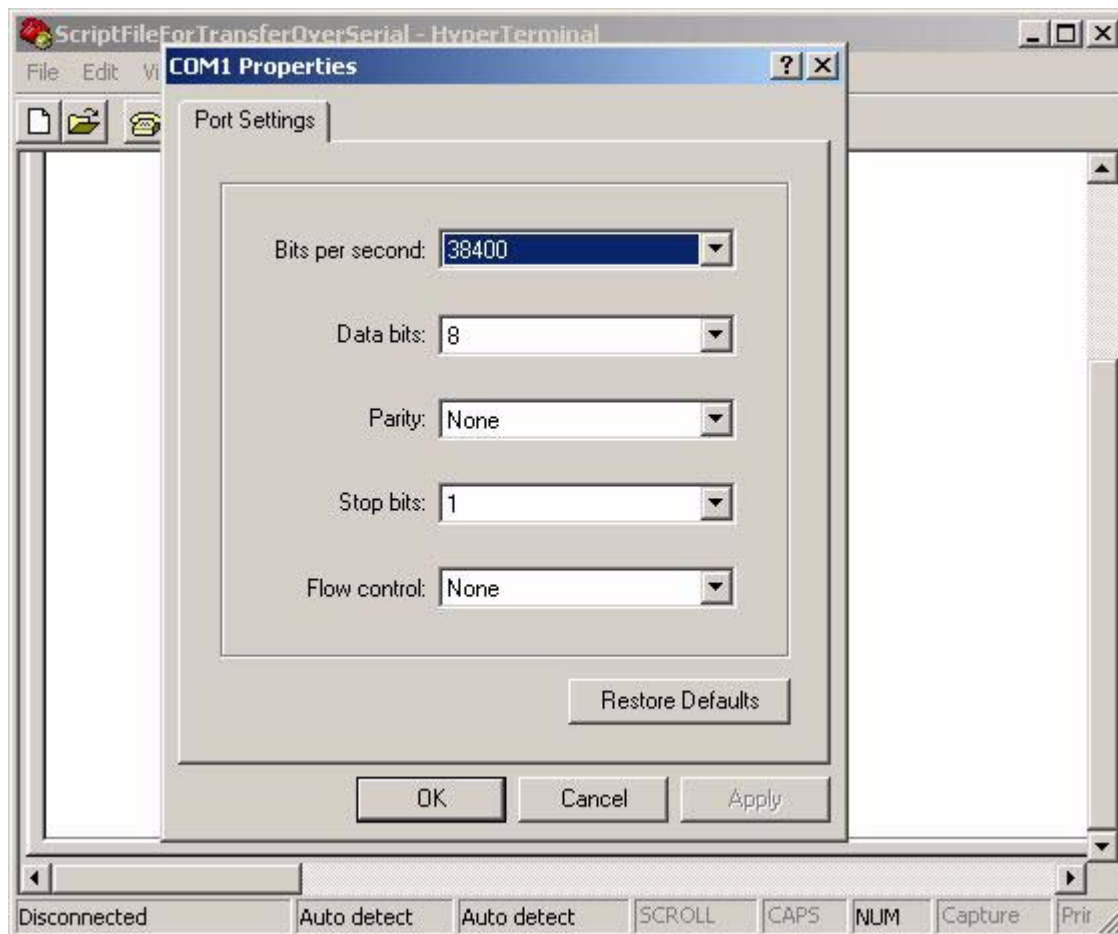
By entering a name for this connection, you can optionally save the connection and open it later without having to re-enter the connection parameters.

After clicking **OK**, the following window displays:



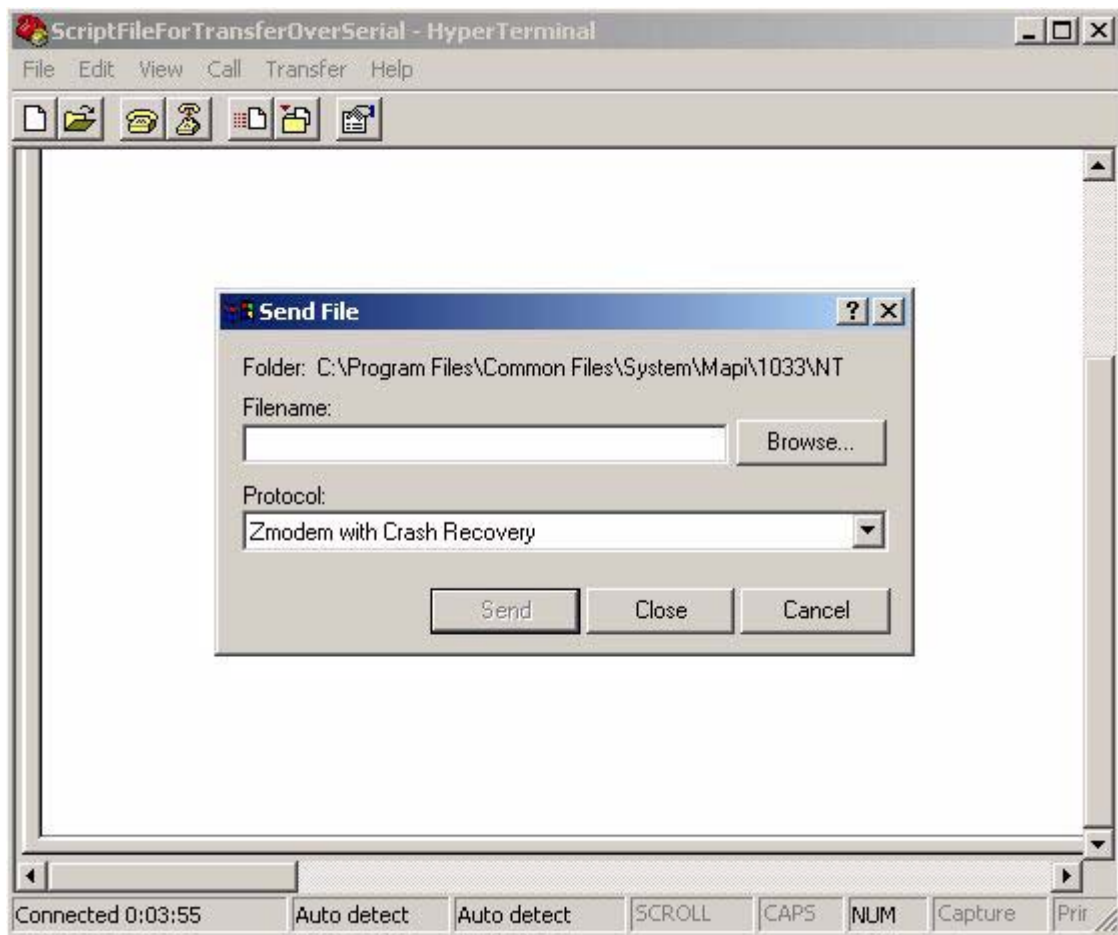
3. Ensure the proper COM port is selected in the **Connect using** pull down selection list.  
The correct COM port is the one to which you have connected the serial cable.

4. Click **OK** and the following COM1 properties window displays:



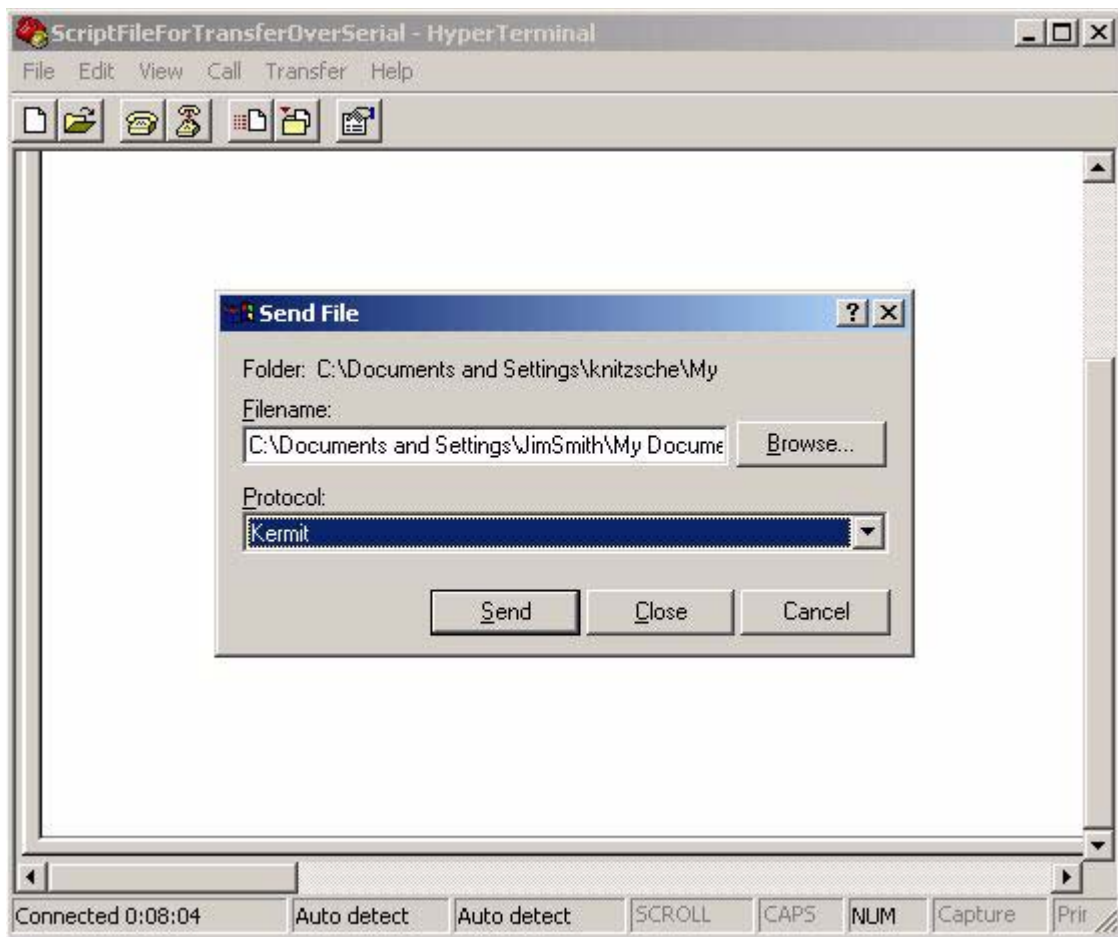
- a. In the **Bits per second** pull down selection list, select **38400**.
  - b. Ensure the **Data bits** selection is **8**.
  - c. Ensure the **Parity** selection is **None**.
  - d. Ensure the **Stop bits** selection is **1**.
  - e. In the **Flow control** pull down selection list, select **None**.
  - f. Click **OK** to close the **COM Properties** window.
5. Open the **Send File** window.  
Select **Transfer** ⇒ **Send File...**

The following displays:



6. Click the **Browse...** button to find the script file to transfer, or, in the **Filename** text box, enter the path and file name of the script file.

7. In the **Protocol** pull down selection list, select **Kermit**.



8. Click the **Send** button to send the designated script file to the node.

This procedure is complete. The script file is now transferred to the node. The next step is to return to the node CLI shell and confirm the script file is on the node. Go to [Verifying the script file is on the node](#) on page 154.

### Verifying the script file is on the node

This procedure explains how to verify the script file has been transferred successfully to the node and how to leave the command shell.

1. Look at the CLI output.

If the kermit file transfer failed, an error message displays. If it has failed, attempt the transfer again by going to [Initializing the node to receive a file with kermit](#) on page 147.

2. Check the contents of the disk0:/config directory with the **ls** command to see whether the script file is present as follows:

```
AIRVANA-03 (shell) (disk0:config) >ls
```

The list of files in the directory is displayed with the size of each file. Ensure the script file you transferred is present and has a file size greater than 0.

