EXHIBIT L – USER MANUAL

FCC ID# PURRFU7

RadioFrame Networks™, Inc.; 18211 NE 68th St. Suite E-120 Redmond, WA 98052
sales: info@radioframenetworks.com or 425.883.2088

iDEN RadioBlade

FCC Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
1) This device may not cause harmful interference, and
2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Caution

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Specifications

Operating Environment

- Operating Ambient Temperature: +0°C to +55°C (+32°F to +131°F)
- Storage Temperature: -40°C to +70°C (-40°F to +158°F)
- Relative Humidity: 10-90% non condensing
- Altitude: -200 to +8000 feet above mean sea level; above 8000', reduce maximum operating ambient temperature by 2°C per 1000' to a maximum of 13000'
- Shock: 40 g's
- Vibration: Level 3 earthquake
- Keep product free from dust, wind, salt, liquids

Agency Compliance

FCC Class A CSA 22.2 No. 60950
ISTA 2A transit

Physical Specifications

- Dimensions: 3" wide x 4" high (plus antenna) x 0.5" thick (approx.)
- Weight: 1 lb (approx.)

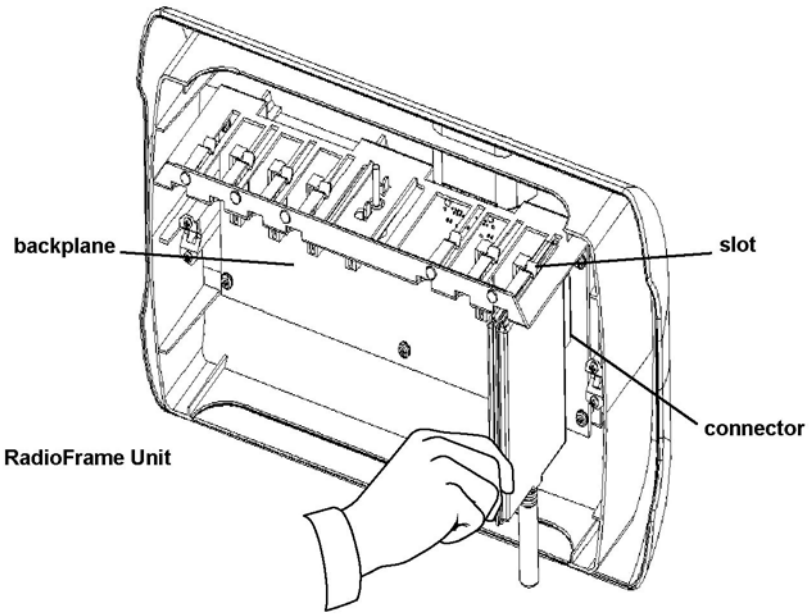
Input Power

- 3.3 VDC, 720mA max
- 2.5 VDC, 50mA max

Tx and Rx Power and Center Frequency Ranges

- Tx center frequency range: 851.0125 to 869.9875MHz
  Tx power range: -20 to +8dBm +/-3dB
- Rx center frequency range: 806.0125 to 824.9875MHz

Installation Instructions and Guidelines



1. Find these items in the shipping box: up to four (4) iDEN RadioBlades in individually wrapped anti-static bags.
2. Insert one iDEN RadioBlade into the specified slot in the RadioFrame Unit (RFU) as shown in the diagram above. For safe operation, follow these guidelines:
   - Do not mount the unit in any orientation other than that specified in the diagram.
   - Do not force the RadioBlade, or damage to equipment can occur.
   - Slide the top of the RadioBlade into the metal slot on top of the RFU until the RadioBlade connector seats firmly into the backplane.

Copyrights/Trademarks/Warranty

RadioFrame Networks warrants that this product is new and free from defects in materials, workmanship, and design. This warranty will continue for one (1) year following installation of the product at a customer site.

RadioFrame System Installation Guide

Version 1.0

http://www.radioframenetworks.com

September 2001
981-6200-00 Rev A

The specifications and information regarding the products in this manual are subject to change without notice. All statements, information, and recommendations in this manual are believed to be accurate but are presented without warranty of any kind, express or implied. Users must take full responsibility for their application of any products.