Note that the file name is the name you entered in the CLI command **kermit receive <filename>**, not the file name of the file before it was transmitted from the laptop.

If the file is not present, attempt the transfer again by going to [Initializing the node to receive a file with kermit](#) on page 147.

3. Use the **exit** command to leave the command shell and return to the normal CLI prompt, as follows:

```
AIRVANA-03 (shell) (disk0:config) >exit
```

The following prompt displays:

```
AIRVANA-03 >
```

This procedure is complete. Go to [Running the script](#) on page 155.

## Running the script

This procedure explains how to run a configuration script.

1. Use the **enable** command to enter the privileged EXEC mode, as follows:

```
AIRVANA-03>enable
```

The CLI prompt changes to the Privilege EXEC prompt, as follows:

```
AIRVANA-03#
```

2. Run the commissioning script by using the CLI **copy** command to copy it to **system:running-config**, as follows:

```
AIRVANA-03#copy disk0:/config/<scriptFileName> system:running-config
```

where:

- **copy** is the CLI copy command
- **disk0:/config/** specifies the required path to the script
- **<scriptFileName>** is the name of the script file
- **system:running-config** is the required destination file name

Always specify **system:running-config** as the destination file when using the CLI **copy** command to run the commissioning script.



Running a configuration script changes the node's current configuration and can be service disrupting.

---

For example: **copy disk0:/config/nodea.txt system:running-config**

The node runs the commissioning script you specified. When the script finishes executing, the CLI displays the script done message, as follows:

```
AIRVANA-03#script done
```

If the script fails to execute successfully or encounters errors, the CLI displays an appropriate error messages and the script stops running at the point where the faulty CLI command tried to execute.

3. Return to the base command prompt by typing **exit** followed by the <ENTER> key twice times, as follows:

```
AIRVANA-03#exit
```

```
AIRVANA-03>
```

This procedure is complete.



## Loopback testing backhaul links

### About this chapter

This chapter describes how to perform loopback tests on each backhaul cable and contains the following sections:

- [Understanding the backhaul link loopback test process](#) on page 158
- [Understanding backhaul loopback testing](#) on page 159
- [Understanding a typical T1/E1 backhaul network](#) on page 160
- [Understanding Ethernet loopbacks](#) on page 160
- [Looping back T1/E1 backhaul links](#) on page 161
- [Looping back Ethernet backhaul links](#) on page 162
- [Entering diagnostic mode and configuring test parameters](#) on page 163
- [Performing external loopback tests on backhaul links](#) on page 164
- [Troubleshooting failed backhaul links](#) on page 166
- [Removing physical loopbacks](#) on page 168

## Understanding the backhaul link loopback test process

This process explains the steps you should follow for performing loop back tests. Loopback testing each backhaul link is recommended to ensure correct installation and operation at the physical layer.

### 1. Understanding the backhaul loopback process

This section explains the T1/E1 loopback testing process.

See [Understanding backhaul loopback testing](#) on page 159.

See [Understanding a typical T1/E1 backhaul network](#) on page 160.

See [Understanding Ethernet loopbacks](#) on page 160.

### 2. Install external loopbacks on each backhaul cable

- If the backhaul cables are T1 or E1, go to [Looping back T1/E1 backhaul links](#) on page 161
- If the backhaul link(s) are Ethernet, go to [Looping back Ethernet backhaul links](#) on page 162

### 3. Preparing for loopback tests

Enter CLI diagnostic mode and configure the test parameters.

See [Entering diagnostic mode and configuring test parameters](#) on page 163.

### 4. Running loopback tests on each backhaul

Perform the loopback test for all backhaul links.

See [Performing external loopback tests on backhaul links](#) on page 164.

### 5. Troubleshooting failed backhaul link(s)

Take additional steps to troubleshoot and correct any backhaul link(s) that failed the external loopback tests.

See [Troubleshooting failed backhaul links](#) on page 166.

### 6. Removing physical loopbacks

The external loops at the far end of all cables must be removed.

See [Removing physical loopbacks](#) on page 168

This procedure is complete. You must complete the commissioning. Go to [Understanding the commissioning completion process](#) on page 188.

## Understanding backhaul loopback testing

Loopback testing each backhaul link verifies the backhaul installation was performed correctly and verifies physical layer operation before the technician leaves the site. During manufacturing the backhaul interfaces are loopback tested to the punch block, ensuring all internal components function properly. Loopback testing during installation can be performed to verify the correct wiring into the punch block and the external physical infrastructure.



### NOTE

The loop back testing described here does not include backhaul circuits, only physical layer functionality at the cell site. Backhaul circuits must undergo end-to-end testing and acceptance at the time they are brought up by the service provider.

The extent of the loopback test (the amount of equipment and cabling that is tested) depends on where the physical loop back is installed. The farther away from the node the loop back is installed, the greater the extent of the test.



### NOTE

Ethernet loopbacks cannot be installed at the far side of a router, switch, FRAD, or other edge device.

Airvana recommends installing the loopback at least as far as the far end of each backhaul cable exiting the cabinet. Installation at that point includes the backhaul cable's wiring into the backhaul punch block and the backhaul cable itself.



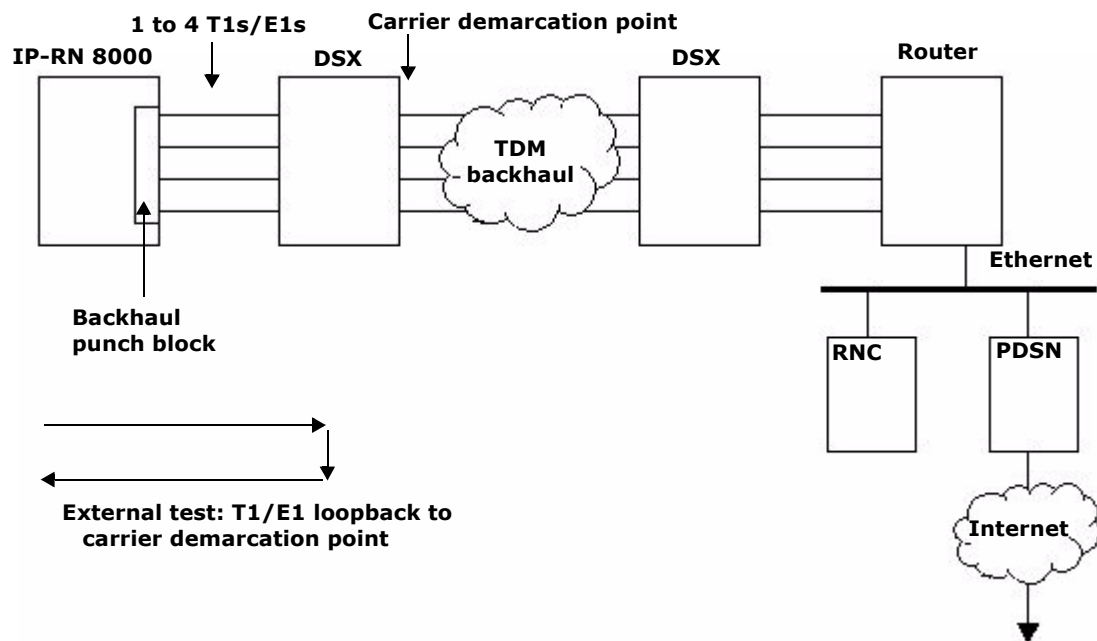
### NOTE

Maximum cable lengths must be considered when installing loopbacks. Loopbacks double the length of a cable (the cable length now equals the outgoing leg plus the return leg, or twice the physical cable length). Failure to consider this factor can result in failed loopback tests for cables that are flawless.

The technician must have appropriate equipment and materials for installing and performing loopbacks.

## Understanding a typical T1/E1 backhaul network

Figure 22 shows a typical network in which T1s/E1s are used for backhaul link(s).



**Figure 22** A typical T1/E1 backhaul network using DSXs (digital cross connects, T1/E1 multiplexors, or similar)

## Understanding Ethernet loopbacks

Like the T1/E1 loopback test, the Ethernet loopback test has two parts:

- Physically loopback the Ethernet
- Run the loopback test

The loopback can be done externally on the cable by physically connecting the receive wires (RXs) to the transmit wires (TXs). The loopback can also be done internally on the hardware transceiver chip. Looping back internally on the transceiver chip only tests limited hardware functionality and does not test the cable connection or the punch down block. Looping back externally tests more. The Ethernet loopback test is not a standard function of Ethernet but is a value-added proprietary feature.

## Looping back T1/E1 backhaul links

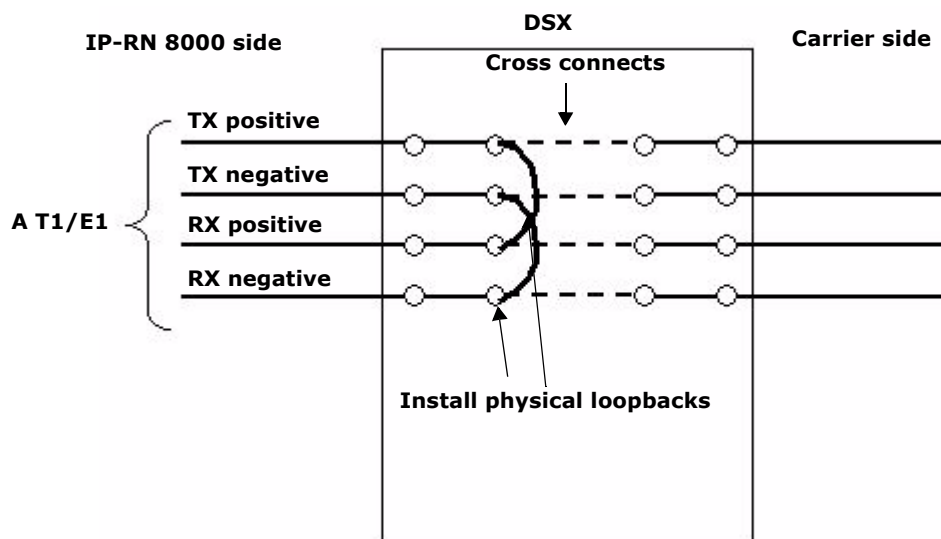
This section explains options for installing physical loopbacks when T1 or E1 backhaul link(s) are deployed at the cell site. Because Airvana does not specify the external T1/E1 equipment used at cell sites, some details of looping back the T1/E1 cables are site-dependent. Depending on the equipment deployed at the site at the time of loopback testing, the location of the installed physical loopback will vary. (See also [Understanding backhaul loopback testing](#) on page 159.) The technique used to create the loopback will also vary depending on installed third-party equipment.



### NOTE

- Physical loopbacks are created by physically connecting the positive transmit wire to the positive receive wire and connecting the negative transmit wire to the negative receive wire.
- Loopbacks must be installed on each and every T1/E1 backhaul cable.

- If the backhaul cables that exit the cabinet are connected to a DSX (or an equivalent type of equipment), the physical loopback should be installed on the IP-RN 8000 side of the DSX (or equivalent of equipment). Use methods and materials to install the loopback that are appropriate to the third-party equipment.



- If the T1/ E1 backhaul cables exiting the cabinet hang free at the far end, build a physical loopback appropriate to the cable type and install it at the far end of the cable.



### NOTE

Maximum cable lengths must be considered when installing loopbacks. Loopbacks double the length of a cable (the outgoing leg along the cable and the return leg). Failure to consider this factor can result in failed loopback tests for cables that are flawless.

This procedure is complete. Go to [Entering diagnostic mode and configuring test parameters](#) on page 163.

## Looping back Ethernet backhaul links

This section explains how to install the physical loopbacks when Ethernet backhaul links are used. If the Ethernet backhaul cable is connected to a patch panel (or another passive, pass-through device), you can install the loopback at the far side of it and thereby include the patch panel in the test.



### NOTE

You cannot loopback the Ethernet at the far side of most network devices, including switches, routers, and FRADS.

Because Airvana does not specify the Ethernet cable/connector types, the details of looping back the Ethernet cables are site-dependent. Typically, Ethernet backhaul cables installed into the backhaul punch block have an RJ-45 jack at the far-end. This section provides the pin-out for the RJ-45 jack.



### NOTE

- Physical loopbacks are created by physically connecting the positive transmit wire to the positive receive wire and connecting the negative transmit wire to the negative receive wire.
- Loopbacks must be installed on all Ethernet backhaul cables. There is one Ethernet backhaul cable on non-redundant systems; there are two on redundant systems.

- If the Ethernet at the point of the loopback installation has an RJ-45 connector on the far end, build a loopback jack using the pin-out in [Table 23](#).

**Table 23** RJ-45 Ethernet pin out for loopback

| RJ-45 wire | Description        | For loopback...   |
|------------|--------------------|-------------------|
| 1          | transmit, positive | connect to wire 3 |
| 2          | transmit, negative | connect to wire 6 |
| 3          | receive, positive  | connect to wire 1 |
| 4          | unused             |                   |
| 5          | unused             |                   |
| 6          | receive, negative  | connect to wire 2 |
| 7          | unused             |                   |
| 8          | unused             |                   |

- If the Ethernet backhaul(s) have a different connector, build a loopback jack as appropriate.
- Install the loopback connectors onto the far end of each Ethernet cable.

This procedure is complete. Go to [Entering diagnostic mode and configuring test parameters](#) on page 163.

## Entering diagnostic mode and configuring test parameters

This procedure explains how to initiate a hard reset and use the CLI to enter diagnostics mode, and how to configure the diagnostics mode for E1 links, if E1 backhaul links are deployed (see [step 4](#)). It is assumed that you already have a CLI link to the node through the serial port on the active BIO/SC module. (See [Establishing the CLI/serial connection](#) on page 135.)

### Requirements

No tools or materials are required.

### Procedure

1. Ensure the CLI session is active by pressing the <ENTER> key on your CLI laptop. A new command prompt appears indicating the session is active.

If the session is not active, see [Establishing the CLI/serial connection](#) on page 135.

2. Use the **reset** command to reboot the node as follows:

```
AIRVANA-03>enable
```

```
AIRVANA-03#reset
```

This causes the node to reboot and to run hardware diagnostics.

After hardware diagnostics run, a diagnostics countdown occurs. This countdown enables you to enter diagnostics mode by pressing the <SPACE BAR> key three times during the countdown. The countdown numbers are transmitted out the serial port and are visible in your CLI session.

3. During the countdown, press any the <SPACE BAR> key three times .

This causes the RN to enter diagnostics node. Loopback test commands are only available in diagnostics mode. The diagnostic mode command prompt is”

```
BIOSC_3>
```

Where “3” is the slot number.

4. If the backhaul links are E1, enter the following three commands to configure the E1 diagnostic mode:

```
BIOSC_3>writeeee 7FF 02
```

```
BIOSC_3>writeeee 100 0
```

```
BIOSC_3>reset
```

Resetting the node causes another reboot. You must enter the diagnostics mode by pressing the <SPACE BAR> key three times during that countdown as you did in [step 3](#) in order to stay in diagnostics mode and to continue with loopback testing.

This procedure is complete. Go to [Performing external loopback tests on backhaul links](#) on page 164.

## Performing external loopback tests on backhaul links

This procedure explains how to perform loopback tests on backhaul links. It is assumed an external loopback has already been installed on each backhaul. (See [Looping back T1/E1 backhaul links](#) on page 161 and [Looping back Ethernet backhaul links](#) on page 162). A CLI session must be active. (See [Establishing the CLI/serial connection](#) on page 135.) The node must be in diagnostic mode. (See [Entering diagnostic mode and configuring test parameters](#) on page 163.) If the backhaul is T1 or E1, diagnostic parameters must have been set. (See [Entering diagnostic mode and configuring test parameters](#) on page 163.)

1. Enter the CLI command to start the loopback test.

The command is: **commsend <number of tests> <ports>**

Where:

- **<number of tests>** specifies the number times each port is to be tested. The valid range is between (0 – 100000).
- **<ports>** specifies the names of the ports to be tested. See [Table 24](#).

**Table 24** Specifying the backhaul links to be tested

| <b>&lt;ports&gt;</b> | <b>Indicates the following ports to be tested</b> |
|----------------------|---------------------------------------------------|
| T1                   | The first T1 or E1 backhaul                       |
| T2                   | The second T1 or E1 backhaul                      |
| T3                   | The third T1 or E1 backhaul                       |
| T4                   | The fourth T1 or E1 backhaul                      |
| FENET1               | The primary Ethernet backhaul                     |

For example, the following command would start the loopback test for a system with two E1 backhaul links: **commsend 10 T1 T2**



### NOTE

If your node uses two Ethernet backhaul links (a primary and a redundant), you need to check them separately. First, establish a CLI connection with the primary BIO/SC and run the loopback test, then establish a CLI connection with the redundant BIO/SC and run the loopback test. You can simply unplug the laptop CLI cable from the primary BIO/SC craft port and plug it into the redundant BIO/SC craft port. The CLI command to run the test is the same: **commsend <number of tests> fenet1**.

2. Evaluate the results.

After the test is complete, the following table of data displays for each backhaul tested.

|                              |     |   |
|------------------------------|-----|---|
| Number of Transmitted Frames | :   | x |
| Number of Received Frames    | :   | x |
| Number of Error Frames       | :   | x |
| Frames without valid Test ID | :   | x |
| Frames with invalid Data     | :   | x |
| Frame Error Rate             | :   | x |
| Error Counters               |     |   |
| Rx Frame Length Violations   | ... | x |
| Rx Non-octet alignment       | ... | x |
| Rx Abort Frames              | ... | x |
| Rx CRC Errors                | ... | x |

If the Number of Received Frames does not equal the Number of Transmitted Frames, or if there are any errors counted, you need to troubleshoot the backhaul. Go to [Troubleshooting failed backhaul links](#) on page 166.

This procedure is complete. Go to [Removing physical loopbacks](#) on page 168.

## Troubleshooting failed backhaul links

This procedure explains how to run the internal loopback test on backhaul links that failed the external loopback test. This section also outlines what to do based on the test results: If the internal loop back passes, troubleshoot the cables and loopback devices. If the internal loopback fails, the node may be faulty and you should call Airvana.

This procedure assumes the node is in diagnostic mode, a CLI session is active, and the preceding loopback procedures have been completed.

1. If the backhaul links are T1 or E1, enter the following CLI command to specify the backhaul links you want to set to internal loopback mode:

```
BIOSC>mmb <port memory locations> 04
```

Where:

- **<port memory locations>** are the backhaul links to place into internal loopback mode. See [Table 25](#).

**Table 25** Specifying the backhaul links to be set to internal loopback mode

| <b>&lt;port memory location&gt;</b> | <b>Indicates the following ports to be set to internal loopback mode</b> |
|-------------------------------------|--------------------------------------------------------------------------|
| f500000a                            | The first T1 or E1 backhaul                                              |
| f500010a                            | The second T1 or E1 backhaul                                             |
| f500020a                            | The third T1 or E1 backhaul                                              |
| f500030a                            | The fourth T1 or E1 backhaul                                             |

For example, the following command sets the second T1 or E1 backhaul to internal loopback mode:

```
BIOSC>mmb f500010a 04
```

2. If the backhaul links are Ethernet, enter the following CLI command:

```
BIOSC>poke874 fenet1 13 803c
```

3. Run the internal backhaul test on the interface(s) you have set to internal loopback mode with the following CLI command:

```
BIOSC>commsend <number of tests> <ports>
```

Where:

- **<number of tests>** specifies the number times each port is to be tested. The valid range is between (0 – 100000).
- **<ports>** specifies the names of the ports to be tested. See [Table 26](#).

**Table 26** Specifying the backhaul links to be tested

| <b>&lt;ports&gt;</b> | <b>Indicates the following ports to be tested</b> |
|----------------------|---------------------------------------------------|
| T1                   | The first T1 or E1 backhaul                       |
| T2                   | The second T1 or E1 backhaul                      |
| T3                   | The third T1 or E1 backhaul                       |
| T4                   | The fourth T1 or E1 backhaul                      |
| FENET1               | The primary Ethernet backhaul                     |

For example, the following command would start the loopback test for a system with two E1 backhaul links:

```
BIOSC>commsend 10 T1 T2
```

4. Evaluate the results.

After the test is complete, the table of data displays for each backhaul tested.

```
Number of Transmitted Frames : x
Number of Received Frames   : x
Number of Error Frames       : x
Frames without valid Test ID : x
Frames with invalid Data     : x
Frame Error Rate             : x
Error Counters
Rx Frame Length Violations ... x
Rx Non-octet alignment       ... x
Rx Abort Frames              ... x
Rx CRC Errors                 ... x
```

If the Number of Received Frames does not equal the Number of Transmitted Frames, or if there are any errors counted, the node has a fault and you need to contact Airvana. This is the end of this procedure.

If the Number of Received Frames does equal the Number of Transmitted Frames and there are no errors, you must troubleshoot the following:

- the backhaul cable
- the physical loopback installed earlier in the loopback testing process
- the backhaul wiring into the punch block
- any external equipment the backhaul cable is attached to, for example a digital cross connect

5. Exit diagnostics mode

Enter the following command to reset the node:

```
BIOSC>reset
```

Allow the node to reboot to completion, skipping the diagnostic mode required for loopback testing.

This procedure is complete. Go to [Removing physical loopbacks](#) on page 168.

## Removing physical loopbacks

This procedure explains the steps to restore the system to normal operational mode after loopback testing is complete.

1. Remove all external, physical loopbacks installed earlier.



Failure to remove any loopbacks installed earlier results in failed backhaul links.

---

This procedure is complete. The loop back testing process is also complete. Go to [Understanding the commissioning completion process](#) on page 188.

## Calibrating transmit power

### About this chapter

This chapter explains how to measure the transmit power budget and calibrate transmit power for each sector. This chapter contains the following sections:

- [Understanding the transmit power calibration process](#) on page 170
- [Understanding calibration purpose](#) on page 171
- [Understanding requirements](#) on page 171
- [Understanding the need for simultaneous CLI sessions](#) on page 171
- [Enabling the base station and checking the IP-RNC 8500](#) on page 172
- [Verifying GPS status](#) on page 172
- [Disabling all sectors](#) on page 174
- [Attaching the sector's test equipment](#) on page 176
- [Enabling and blossoming the sector to be calibrated](#) on page 178
- [Starting FTAP for the sector](#) on page 179
- [Measuring power loss for the sector](#) on page 180
- [Setting the sector's transmit power](#) on page 181
- [Verifying the sector's power level](#) on page 182
- [Completing the sector's transmit power calibration process](#) on page 183
- [Blossoming and enabling all sectors](#) on page 185

## Understanding the transmit power calibration process

This process explains the procedures to measure antenna jumper attenuation and to calibrate transmit power for each sector accordingly.

### 1. Understanding calibration purpose and requirements

See [Understanding calibration purpose](#) on page 171.

See [Understanding requirements](#) on page 171.

### 2. Opening two CLI/telnet sessions

Simultaneous CLI sessions are needed to the local IP-RN 8000 and the remote IP-RNC 8500. This requires that the laptop is connected to the BIO/SC craft Ethernet and that IP is configured appropriately.

See [Understanding the need for simultaneous CLI sessions](#) on page 171.

### 3. Enabling the BTS and checking the connection with the IP-RNC 8500

Enable the BTS function of the IP-RN 8000 and verify the connection with the IP-RNC 8500.

See [Enabling the base station and checking the IP-RNC 8500](#) on page 172.

### 4. Verifying GPS status

Verify that GPS is locked and time is acquired.

See [Verifying GPS status](#) on page 172.