United States Federal Communications Commission Notice

The following information is for FCC compliance of Class A devices: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Limited Warranty

Hardware. RadioFrame Networks warrants that this product is new and free from defects in materials, workmanship, and design. This warranty will continue for one (1) year following installation of the product at a customer site. In no event shall RadioFrame Networks or its suppliers be liable for any indirect, special, consequential, or incidental damages, including, without limitation, lost profits or loss or damage to data arising out of the use or inability to use this manual, even if RadioFrame Networks or its suppliers have been advised of the possibility of such damages.

Software. RadioFrame Networks warrants that commencing from the date of delivery to customer and continuing for a period of one (1) year, the Software substantially conforms to its published specifications. Except for the foregoing, the Software is provided AS IS. This limited warranty extends only to the customer who is the original licensee. Customer's sole and exclusive remedy and the entire liability of RadioFrame Networks and its suppliers under this limited warranty will be, at RadioFrame Networks' option, repair or replacement of the Software if reported to RadioFrame Networks. In no event does RadioFrame Networks warrant that the Software is error free or that customer will be able to operate the Software without problems or interruptions. In addition, due to the continual development of new techniques for intruding upon and attacking networks, RadioFrame Networks does not warrant that the Software or any equipment, system or network on which the Software is used will be free of vulnerability to intrusion or attack.

Restrictions

This warranty does not apply if the Product (a) has been altered, except by RadioFrame Networks, (b) has not been installed, operated, repaired, or maintained in accordance with the instructions supplied by RadioFrame Networks, (c) has been subjected to abnormal physical or electrical stress, misuse, negligence, or accident; or (d) is sold or, in the case of Software, licensed, for beta, evaluation, testing, or demonstration purposes for which RadioFrame Networks does not receive a payment of purchase or license fee.

Trademark Notice

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Contents

About This Guide

This guide provides hardware installation procedures and information for the RadioFrame System (RFS). The guide is organized as follows:

Chapter	Title	Description
1	Preparing for the Installation	Describes the RadioFrame System, its components and features, tools and parts required for the installation, as well as safety recommendations, warnings, and guidelines. **NOTE**: Read all safety precautions before attempting to install the RFS or any of its components.
2	Installing the RadioFrame System	Includes step-by-step instructions for unpacking, mounting, wiring, connecting, and verifying all RFS components.
3	Troubleshooting	Includes instructions for resolving problems encountered during the installation.
	Glossary	Describes terms used in this guide.
	Hardware Specifications	For each RFS component.

Audience

This guide is intended for Field Service Technicians who will be installing the RadioFrame System. Such individuals must be familiar with electronic circuitry and wiring practices and have experience as an electronic or electromechanical technician. Installers shall have the following knowledge, training, and capabilities:

- RadioFrame System Certification
- CAT 5 and coaxial cabling installation
- General building practices, for example mounting in drywall and concrete drilling

Conventions

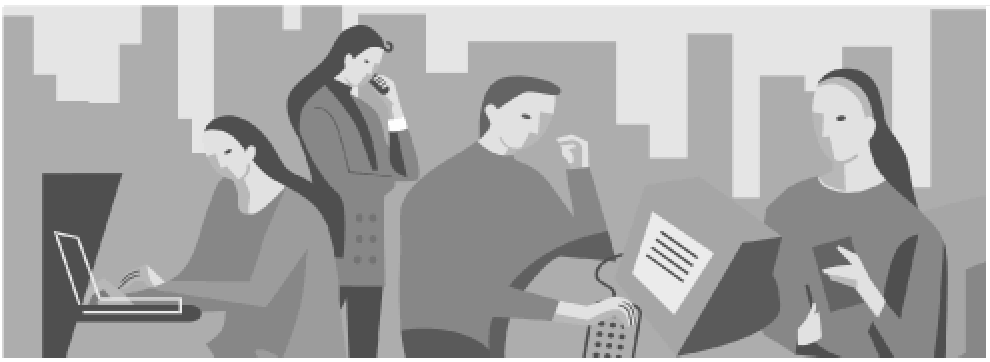
Convention	Description
 Note	Notes describe operational or informational hints or tips.
 Caution	Cautions describe situations where damage can occur to equipment if directions are not properly followed.
 Warning!	Warnings describe situations where bodily harm can occur if directions are not properly followed.

Obtaining Service and Support

For questions pertaining to system and product functions, features, specifications, and requirements during installation, contact RadioFrame Networks customer support.