### 5. Disabling all sectors

All sectors must be disabled (transmission must be stopped) before continuing with the calibration.

See [Disabling all sectors](#) on page 174.

### 6. Calibrating each sector's power transmission offset

Perform the following procedures in sequence for each sector deployed:

- a. Attach the test equipment to the sector's transmit jumper antenna cable

See [Attaching the sector's test equipment](#) on page 176.

- b. Enable and blossom the sector

See [Enabling and blossoming the sector to be calibrated](#) on page 178

- c. Start the FTAP test for the sector

See [Starting FTAP for the sector](#) on page 179.

- d. Measure the power loss at the end of the sector's transmit antenna jumper cable at three levels and find the average loss.

See [Measuring power loss for the sector](#) on page 180.

- e. Set the sector's transmit power.

See [Setting the sector's transmit power](#) on page 181.

- f. Verify the sector's transmit power level

See [Verifying the sector's power level](#) on page 182.

- g. Shut the sector down, remove test equipment, and re-connect the antenna

See [Completing the sector's transmit power calibration process](#) on page 183

This procedure is complete. You must run the commissioning script to configure the node for normal operations. Go to [Understanding the backhaul link loopback test process](#) on page 158.

## Understanding calibration purpose

The purpose of the procedures in this chapter is to measure the power loss over the antenna jumper so that you can adjust the transmission level for the sector appropriately to compensate.

## Understanding requirements

The following are required to measure and calibrate the transmit power for each sector:

- The IP-RN 8000 must have been completely configured for normal operations with the commissioning script.
- Backhaul links must be operative at the physical level and at the IP level providing connectivity to the IP-RNC 8500 to which this IP-RN 8000 is homed.
- The IP-RNC 8500 to which this IP-RN 8000 is homed must be operating.
- You must know the management IP address of the IP-RNC 8500 to which the IP-RN 8000 is homed in order to telnet to it.

## Understanding the need for simultaneous CLI sessions

Calibrating transmit power requires two simultaneous CLI sessions, one to the local IP-RN 8000 and one to the remote IP-RNC 8500. Simultaneous CLI sessions require a connection from the laptop to the BIO/SC craft Ethernet port and that the appropriate IP configuration is completed. Once this connection is active, you can open two CLI/telnet sessions, one to the local IP-RN 8000 and one to the remote IP-RNC 8500. (Alternatively, you can use the CLI/serial connection to control the local IP-RN 8000 and use CLI/telnet to control the remote IP-RNC 8500.)

Before proceeding, open these two CLI sessions. Opening the IP-RNC 8500 requires that you know and use the IP-RNC 8500's management IP address.

See [Understanding the CLI connection process](#) on page 132.

## Enabling the base station and checking the IP-RNC 8500

This procedure explains how to enable the BTS function in the IP-RN 8000 and to verify the IP-RN 8000 has connectivity with the IP-RNC 8500 to which it is homed.

### Requirements

CLI session with the IP-RN 8000

### Procedure

1. Using the CLI session to the IP-RN 8000, enable the BTS function as follows:

```
AIRVANA-03>enable
AIRVANA-03#no shutdown
AIRVANA-03#exit
AIRVANA-03>
```

This configures the node to establish a connection with the IP-RNC 8500 to which it is homed.

2. Verify the node is communicating with the IP-RNC 8500, as follows:

```
AIRVANA-03>show abis peer
After several seconds, the following displays:
PeerAddressPortStateRxMsgsRxhellos
172.16.1.32602UP22648
```

If an IP address followed by a few digits and then “UP” is not displayed, the node does not have a connection to the IP-RNC 8500. This connection is required for the test to proceed.

This procedure is complete. Go to [Verifying GPS status](#) on page 172.

## Verifying GPS status

This procedure explains how to verify that the IP-RN 8000’s GPS system is operational and locked onto a satellite.

### Requirements

An IP-RN 8000 CLI session.

### Procedure

1. Verify GPS is locked to a satellite with the following:

```
AIRVANA-03>show gps-health
```

The following displays:

```
GPS module is present
```

```
GPS Lock Status: Locked
```

```
Even Second: Valid
```

If the display shows any other values, GPS is not functioning properly. Troubleshoot the following:

- The TFU module containing the GPS module. Ensure that it is properly inserted in the chassis and that its LEDs indicate normal operations.
  - Verify that the GPS antenna jumper cables exiting the cabinet through the Rox System cabinet seal are properly connected to GPS antennas and that those antennas are functioning properly.
2. Enter the following command to display the current UTC (Universal Time Coordinated) time as reported by the GPS module:

```
AIRVANA-03>show gps time
```

The GMT time displays:

```
Current UTC Time read from the GPS: 19:32:18 07/01/02
```

```
Even-second is valid.
```

Verify the time displayed is correct.

If the correct time does not display, troubleshoot the GPS antennas and receivers.



It can take 10 minutes after the GPS antenna is connected and the TFU module is powered on for the GPS to acquire and display the correct time.

---

This procedure is complete. [Disabling all sectors](#) on page 174.

## Disabling all sectors

This procedure explains how to ensure all sectors are disabled for transmission.



Failure to disable sectors before proceeding can release EMI radiation. This can cause injury and can results in interference with other EMI devices.

---



Terminology note: Sectors can be “enabled” (turned on) and disabled (turned off). If a sector is enabled, the transmit power can be “blossomed” (turned on) or “wilted” (turned off).

---

### Requirements

- A CLI session to the IP-RN 8000

### Procedure

1. Check the sector status with the following CLI command:

```
AIRVANA-03>show sector-element
```

```
Name Carrier Sector CAI Channel Power Admin Oper
```

```
-----  
element1/4/1 carrier1 sector1 IS-856 850 35 dBm DOWN DOWN
```

```
element1/4/2 carrier1 sector2 IS-856 850 35 dBm DOWN DOWN
```

```
element1/4/3 carrier1 sector3 IS-856 850 35 dBm DOWN DOWN
```

The display shows all sectors. Before continuing, all sectors must have an Admin of DOWN and an Oper of DOWN.

2. If any sector does not have an Admin of DOWN and an Oper of DOWN, you must shut it down using the following commands (this example shuts down all three sectors):

```
AIRVANA-03>enable
AIRVANA-03#configure
AIRVANA-03 (config)#sector-element element1/4/1
AIRVANA-03 (config-element)#shutdown
AIRVANA-03 (config-element)#exit
AIRVANA-03 (config)#sector-element element1/4/2
AIRVANA-03 (config-element)#shutdown
AIRVANA-03 (config-element)#exit
AIRVANA-03 (config)#sector-element element1/4/3
AIRVANA-03 (config-element)#shutdown
AIRVANA-03 (config-element)#exit
AIRVANA-03 (config)#exit
AIRVANA-03#exit
```

This procedure is complete. Go to [Attaching the sector's test equipment](#) on page 176.

## Attaching the sector's test equipment

This procedure explains how to attach test equipment to the sector's transmit antenna jumper cable exiting the cabinet.

### Required tools

The following tools are used if the antenna jumper cables exiting the cabinet used standard N-type connectors to attach to external equipment. If you assembled your own jumper cables using different connectors, you need appropriate tools.

- 13/16 inch open ended wrench
- Torque wrench with 13/16 inch open ended bit
- 30 dB attenuator pad with connector appropriate for antenna jumper cable rated for a maximum of 50 watts
- Power splitter to split the transmit signal for use by the power meter and the AT, with appropriate cables and connector adapters
- Power meter with connector appropriate for coupler
- 1xEV-DO access terminal (AT)

### Warnings



You must have disabled the sector before continuing. Failure to disable the sectors can result in EMI radiation that could cause injury and could cause interference with other devices.



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.



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

---

### Procedure

1. Identify the sector you are calibrating.  
For information about sectors, see Understanding radio sectors on page 14.
2. Identify the transmit antenna jumper cable for the sector exiting the Rox System cabinet seal.  
For information about identifying the transmit jumper cable for the sector, see RF and GPS cable locations on page 101.
3. Use the 13/16 inch open ended wrench to disconnect the transmit antenna jumper cable for the sector from external equipment.
4. Attach a 30 dB attenuator pad to the end of the antenna jumper cable.



Failure to attach attenuator pad may result in damage to the power meter and the access terminal.

---



You must account for the attenuator when making power budget calibrations later.

---

5. Connect the power splitter to the attenuator, using appropriate adapters.



You must account for the power splitter when making power budget calibrations later.

---

6. Connect the power meter to one branch of the power splitter using appropriate adapters.
7. Connect the AT to the other branch of the power splitter using appropriate adapters.

This procedure is complete. Go to [Enabling and blossoming the sector to be calibrated](#) on page 178.

## Enabling and blossoming the sector to be calibrated

This procedure explains how to enable the sector being calibrated and turn on (blossom) transmission for the sector. This is needed for the AT to establish an active 1xEV-DO session with the IP-RNC 8500.

### Requirements

- CLI session to the IP-RN 8000
- CLI session to the IP-RNC 8500
- A turned on 1xEV-DO AT
- All sectors are disabled

### Procedure

1. Use the CLI session to the IP-RN 8000 to enable and blossom the sector being calibrated, as follows:

```
AIRVANA-03>enable
```

```
AIRVANA-03#configure
```

```
AIRVANA-03 (config)#sector-element <sector-element>
```

Where: <sector-element> is **element1/4/1** for sector1/alpha, **element1/4/2** for sector2/beta, **element1/4/3** for sector1/gamma

```
AIRVANA-03 (config-element)#tx-power 25
```

```
AIRVANA-03 (config-element)#no shutdown
```

```
AIRVANA-03 (config-element)#exit
```

```
AIRVANA-03 (config)#exit
```

```
AIRVANA-03#exit
```

2. Verify the sector is up as follows:

```
AIRVANA-03>show sector-element
```

```
Name Carrier Sector CAI Channel Power Admin Oper
```

```
-----
```

```
element1/4/1 carrier1 sector1 IS-856 850 25 dBm UP UP
```

```
element1/4/2 carrier1 sector2 IS-856 850 35 dBm DOWN DOWN
```

```
element1/4/3 carrier1 sector3 IS-856 850 35 dBm DOWN DOWN
```

The sector you blossomed should have an Admin of UP and an Oper of UP.

This procedure is complete. Go to [Starting FTAP for the sector](#) on page 179.

## Starting FTAP for the sector

This procedure explains how to get the UATI identifier for the AT that is required for the FTAP test and how to start the FTAP test. Starting FTAP cause the IP-RNC 8500 to transmit a steady stream of data to the specified AT using the current sector (only one sector at a time is enabled). This causes the IP-RN 8000 to transmit to the AT at a steady rate, enabling power measurement and calibration.

### Requirements

- A 1xEV-DO access terminal (AT)
- A CLI session to the IP-RN 8000
- A CLI session to the IP-RNC 8500

### Procedure

1. Ensure the AT is turned on and has established a 1xEV-DO connection.

How to do this depends on the type of AT. It may just require turning the AT on, or additional steps may be required.

2. Use the CLI session to the IP-RNC 8500 to find the AT's UATI as follows:

```
AIRVANA-07>enable
```

```
AIRVANA-07#show lxevd session all 1001 40
```

The following displays (the complete table is not displayed here):

```
UATI List
```

```
Inst UATI24 RATI ...
```

```
(Dec) (Hex) ...
```

```
-----
1 10 000003F2 ...
```

The UATI in this case is 000003F2.

If no UATI is displayed, there may be a problem with the AT or with the network. This test requires a completely configured and operational IP-RAN network and an operational 1xEV-DO AT.

3. Still using the CLI session to the IP-RNC 8500, enter TAP configuration mode, as follows

```
AIRVANA-07#tap
```

4. Configure the TAP session with the UATI of the AT discovered above, as follows:

```
AIRVANA-07 (tap) #user 0x3f2
```

Where: **0x** indicates hexadecimal and **3f2** is the UATI found above (leading zeros are not required)

5. Start the FTAP test as follows:

```
AIRVANA-07 (tap-0x3f2) #at-tx-mode ftap-loopback
```

```
AIRVANA-07 (tap-0x3f2) #start ftap 3600
```

Where **3600** is the number of seconds the FTAP test runs without being intentionally stopped.

Using 3600, the FTAP test will stop in one hour. If you have not completed the calibration for this sector by then, you must restart the FTAP test.

This procedure is complete. Go to [Measuring power loss for the sector](#) on page 180.

## Measuring power loss for the sector

This procedure explains how to measure the loss of transmit power over the sector's transmit jumper cable and test equipment at three different transmit power levels.

### Requirements

A CLI session to the IP-RN 8000

### Procedure

1. Using the CLI session to the IP-RN 8000, set the sector's transmit power level to 25 dBm as follows:

```
AIRVANA-03>enable  
AIRVANA-03#configure  
AIRVANA-03 (config)#sector-element element1/4/1  
AIRVANA-03 (config-element)#tx-power 25  
AIRVANA-03 (config-element)#no shutdown
```

These commands configure the first sector (identified by sector-element element1/4/1).

To configure sector 2, use: sector-element element1/4/2.

To configure sector 3, use: sector-element element1/4/3.

2. As a result of these commands, the sector transmission blossoms. Wait until the power meter shows a stable power level. Find the differences between this detected power level and the configured transmit power level (25 dB) and write it down. The detected power level should be somewhat less than the transmit power level due to power lost over the antenna jumper cable and test equipment.
3. Change the transmit power level for the sector to 35 dBm using the following:  

```
AIRVANA-03 (config-element)#tx-power 35
```
4. The sector transmission blossoms. Wait until the power meter shows a stable power level. Find the differences between this detected power level and the configured transmit power level (35 dB) and write it down.
5. Change the transmit power level for the sector to 45 dBm using the following:  

```
AIRVANA-03 (config-element)#tx-power 45
```
6. The sector transmission blossoms. Wait until the power meter shows a stable power level. Find the differences between this detected power level and the configured transmit power level (35 dB) and write it down.
7. Find the average of the three numbers you calculated. Each of those calculations was the power loss at a given transmit level. The average of those is the average power loss (without compensation for test equipment) and is used to calibrate the power level of the transmission on this sector.

This procedure is complete. Go to [Setting the sector's transmit power](#) on page 181.

## Setting the sector's transmit power

This procedure explains how to calibrate the sector's power transmission level using the results of the power loss measurements taken in the previous procedure.

### Requirements

- A CLI session to the IP-RN 8000
- The average dB loss for the sector calculated in the previous procedure

### Procedure

1. Calculate the power loss parameter for the CLI command using the average power loss from the previous procedure as follows:
  - a. Subtract the power loss of the power splitter and attenuator.
  - b. Round the result off to the nearest 1/8th (to the nearest 0.125)

For example, if the average dB power loss was 33.55 dB and the power splitter and attenuator have a combined loss of 32 dB:

- a.  $33.55 - 32 = 1.55$
- b. 1.55 rounded to the nearest 1/8th is 1.625

So, the result is 1.625. This result is used in the next step.

2. Turn off the sector as follows:

```
AIRVANA-03>enable
```

```
AIRVANA-03#configure
```

```
AIRVANA-03 (config) #sector-element element1/4/1
```

Use **element1/4/2** for sector 2/beta and **element1/4/3** for sector 3/gamma

```
AIRVANA-03 (config-element) #shutdown
```

3. Set the transmit power level for the sector as follows:

```
AIRVANA-03 (config-element) #pa-offset +1.625
```

Where **+1.625** is the result calculated in step 1

4. Turn on the sector as follows:

```
AIRVANA-03 (config-element) #no shutdown
```

```
AIRVANA-03 (config-element) #exit
```

```
AIRVANA-03 (config) #exit
```

```
AIRVANA-03#exit
```

This procedure is complete. Go to [Verifying the sector's power level](#) on page 182.

## Verifying the sector's power level

This procedure explains how to verify the sector's calibration.

### Requirements

A CLI session to the IP-RN 8000

### Procedure

1. At the CLI session to the IP-RN 8000, use the following commands to set the power level to 25 dBm:

```
AIRVANA-03>enable
```

```
AIRVANA-03#configure
```

```
AIRVANA-03 (config)#sector-element element1/4/1
```

```
AIRVANA-03 (config-element)#tx-power 25
```

```
AIRVANA-03 (config-element)#no shutdown
```

These commands configure the first sector (identified by **element1/4/1**).

- To configure sector 2, use: **sector-element element1/4/2**.
- To configure sector 3, use: **sector-element element1/4/3**.

2. As a result of these commands, the sector transmission blossoms. Wait until the power meter shows a stable power level and write it down.
3. Change the transmit power level for the sector to 35 dBm using the following:  

```
AIRVANA-03 (config-element)#tx-power 35
```
4. The sector transmission blossoms. Wait until the power meter shows a stable power level and write it down.
5. Change the transmit power level for the sector to 45 dBm using the following:  

```
AIRVANA-03 (config-element)#tx-power 45
```
6. The sector transmission blossoms. Wait until the power meter shows a stable power level and write it down.
7. Analyze the results to see if calibration is successful.

All three measurements should be within 1 dBm of the transmit power set with the **tx-power** command after compensation for the power loss in the power coupler and attenuator pad.

- If all three results after compensating for the power splitter and attenuator pad are within 1 dB of the power level set, the sector's transmission power has been calibrated successfully.
  - If any of the three results after compensating for the power splitter and attenuator pad are not within 0.5 dBm of the power level set, the sector's transmission power has not been calibrated successfully.
8. At this point you can optionally connect a radio frequency spectrum analyzer to the Tx sample port on the PA module for the sector and analyze the wave form for correctness. For information about the Tx sample port, see Understanding the Power Amplifier module on page 18.

This procedure is complete.

- If the sector's calibration is successful, go to [Completing the sector's transmit power calibration process](#) on page 183.
- If the sector's calibration is not successful, go to [Measuring power loss for the sector](#) on page 180.

## Completing the sector's transmit power calibration process

This procedure explains how to stop FTAP for the sector and remove test equipment in preparation for calibrating the next sector or completing the entire calibration process, as appropriate.

### Requirements

If you assembled your own jumper cables using different connectors, you need appropriate, site-specific tools.

- 13/16 inch open ended wrench
- Torque wrench with 13/16 inch open ended bit
- 30 dB attenuator pad with connector appropriate for antenna jumper cable
- Power meter with connector appropriate for antenna jumper cable
- An operational CLI/serial session to the active BIO/SC module
- See Establishing the CLI/serial connection on page 153.

### Warnings



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.

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

---

### Procedure

1. Shut down the sector as follows (this example shuts down sector1):

```
AIRVANA-03>enable
AIRVANA-03#configure
AIRVANA-03 (config)#sector-element element1/4/1
AIRVANA-03 (config-element)#shutdown
• To shut down sector 2, use: sector-element element1/4/2.
• To shut down sector 3, use: sector-element element1/4/3.
AIRVANA-03 (config-element)#exit
AIRVANA-03 (config)#exit
AIRVANA-03#exit
AIRVANA-03>
```

2. Use the CLI session with the IP-RNC 8500 to stop the FTAP session as follows:

```
AIRVANA-07>(tap-0x3f2)#exit
AIRVANA-07>(tap)#exit
AIRVANA-07#exit
AIRVANA-07>
```

3. Disconnect the power meter, attenuator pad, and power splitter from the end of the transmit jumper cable for the sector.
4. Connect the antenna jumper cable that was just attached to the test equipment to the proper external antenna cable/surge protection equipment.

The connections are typically N-type and require a 13/16 inch open ended wrench. If you assembled your own jumper cables, the connector type may be different

Tighten connections snugly. Do not overtighten.



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.

- If you have completed calibration of all sectors, go to [Blossoming and enabling all sectors](#) on page 185.
- If you still have sectors to calibrate, go to [Starting FTAP for the sector](#) on page 179.

## Blossoming and enabling all sectors

This procedure explains how to restart transmission (blossom) for all sectors deployed on the node. This procedure is only followed after all sectors have been calibrated and all test equipment is removed.



Do not blossom and enable sectors unless all calibration is complete, all test equipment is removed, and all antennas are reconnected.

---

### Requirements

- An operational CLI/serial session to the active BIO/SC module
- See Establishing the CLI/serial connection on page 153.

### Procedure

1. If sector 1 (alpha) is deployed on the node, set the power transmission level to the figure specified by network planners and blossom the transmission as follows:

```
AIRVANA-03>enable
AIRVANA-03#configure
AIRVANA-03 (config)#sector-element element1/4/1
AIRVANA-03 (config-element)#tx-power <specified by network planners>
AIRVANA-03 (config-element)#no shutdown
AIRVANA-03 (config-element)#exit
AIRVANA-03 (config)#exit
AIRVANA-03#exit
AIRVANA-03>
```

2. If sector 2 (beta) is deployed on the node, set the power transmission level to the figure specified by network planners and blossom the transmission as follows:

```
AIRVANA-03>enable
AIRVANA-03#configure
AIRVANA-03 (config)#sector-element element1/4/2
AIRVANA-03 (config-element)#tx-power <specified by network planners>
AIRVANA-03 (config-element)#no shutdown
AIRVANA-03 (config-element)#exit
AIRVANA-03 (config)#exit
AIRVANA-03#exit
AIRVANA-03>
```

3. If sector 3 (gamma) is deployed on the node, set the power transmission level to the figure specified by network planners and blossom the transmission as follows:

```
AIRVANA-03>enable
AIRVANA-03#configure
AIRVANA-03 (config)#sector-element element1/4/3
AIRVANA-03 (config-element)#tx-power <specified by network planners>
AIRVANA-03 (config-element)#no shutdown
AIRVANA-03 (config-element)#exit
AIRVANA-03 (config)#exit
AIRVANA-03#exit
AIRVANA-03>
```

4. Verify all sectors are operational as follows.

```
AIRVANA-03>show sector-element
Name Carrier Sector CAI Channel Power Admin Oper
-----
element1/4/1 carrier1 sector1 IS-856 850 XX dBm UP UP
element1/4/2 carrier1 sector2 IS-856 850 XX dBm UP UP
element1/4/3 carrier1 sector3 IS-856 850 XX dBm UP UP
The sector you blossomed should have an Admin of UP and an Oper of UP
The Power is as you configured it for each sector.
```

This procedure is complete. Go to [Chapter 15, Completing commissioning](#).

## Completing commissioning

### About this chapter

This chapter explains how to complete the commissioning process. This chapter contains the following sections:

- [Understanding the commissioning completion process](#) on page 188
- [Checking the modules with CLI](#) on page 188
- [Disconnecting the laptop](#) on page 189
- [Preparing the cabinet for your departure](#) on page 189
- [Preparing the site for your departure](#) on page 190

## Understanding the commissioning completion process

This process explains the steps you must take to complete the commissioning process.

1. **Checking the status of all modules with CLI**

See [Checking the modules with CLI](#) on page 188

2. **Disconnecting the Laptop**

See [Disconnecting the laptop](#) on page 189

3. **Ensuring the cabinet is prepared for your departure**

See [Preparing the cabinet for your departure](#) on page 189

4. **Ensuring the site is prepared for your departure**

See [Preparing the site for your departure](#) on page 190

This is the end of the commissioning phase. Now that installation and commissioning is complete, you are done with this book. The next phase is network integration, in which network-wide connectivity tests are performed and other steps are taken to ensure network operation.

## Checking the modules with CLI

This procedure explains how to check the node to ensure all modules are operational. It is assumed you have an open CLI session to the active BIO/SC module.