Telephone	(425) 883-2088
Website	www.radioframenetworks.com
E-mail	customersupport@radioframenetworks.com
Postal mail	RadioFrame Networks, Inc. 18211 NE 68th St., Suite E-120 Redmond, WA 98052

For service and support of a RadioFrame System purchased from a reseller, contact the reseller.



1

Preparing for the Installation

This section describes the RadioFrame System, its components, features and functions, tools required for the installation, and safety precautions.

The RadioFrame System

The RadioFrame System (RFS) is a configurable indoor wireless system capable of supporting multiple air interfaces simultaneously. The system is scaleable for various applications and offers highly automated features.

Each RFS consists of at least one Network Chassis Unit™ (NCU) connected to as many as 8 Airlink Chassis Units™ (ACUs). Each ACU connects up to 8 RadioFrame Units (RFUs), and each RFU contains up to 7 RadioBlades™. Each RadioBlade supports one of several voice and wireless data standards, including GSM, CDMA, iDEN, and 802.11b (WLAN).

The RadioFrame System:

- Supports multiple standards, including GSM, CDMA, iDEN, 802.11b (WLAN), and many others.

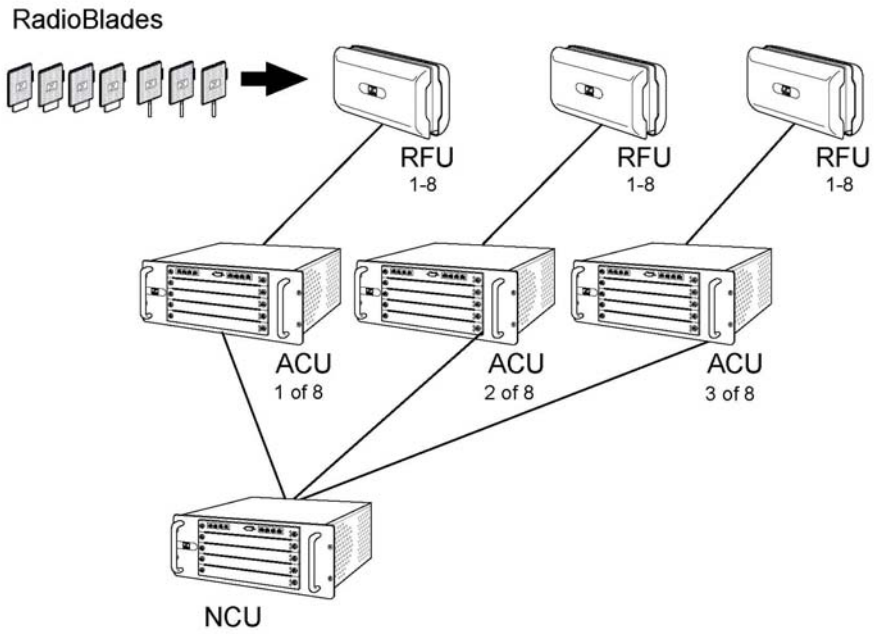


Figure 1 The RadioFrame System consists of one NCU, up to 8 ACUs, and up to 8 RFUs per ACU. Each RFU can hold up to 7 RadioBlades.

- Is modular and scaleable to increase operator flexibility.
- Is designed for easy installation with CAT 5 wiring and remote power for antenna units.
- Is easy to deploy and manage with web browser and SNMP management interfaces.
- Increases operator efficiency through plug-and-play features.
- Provides a simulcasting option for increased coverage and capacity usage.
- Provides SS7 for mobility.
- Provides PBX Interworking for enterprise features and reduced costs.

Network Chassis Unit or NCU

The Network Chassis Unit is the main controller of the RFS, providing external network interfaces and the baseband network processing for the ACUs and RFUs. The NCU also is the interface between the RFS and the telecommunications switching entities. The NCU is 7" high x 19" wide x 13" deep, powered by 120VAC, and rack mounted. Connections are CAT 5 (RJ45) except power, an EIA-232 interface, two BNC ports, and an SMB port for GPS antenna connection. The NCU connects up to 8 ACUs, a WLAN, and in iDEN installations, an iSC (integrated Site Controller). An RFS with a single NCU provides a coverage area of up to 2 million square feet.

Figure 2 The NCU is the main controller of the RFS.