1. Enter the following command to display a report showing the status of all modules:

```
AIRVANA-03>show module
```

The following displays:

| Name    | Contains   | Status | Up Time          |
|---------|------------|--------|------------------|
| slot1/1 | radio1/1/1 | Active | 000d:00h:02m:14s |
| slot1/2 | tfu1/2/1   | Active | 000d:00h:02m:14s |
| slot1/3 | sc1/3/1    | Active | 000d:00h:02m:18s |
| slot1/4 | modem1/4/1 | Active | 000d:00h:02m:14s |
| slot1/5 | radio1/5/1 | Active | 000d:00h:02m:14s |
| slot1/6 | tfu1/6/1   | Active | 000d:00h:02m:14s |
| slot1/7 | sc1/3/1    | Ative  | 000d:00h:02m:14s |
| slot1/8 | modem1/8/1 | Active | 000d:00h:02m:14s |
| slot1/9 | radio1/9/1 | Active | 000d:00h:02m:14s |

Every module in the network element is listed with a status of Active.

### Disconnecting the laptop

This procedure explains how to disconnect the laptop and close its front door shelf in preparation for departure.

1. Unplug the serial cable from the laptop's COM port and from the BIO/SC module craft port.



You might want to leave the cable in the document holder on the inside of the front door. For information about the document holder, see [Figure 3](#) on page 5.

---

2. If the laptop is connected to the node over Ethernet, disconnect all Ethernet cables.
3. Turn the laptop off.
4. Remove the laptop from the front door laptop shelf.

For information about the laptop front door shelf, see [Figure 3](#) on page 5.

5. Close the front door laptop shelf.

See [Closing the PC shelf](#) on page 202.

6. Leave any pertinent notes or documents in the front door document holder.

This procedure is complete.

### Preparing the cabinet for your departure

This procedure explains how to prepare the cabinet for the departure of the field technician.

1. Visually examine the cabinet's interior and exterior from all sides and inspect for:
  - Loose cables that might interfere with the front door closing
  - Loose modules that should be inserted properly but are not inserted all the way
  - Any access panels that are not installed properly
  - Loose power or backhaul cables exiting the cabinet that are not properly enclosed in conduit
  - Improperly installed conduit
  - Loose or dangling antenna cables
  - Check the gasket on the inside edge of the front door.  
This gasket should be seated properly all the way around.
  - Anything out of the ordinary



Failure to ensure all aspects of the installation were properly performed before leaving the site can result in damage to the equipment or service interruption.

---

2. Press in the tech-on-site switch.

See [Understanding the tech-on-site switch](#) on page 36.

3. Close the front door.  
See [Closing the door](#) on page 199.
4. Use a padlock to lock the cabinet front door.

This procedure is complete.

## Preparing the site for your departure

This procedure explains how to prepare the site for the departure of the field technician.

1. Remove all packing containers or trash and dispose of it properly.
2. Visually inspect the site and fix any problems.
3. Close and lock any:
  - Equipment boxes or pedestals
  - Gates or fences

This is the end of the commissioning phase. Now that installation and commissioning is complete, you are done with this book. The next phase is network integration, in which network-wide connectivity tests are performed and other steps are taken to ensure network operation.

## IP-RN 8000 Specifications

### About this appendix

This appendix provides specifications for the IP-RN 8000. It contains a series of tables and sections covering these specifications:

- [IP-RN 8000 physical and environmental specifications](#) on page 192
- [Power specifications](#) on page 193
- [Grounding connection specifications](#) on page 193
- [Backhaul cable and power cable access ports](#) on page 193
- [Bell Core Earthquake Standards](#) on page 194
- [Connectors, screws, nuts, washers](#) on page 194
- [Module physical specifications](#) on page 195
- [Backhaul cable specifications](#) on page 195
- [DB-9 BIO/SC serial port pin-out](#) on page 196
- [Compliance with regulatory and industry standards](#) on page 196

**Table 27** IP-RN 8000 physical and environmental specifications

| Specification                  | Description                         |                                                                                                                                                        |
|--------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Weight                         | Fully populated                     | approximately 630 lbs (286 kg)                                                                                                                         |
| Dimensions                     | Height                              | 59.5 inches (1511.3 mm)                                                                                                                                |
|                                | Width                               | 30.5 inches (774.7 mm)                                                                                                                                 |
|                                | Depth                               | 39 inches (990.5 mm)                                                                                                                                   |
| Operating temperature range    | With heater                         | -40°C to 46°C                                                                                                                                          |
|                                | Without heater                      | -10°C to 46°C<br>Startup and operation is possible at temperatures as low as -40°C, but the IP-RN 8000 may not satisfy all specifications below -10°C. |
|                                | Rate of temperature change          | Not to exceed a change of more than 15°C per hour.                                                                                                     |
| Non-operating (storage) ranges | Temperature                         | -40°C to 70°C                                                                                                                                          |
|                                | Humidity                            | 0 to 95% noncondensing                                                                                                                                 |
| Loading                        | Wind                                | 150 miles per hour. Exp. D (241 kilometers per hour)                                                                                                   |
|                                | Snow                                | 60 pounds per square foot (may be higher depending on installation) (27.2 kilograms per square)                                                        |
|                                | Seismic                             | Bellcore Zone 4 (GRE-CORE)                                                                                                                             |
| Ratings                        | UL                                  | UL 1950 (UL60950)                                                                                                                                      |
| Construction                   | Aluminum structure and body         |                                                                                                                                                        |
| Lifting eyes                   | 1/2 inch diameter                   |                                                                                                                                                        |
| Heat exchanger                 | Closed loop design for use outdoors |                                                                                                                                                        |
| Standard alarms                | High temperature                    | Set-point 70°C                                                                                                                                         |
|                                | Low temperature                     | Set-point 14°C                                                                                                                                         |
|                                | Intrusion                           | On front door (pull the tech-on-site switch to override the door alarm)                                                                                |
| Altitude                       | Maximum                             | 3000 meters                                                                                                                                            |

**Table 28** Power specifications

| Specification                                                           | Description                                   |
|-------------------------------------------------------------------------|-----------------------------------------------|
| Input Voltage Operating Range                                           | 24 V DC to 29 V DC                            |
|                                                                         | 27 V DC nominal at the cabinet power terminal |
|                                                                         | Negative Return                               |
| Input Drop Out Time                                                     | Drops to 0V for 100 uSec max                  |
| Input Current                                                           | 85 A maximum without a heater                 |
| Input Voltage ripple and noise over all load and environment conditions | < 100 mV peak to peak from 0 – 20 MHz         |
|                                                                         | < 200 mV peak to peak from 0 – 100 MHz        |
|                                                                         | < 19 mV RMS from 0 – 10 MHz                   |
|                                                                         | < 5 mV RMS from 0 – 100 KHz                   |
| Power cable                                                             | 2/0 maximum, 1/0 minimum                      |
| Ground cable                                                            | 1/0                                           |

**Table 29** Grounding connection specifications

| Specification                       | Description                                                                                    |
|-------------------------------------|------------------------------------------------------------------------------------------------|
| Optional side grounding connections | Three pairs of threaded holes designed for dual hole lugs. The thread specification is 1/4-20. |

**Table 30** Backhaul cable and power cable access ports

| Specification                                                                                                                               | Description                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Backhaul cable access port - Airvana fixture attached                                                                                       | 1 inch diameter access port for backhaul cables. Conduit must be attached as appropriate for local conditions and according to local code requirements.                                 |
| Backhaul cable access port - Airvana fixture removed                                                                                        | 1.36 inches diameter                                                                                                                                                                    |
| Power cable access port - Airvana fixture* attached                                                                                         | 3 inch diameter access port for power cables and optionally for backhaul cables. Conduit must be attached as appropriate for local conditions and according to local code requirements. |
| Power cable access port - Airvana fixture* removed                                                                                          | 3.54 inches diameter                                                                                                                                                                    |
| * The fixture is a removable connector on the conduit opening. You can install conduit with the fixture in place or removed as appropriate. |                                                                                                                                                                                         |

**Table 31** Bell Core Earthquake Standards

| Specification    | Description                                                                                                                                              |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bell Core Zone 4 | Installations procedures in this guide provide protection from earthquakes in the following Bell Core seismic zones: Zone 1, Zone 2, Zone 3, and Zone 4. |

**Table 32** Connectors, screws, nuts, washers

| RF cables                     | Male N-type connector. Use 13/16 inch open ended wrench.                                                                                                                                                                                                                                                                                                                            |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GPS cables                    | Male N-type connector. Use 13/16 inch open ended wrench.                                                                                                                                                                                                                                                                                                                            |
| Access panel screws           | <p>Tamper proof screw with rubber lock washer.</p> <ul style="list-style-type: none"> <li>Screw: button socket, 1/4-20 by 3/4 inch, stainless steel, with pin.</li> <li>Washer: lock washer, SLFSE, 1/4 inch</li> </ul>                                                                                                                                                             |
| Tamper resistant screw driver | 5/32 inch tamper resistant hex driver                                                                                                                                                                                                                                                                                                                                               |
| Access panel gasket washer    | RACO 1209 washer                                                                                                                                                                                                                                                                                                                                                                    |
| Cabinet anchor bolts          | <ul style="list-style-type: none"> <li>Bolt: stainless steel, 1/2-inch bolts rated as ASTM, F-593, condition C (minimum)</li> <li>Washer: stainless steel 1/2 inch flat washer</li> <li>Lock washer: stainless steel 1/2 inch lock washer</li> </ul> <p>The bolts must extend at least 1.125 inches above the concrete pad and not more than 1.5 inches about the concrete pad.</p> |

**Table 33** Module physical specifications

| Module                                           | Specification |                         |
|--------------------------------------------------|---------------|-------------------------|
| BIO/SC<br>Base Input Output/System<br>Controller | Weight        | 4 lbs (1.8 kg)          |
|                                                  | Height        | 17.5 inches (444.5 mm)  |
|                                                  | Length        | 15.0 inches (381 mm)    |
|                                                  | Depth         | 1.2 inches (30.48 mm)   |
| TFU<br>(Timing Frequency Unit)                   | Weight        | 5 lbs (2.3 kg)          |
|                                                  | Height        | 17.5 inches (444.5 mm)  |
|                                                  | Length        | 15.0 inches (381 mm)    |
|                                                  | Depth         | 2.2 inches (55.88 mm)   |
| 1xDOM<br>(1xEV Data Only<br>Modem)               | Weight        | 5 lbs (2.3 kg)          |
|                                                  | Height        | 17.5 inches (444.5 mm)  |
|                                                  | Length        | 15.0 inches (381 mm)    |
|                                                  | Depth         | 1.2 inches (30.48 mm)   |
| RM<br>(Radio Module)                             | Weight        | 5.5 lbs (2.5 kg)        |
|                                                  | Height        | 8.25 inches (209.55 mm) |
|                                                  | Length        | 15.0 inches (381 mm)    |
|                                                  | Depth         | 3.8 inches (96.52 mm)   |
| PA<br>(Power Amplifier)                          | Weight        | 22 lbs (10 kg)          |
|                                                  | Height        | 13.2 inches (335.88 mm) |
|                                                  | Length        | 15.3 inches (388.62 mm) |
|                                                  | Depth         | 3.8 inches (96.52 mm)   |

**Table 34** Backhaul cable specifications

| Backhaul type | Descriptions                                                                                                                      |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Ethernet      | Maximum length: 200 feet (60.96 meters).<br>Temperature range: -40°C to 70°C<br>Maximum diameter: 0.562 inches (1.43 centimeters) |
| T1/E1         | ANSI/EIA/TIA 568<br>Temperature range: -40°C to 70°C<br>Maximum diameter: 0.562 inches (1.43 centimeters)                         |

**Table 35** DB-9 BIO/SC serial port pin-out

| Pin | Description   |
|-----|---------------|
| 1   | Not connected |
| 2   | TXD           |
| 3   | RXD           |
| 4   | Not connected |
| 5   | Ground        |
| 6   | Ground        |
| 7   | CTS           |
| 8   | RTS           |
| 9   | Not connected |