Airlink Chassis Unit or ACU

The Airlink Chassis Unit provides the baseband airlink processing for up to 8 RadioFrame Units, providing a coverage area up to 250,000 square feet. The

Figure 3 The ACU provides the airlink processing functions for the system.

ACU is the interface between the RFUs and the Network Chassis Unit, and provides power, signals, and timing to the RFUs. The ACU is 7" high x 19" wide x 13" deep, powered by 120VAC, and rack mounted. All connections are CAT 5 (RJ45) except for power.

RadioFrame Unit or RFU

The RadioFrame Unit serves as the access interface between signals received from mobile terminals, via a standard air interface, and the airlink processing performed in the ACU. The RFU is approximately 8" high x 13.5" wide x 5" deep and mounts conveniently on a wall, or on or above the ceiling to serve a coverage area up to 32,000 square feet (100' cell radius). The RFU connects to the ACU via a single CAT 5 connection, receiving its power, signals, and timing from the ACU. Each RFU holds up to 7 RadioBlades.

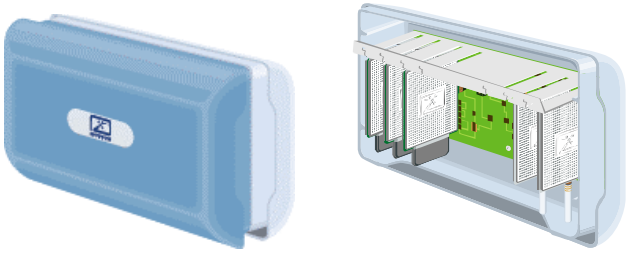


Figure 4 Each RFU holds up to 7 RadioBlades.

RadioBlades

Each RadioBlade provides a single RF channel transceiver supporting one of several voice and wireless data standards, including GSM, CDMA, iDEN, 802.11b (WLAN), and many others. Each RadioBlade is approximately 4" high x 1/2" wide x 3" deep and inserts into a slot in the RFU. Each RadioBlade contains an onboard omni antenna and provides a coverage area of approximately 32,000 square feet (nominal 100' radius cell).

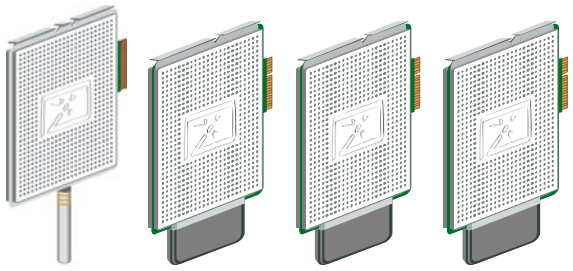


Figure 5 Each RadioBlade supports one standard platform including GSM, CDMA, iDEN, 802.11b (WLAN), and many others.

Tools and Parts Required

The RadioFrame System comes with all the parts necessary to mount each component of the system. Tools required to mount the system components are as follows:

- #2 Phillips screw driver
- For RFU ceiling mounts, drill with 3/16" bit for use with provided wood screws, or a 9/32" bit and four ¼" bolts (not provided)

Safety Precautions

Read all the notices in this section prior to installing or using the RadioFrame System or any of its components, including the Network Chassis Unit (NCU), Airlink Chassis Unit (ACU), RadioFrame Unit (RFU), or RadioBlade.

Safety Recommendations

- Keep tools away from walk areas where you and others could fall over them.
- Wear safety glasses if you are working under any conditions that might be hazardous to your eyes.

- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.

Safety Warnings

 Warning!	Only trained and qualified personnel should be allowed to install, replace, or service this equipment.
 Warning!	This product relies on the building's installation for short-circuit (over current) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A international) is used on the phase conductors (all current-carrying conductors).
 Warning!	To comply with FCC RF exposure requirements, iDEN antennas must be installed to provide at least 20cm separation from all persons, with antenna gain not exceeding 0 dBi.
 Warning!	Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.
 Warning!	The plug-socket combination must be accessible at all times because it serves as the main disconnecting device.

The RadioFrame Unit (RFU) is intended to be mounted on a wall. The RFU can also be installed on or above a ceiling. Please read the RFU mounting instructions carefully before beginning installation. Failure to use the correct hardware or to follow the correct procedures could result in a hazardous situation to people and damage to the system.

Ultimate disposal of this product should be handled according to all national laws and regulations.

Safety with Electricity

To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ45 connectors; incorrect interconnection can cause equipment damage. Use caution when connecting cables.

Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

Hazardous network voltages are present in WAN ports regardless of whether power to the attached equipment is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the router first.

Before opening the NCU or ACU, disconnect the telephone-network cables to avoid contact with telephone-network voltages.

Do not touch the power supply when the power cord is connected. For systems with a power switch, line voltages are present within the power supply even when the power switch is off and the power cord is connected. For systems without a power switch, line voltages are present within the power supply when the power cord is connected.

Guidelines for Working on Equipment Powered by Electricity

- Locate the emergency power off switch for the room in which you are working. Then, if an electrical accident occurs, you can act quickly to turn off the power.
- Before installing, removing, or repairing an NCU or ACU, unplug the power cord.
- Disconnect all power before working near power supplies.
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.
- Look carefully for possible hazards in your work area, such as moist floors, ungrounded extension cables, frayed power cords, and missing safety grounds.

In the Event of an Electrical Accident

- Use caution; do not become a victim yourself.
- Turn off power to the system.
- If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
- Determine if the victim needs rescue breathing or external cardiac compressions, then take appropriate action.

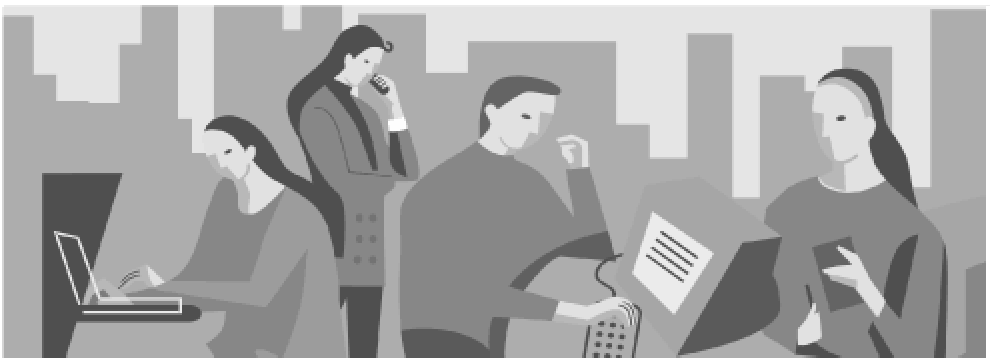
Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. It occurs when electronic printed circuit cards are improperly handled and can result in complete or intermittent failures. Always follow ESD prevention procedures when removing and replacing cards.

Ensure that the NCU or ACU is electrically connected to earth ground. Wear an ESD-preventive wrist strap, ensuring that it makes a good skin contact. Connect the clip to an unpainted surface of the chassis frame to safely channel unwanted ESD voltages to ground. To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. If no wrist strap is available, ground yourself by touching the metal part of the chassis.

Caution

For safety, periodically check the resistance value of the antistatic strap, which should be between 1 and 10 megohm (Mohm).



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Installing the RFS

The RadioFrame System is modular and simple to install using the Site Design Specification (SDS). The SDS specifies the following:

- Location of each system component: NCU, ACUs, RFUs, and RadioBlades.
- Mounting type for each component: rack, wall, or ceiling.
- Cabling requirements, including maximum cabling lengths, existing wiring/raceways that can be used, and terminations and connections required.
- Locations of approved power sources for each NCU and ACU.

Identify the RFS Installation Locations

Refer to the Site Design Specification (SDS) to determine the installation location of each component of the RFS. The NCU is typically installed in a telecommunications room or other closet, ACUs are installed in a similar location depending on the system layout, and each RFU is installed on a wall or on or above a ceiling in open areas of the building. RadioBlades are inserted into each RFU.

Wire the RFS

All components of the RFS are connected using standard CAT 5 cabling installed in existing raceways or conduits when available. Use only RJ45 connectors for system components. The NCU may also be connected to a wireless LAN (WLAN), and in iDEN installations, the NCU must be connected to the iSC (integrated Site Controller). All wiring specifications, including acceptable run lengths and termination points, are listed in the Site Design Specification (SDS).

Wire the RFS according to the Site Design Specification

1. Run CAT 5 cabling between RFS components, and terminate the cabling according to the SDS.
2. Label all termination points according to the SDS.
3. Test the cabling as specified by the SDS.