**Table 36** Compliance with regulatory and industry standards

| Type                 | Standard                   |
|----------------------|----------------------------|
| Safety Certification | CSA-C22.2 No. 60950        |
| EMC                  | FCC Part 15 Class A        |
|                      | FCC Part 24                |
| T1 Interconnection   | FCC Part 68                |
| Bell Core            | GR-487-CORE                |
|                      | GR-1089-CORE Level 3       |
|                      | GR-63-CORE Level 3         |
| Seismic              | Bellcore Zone 4 (GRE-CORE) |

## Using the door

### About this appendix

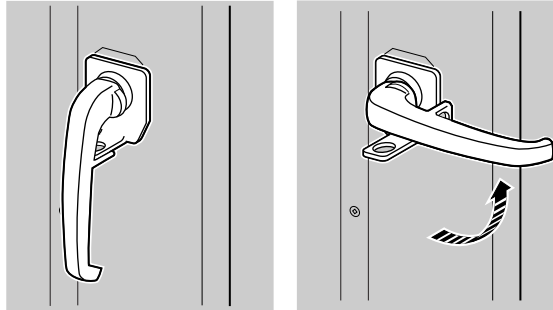
This appendix describes how to use the IP-RN 8000 front door. It contains these sections:

- [Opening the door](#) on page 198
- [Closing the door](#) on page 199
- [Padlocking the door](#) on page 200
- [Opening the PC shelf](#) on page 201
- [Closing the PC shelf](#) on page 202

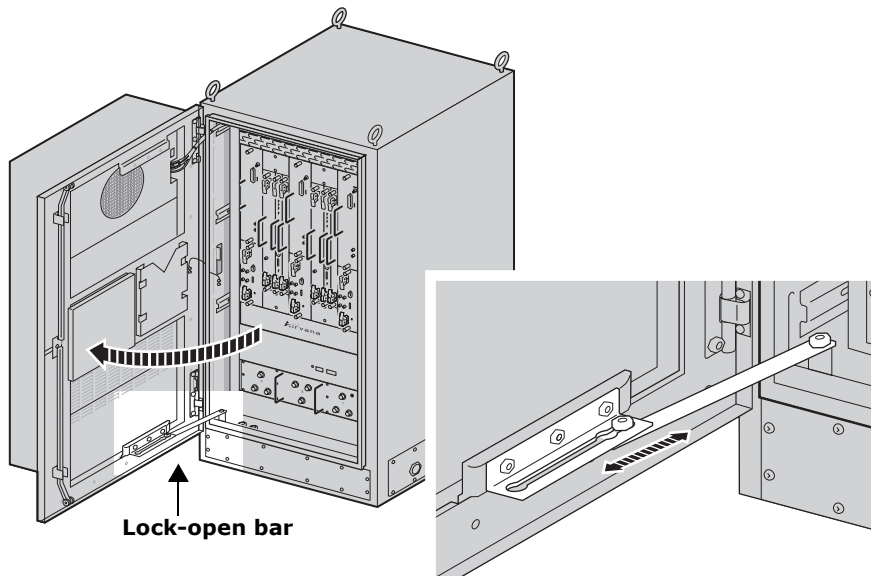
## Opening the door

To open the front door:

1. Turn the front-door handle up to the right.



2. Pull the door all the way open until the hinge locking bar locks the door open, preventing it from closing accidentally.

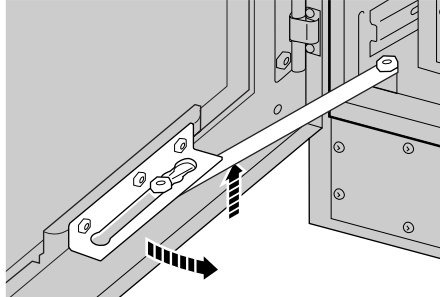


If the IP-RN 8000 is powered on, the DOOR/INTRUSION alarm panel LED lights and you must pull the shaft of the tech-on-site switch at the lower right inside edge of the door seal on the cabinet to notify AirVista that a technician is on-site. See [Understanding the tech-on-site switch](#) on page 36.

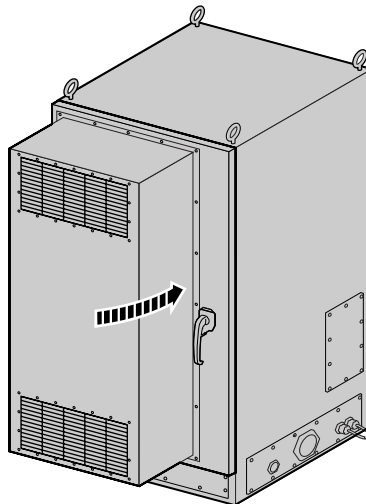
## Closing the door

To close the door:

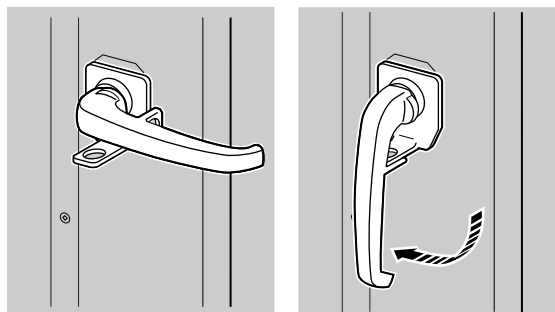
1. Lift the hinge locking bar with your foot to release the door-open lock.



2. Open the door handle by turning the handle in a clockwise direction and push the door closed.



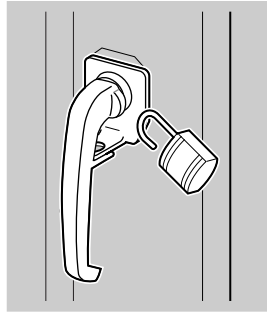
3. Turn the door handle to the down position.



## **Padlocking the door**

To padlock the front door:

1. Ensure the door is closed and the handle is in the down position.
2. Open the padlock and insert it in the door-handle padlock hole.

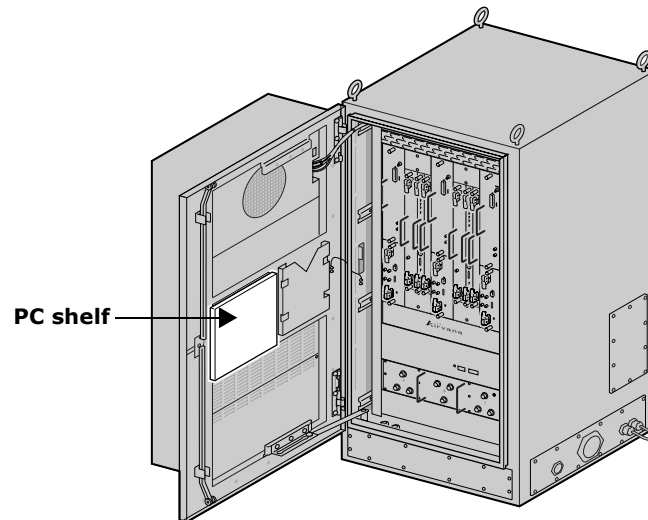


3. Lock the padlock.

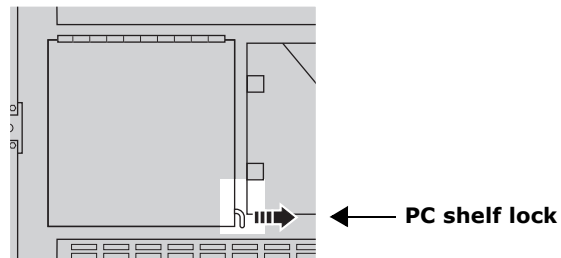
## Opening the PC shelf

To open the PC shelf:

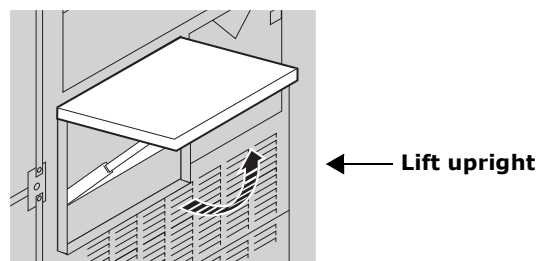
1. Locate the PC shelf on the inside of the front door.



2. Pull the lock on the PC shelf's lower right corner out to the right.



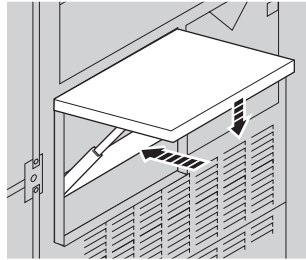
3. Lift the PC shelf upright until it locks in the open position.



## Closing the PC shelf

To close the PC shelf, push in the support hinge under it to unlock the shelf and then fold down the PC shelf.

**1. Push support hing in.**



**2. Fold PC shelf down.**

## Using access panels

### About this appendix

This appendix contains access panel procedures used multiple times throughout the main installation process. This appendix contains the following sections:

- [Removing the power terminal access panel](#) on page 204
- [Re-installing the power terminal access panel](#) on page 205
- [Re-installing the right side cable access panel](#) on page 207

## Removing the power terminal access panel

This procedure explains how to remove the power terminal access panel.

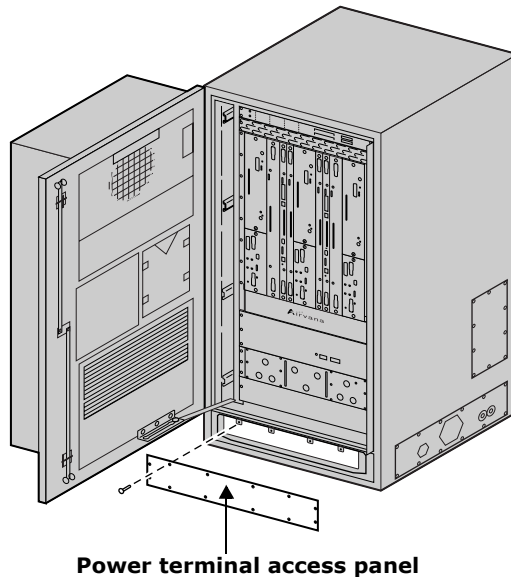
### Requirements

- 5/32 inch tamper-resistant hex drive screw driver.

To remove the power terminal access panel:

1. Open the front door.  
See [Opening the door](#) on page 198.
2. Locate the power terminal access panel on the cabinet.

**Front view, door open**



3. Use the 5/32 inch tamper-resistant hex driver to remove all screws from the access panel.  
Each screw has a rubber, sealing lock washer on its shank.
4. Carefully set aside the access panel and the screws with their rubber washers.  
You will use these to reinstall the panel.



**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.

This procedure is complete.

## Re-installing the power terminal access panel

This procedure explains how to re-install the power terminal access panel.

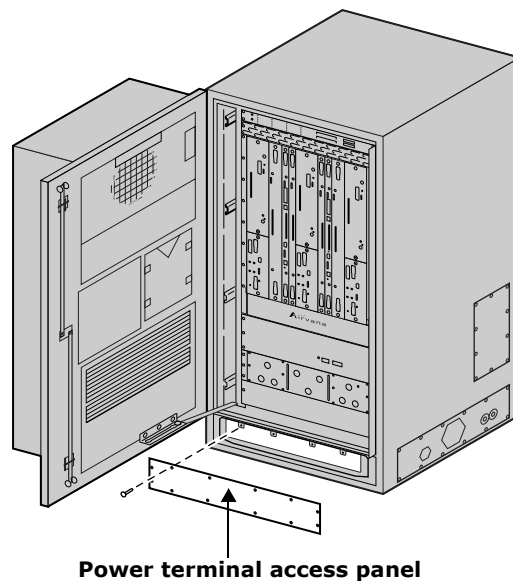
### Requirements:

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

To reinstall the power terminal access panel:

1. Open the front door.  
See [Opening the door](#) on page 198.
2. Locate the power terminal access panel area on the cabinet.

Front view, door open



3. Retrieve the access panel and the 11 tamper-proof screws and rubber washers that you set aside when removing the panel.
4. Examine the inside edge of the access panel to ensure the access panel is undamaged.  
The gasket on the inside edge must be intact to ensure a proper seal.
5. Position the access panel and start all screws by hand.

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



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.*

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



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

---

This procedure is complete.

## Re-installing the right side cable access panel

This procedure explains how to re-install the right side cable access panel.

Required tools and materials:

- 5/32 inch tamper-resistant hex drive screw driver
- 5/8 inch open ended wrench
- 11/16 open ended wrench
- Torque wrench with a 5/32 inch tamper-resistant hex drive bit
- Thread tapping set with bit for 1/4-20 threads at 3/4 inch depth

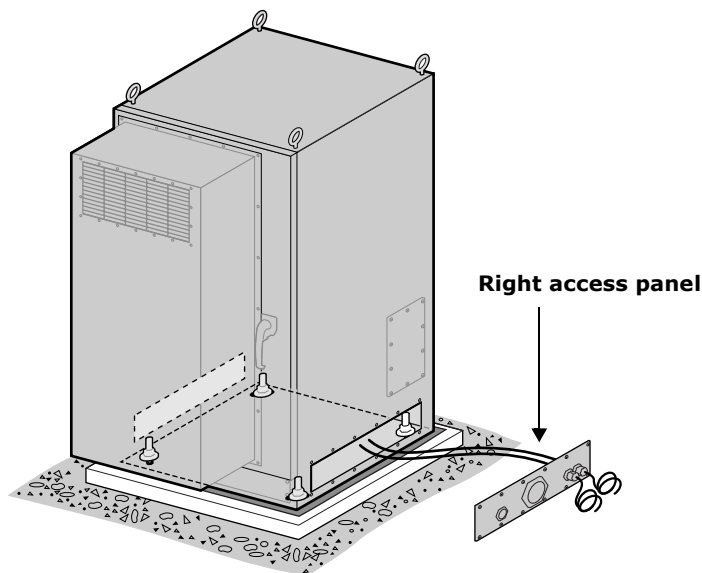


Conduit and cables may already be installed into the access panel.

---

To reinstall the right-side cable-access panel:

1. Locate the right-side access panel.



2. Retrieve the 12 tamper-resistant screws and rubber washers that you set aside when removing the panel.
3. Examine the inside edge of the access panel to ensure the access panel is undamaged:  
The gasket on the inside edge must be intact to ensure a proper seal.
4. Slide the access panel into place along the grounding wires.  
If the access panel does not slide towards the cabinet along the grounding wires, loosen the nuts securing the access panel to each grounding wire.

5. Position the access panel and start all screws by hand.

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



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 fix damaged threads.**

---

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



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

---

7. Re-seal the ground wires.
  - a. Examine the two ground wires that protrude through the side of the access panel.

Each ground wire has a rubber grommet and a 11/16 inch sealing net. The rubber grommets may be in their proper location, tight against the access panel. Or, the rubber grommets may have been pushed away from the access panel when the access panel was moved back into place.
  - b. For both ground wires, ensure the rubber grommet is pushed back snugly against the access panel.
  - c. Hand tighten the 11/16 inch nut, sealing the grommet in place.
  - d. Using the 11/16 inch open ended wrench, tighten the nuts on both grounding wires.

Wrench tighten snugly, but do not overtighten.



Conduit must be installed to all openings on this access panel to ensure equipment protection from the external environment. See [Planning conduit and grounding installation](#) on page 53.

---

This procedure is complete.

|                      |                                                                                                                                                                                                                                                                                                                                                           |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1xEV-DO</b>       | 1x Evolution-Data Only. A 3G Mobile Wireless technology based on CDMA that offers high-speed, high-capacity wireless Internet connectivity, and is optimized for packet data services. 1xEV-DO provides a peak data rate of 2.4 Mbps on the forward link within a single 1.25 MHz CDMA carrier.                                                           |
| <b>1xRTT</b>         | 1x Radio Transmission Technology. A 3G Mobile Wireless technology based on CDMA that doubles the voice capacity of current CDMA mobile systems, and adds packet data capability.                                                                                                                                                                          |
| <b>3G</b>            | Third Generation. Generic name for mobile wireless systems used for offering advanced voice and data services, the first two generations refer to the existing analog and digital cellular networks respectively. W-CDMA, 1xRTT and 1xEV-DO are the most popular 3G standards.                                                                            |
| <b>3GPP</b>          | A global standards body that is developing 3G standards for the W-CDMA air interface technology.                                                                                                                                                                                                                                                          |
| <b>3GPP2</b>         | A global standards body that is developing 3G standards for the CDMA2000 family of air interface technologies including 1xRTT and 1xEV-DO.                                                                                                                                                                                                                |
| <b>AirVista</b>      | Airvana's web-based network management system                                                                                                                                                                                                                                                                                                             |
| <b>Air Interface</b> | The Air Interface is the part of a mobile wireless standard that defines the protocol enabling the subscriber terminal and the radio access network to interoperate.                                                                                                                                                                                      |
| <b>ATM</b>           | A telecommunications method for relaying images, sound and text simultaneously at very high speeds.                                                                                                                                                                                                                                                       |
| <b>BTS</b>           | Base Transceiver Station. Radio equipment that cellular operators need to place at the center of each cell, usually simply called a base station.                                                                                                                                                                                                         |
| <b>BSC</b>           | Base Station Controller. A wireless network equipment that controls Base Stations.                                                                                                                                                                                                                                                                        |
| <b>carrier</b>       | An electrical signal that emits at a continuous frequency and carries data. Information is encoded onto the carrier by changing the frequency, amplitude, or phase of the signal (this process is called modulation). The signal is extracted at the other end through demodulation. Carriers are modulated and demodulated according to fixed protocols. |
| <b>CDMA</b>          | Code Division Multiple Access. A global Mobile Wireless technology based on a method of sharing frequency among many users by encrypting each user's signal using a different code.                                                                                                                                                                       |
| <b>cell</b>          | The basic geographical unit of a cellular network, a cell is the area served by a cell site. Its size varies depending on the terrain, capacity demands, and strength of the signal from the cell site.                                                                                                                                                   |
| <b>cell site</b>     | A transmitter/receiver location in a cellular network. The cell site establishes radio links between the wireless network and the user. The site contains an antenna tower, transmission radios, and radio controllers.                                                                                                                                   |
| <b>channel</b>       | A pair of radio frequencies. One frequency is used for sending and the other for receiving.                                                                                                                                                                                                                                                               |

|                              |                                                                                                                                                                                                                                                                                         |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>cluster</b>               | Two or more nodes bundled together to appear as a single system. Clusters can be used to provide near continuous access to application services, including databases, Web services, and file services.                                                                                  |
| <b>Ethernet</b>              | The world's most widely deployed standard for Local Area Networking; it operates at 10, 100,1,000 and 10,000 Mbps.                                                                                                                                                                      |
| <b>Frame Relay</b>           | A widely used connection oriented packet-networking technology.                                                                                                                                                                                                                         |
| <b>IP-RN 8000</b>            | IP-Radio Node 8000. Airvana's Base Transceiver Station.                                                                                                                                                                                                                                 |
| <b>IP-RNC 8500</b>           | IP-Radio Network Controller. Airvana's Base Station Controller.                                                                                                                                                                                                                         |
| <b>IS-95</b>                 | The industry standard name for CDMA Mobile wireless technology.                                                                                                                                                                                                                         |
| <b>Metropolitan Ethernet</b> | A low cost Wide Area Network technology that transports user data as Ethernet frames over an optical network, typically in a metropolitan area.                                                                                                                                         |
| <b>PSK</b>                   | Phase Shift Keying; a modulation technique.                                                                                                                                                                                                                                             |
| <b>QAM</b>                   | Quadrature Amplitude Modulation; a multi-level modulation technique.                                                                                                                                                                                                                    |
| <b>QPSK</b>                  | Spectrally efficient modulation technique that breaks the information path into two parts called the "in phase" and the "quadrature phase" components. The combination of these two signals creates one of four unique symbols that are then used to modulate the phase of the carrier. |
| <b>Radio Access Network</b>  | The part of a wireless network comprised of Base Stations and Base Station Controllers.                                                                                                                                                                                                 |
| <b>VoIP</b>                  | Voice over IP. A method of sending voice information over a packet-switched network, such as the Internet, using TCP/IP.                                                                                                                                                                |
| <b>VPN</b>                   | Virtual Private Network. A networking technology used to send data securely over public data networks.                                                                                                                                                                                  |
| <b>WAP</b>                   | Wireless Application Protocol. Stack of protocols designed for sending simplified Web pages to wireless devices. It replaces web protocols with its own, and requires that pages be written in WML instead of HTML.                                                                     |
| <b>W-CDMA</b>                | Wideband CDMA. A 3G CDMA system that is an evolution of the current GSM network. W-CDMA operates on a 5 MHz channel and supports voice and data services.                                                                                                                               |

# Acronyms

|                    |                                                  |
|--------------------|--------------------------------------------------|
| <b>1xEV-DO</b>     | 1x Evolution-Data Only standard                  |
| <b>1xDOM</b>       | 1x Evolution Data Only module                    |
| <b>1xRTT</b>       | 1x Radio Transmission Technology                 |
| <b>3G</b>          | Third Generation                                 |
| <b>3GPP</b>        | Third Generation Partnership Project             |
| <b>AIU</b>         | Antenna Interface Unit                           |
| <b>ATM</b>         | Asynchronous Transfer Mode                       |
| <b>BIO</b>         | Base Input/Output                                |
| <b>BIO/SC</b>      | Base Input Output/System Controller              |
| <b>BIO TM</b>      | Base Input/Output Transition Module              |
| <b>BTS</b>         | Base Transceiver Station                         |
| <b>BSC</b>         | Base Station Controller                          |
| <b>CDMA</b>        | Code Division Multiple Access                    |
| <b>CLI</b>         | Command Line Interface                           |
| <b>CTIA</b>        | Cellular Telecommunications Industry Association |
| <b>FTP</b>         | File Transfer Protocol                           |
| <b>GPS</b>         | Global Positioning System                        |
| <b>GSM</b>         | Global System for Mobile Communications          |
| <b>LED</b>         | Light Emitting Diode                             |
| <b>HSC</b>         | Hot Swap Controller                              |
| <b>IP-RAN</b>      | IP Radio Access Network                          |
| <b>IP-RN 8000</b>  | IP-Radio Node                                    |
| <b>IP-RNC 8500</b> | IP-Radio Network Controller                      |
| <b>ITU</b>         | International Telecommunications Union           |
| <b>PA</b>          | Power Amplifier                                  |
| <b>PCS</b>         | Personal Communications System                   |
| <b>PDU</b>         | Power Distribution Unit                          |
| <b>PSK</b>         | Phase Shift Keying                               |
| <b>RNSM</b>        | Radio Node Server Module                         |
| <b>SC</b>          | System Controller                                |
| <b>SC TM</b>       | System Controller Transition Module              |
| <b>TDMA</b>        | Time Division Multiple Access                    |

## Acronyms

---

|               |                                         |
|---------------|-----------------------------------------|
| <b>TIA</b>    | Telecommunications Industry Association |
| <b>QAM</b>    | Quadrature Amplitude Modulation         |
| <b>RF</b>     | Radio Frequency                         |
| <b>RM</b>     | Radio Module                            |
| <b>TFU</b>    | Timing Frequency Unit                   |
| <b>VoIP</b>   | Voice over IP                           |
| <b>VPN</b>    | Virtual Private Network                 |
| <b>WAP</b>    | Wireless Application Protocol           |
| <b>W-CDMA</b> | Wideband CDMA                           |

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