Unpacking the RFS

Each NCU, ACU, and RFU is shipped in its own box, and RadioBlades are shipped several to a box in individually wrapped anti-static packaging. In iDEN installations, an Ethernet Media Converter may also be provided in its own container with the cables necessary to install it.

Unpack each unit only at the time of installation—leave items in their shipping containers until ready for use. Unpacking instructions are contained inside each shipping container.

Install the NCU

The NCU is the main controller of the RadioFrame System. Typically, the NCU is mounted in a rack in a telecommunications room or other closet supplied with 120VAC.

Unpack and mount the Network Chassis Unit (NCU)

1. Find these items in the NCU shipping container: one NCU, four mounting screws, one 120VAC power cord, one coaxial cable with two male BNC connectors, and one set of product documentation.
2. Mount the NCU only in an EIA-standard compliant (19") rack using all 4 screws provided. Refer to the SDS for the exact location of the NCU. For safe operation, follow these guidelines:
   - Do not mount the NCU in any orientation other than that specified in the following illustration.
   - Mount the NCU so that both the front and the back are accessible.
   - If the mounting holes do not line up, adjust the NCU up or down until the mounting holes line up.


Caution

Do not block the air vents on the sides or rear of the NCU.

3. Plug the NCU into an approved power source (for more information, refer to "Hardware Specifications").
4. Verify that the NCU is receiving power and that each NCU card is operational.

   Each card installed in the front and back of the NCU has two LEDs: Power and Status. All LEDs should light green. If any LEDs do not light or are red, refer to "Troubleshooting."


Note!

The Status light on the top card in the front of the NCU will remain red until the NCU is connected to a timing source.

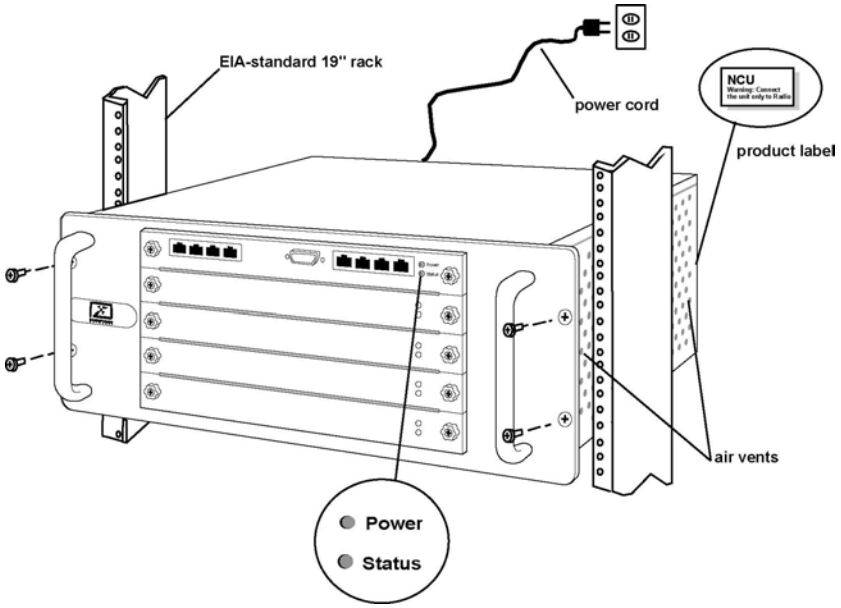


Figure 6 Mount the NCU only in an EIA-standard compliant 19″ rack.

Connect the ACU patch cables to the NCU

1 Connect each ACU RJ45-to-RJ45 CAT 5 patch cable to the specified RJ45 port (1-8) on the back of the NCU (see Figure 10).

Refer to the Site Design Specification to determine which ACU connects to each port on the NCU. The Activity and Link LEDs above each NCU port will remain unlit until each ACU has been installed and plugged in.

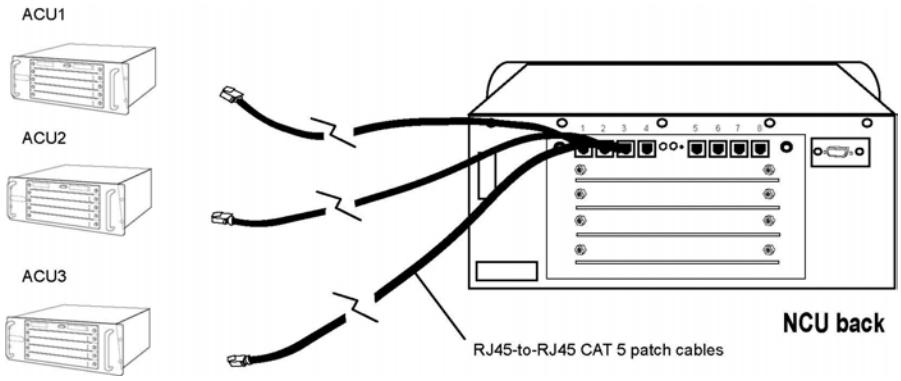


Figure 7 Connect each RJ45 port on the back of the NCU to the associated ACU.

Install the ACUs

The method used to mount an Airlink Chassis Unit (ACU) is the same as for an NCU. Typically, mount an ACU, then install all the RFUs associated with that ACU by completing the procedure "Install the RFUs" next in this guide. Repeat the procedures "Install the ACU" and "Install the RFUs" for each ACU installation.

Unpack and mount the Airlink Chassis Unit (ACU)

1. Find these items in the ACU shipping container: one ACU, four mounting screws, and one 120VAC power cord.
2. Mount the ACU only in an EIA-standard compliant (19") rack using all 4 screws provided. Refer to the SDS for the exact location of the ACU. For safe operation, follow these guidelines:
   - Do not mount the ACU in any orientation other than that specified in the following illustration.
   - Mount the ACU so that both the front and the back are accessible.

- If the mounting holes do not line up, adjust the ACU up or down until the mounting holes line up.

Caution Do not block the air vents on the sides or rear of the ACU.

3 Plug the ACU into an approved power source (for more information refer to "Hardware Specifications").

4 Verify that the ACU is receiving power and that each ACU card is operational.

Each card installed in the front and back of the ACU has two LEDs: Power and Status. All LEDs should light green. If any LEDs do not light or are red, refer to "Troubleshooting."

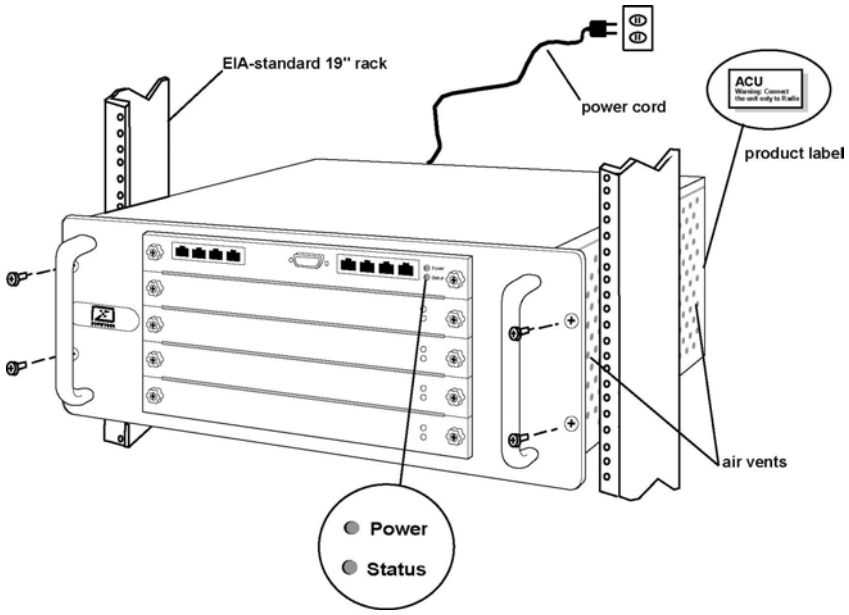


Figure 8 Mount the ACU only in an EIA-standard compliant 19" rack.

Connect the ACU to the NCU and the ACU to the RFUs

1. Connect Port 1 on the front of the ACU to the specified port on the back of the NCU using an RJ45-to-RJ45 CAT 5 cable.
2. Verify that the ACU is connected to the NCU.

   The Link and Activity LEDs above Port 1 should both light green, and the Activity LED should blink rapidly indicating that the connection to the NCU is operating. If the LEDs do not come on, refer to "Troubleshooting."
3. Connect each RFU to the specified port (1-8) on the back of the ACU using RJ45-to-RJ45 CAT 5 patch cables.

   The Link and Activity LEDs above each RFU port will remain unlit until each RFU has been installed.

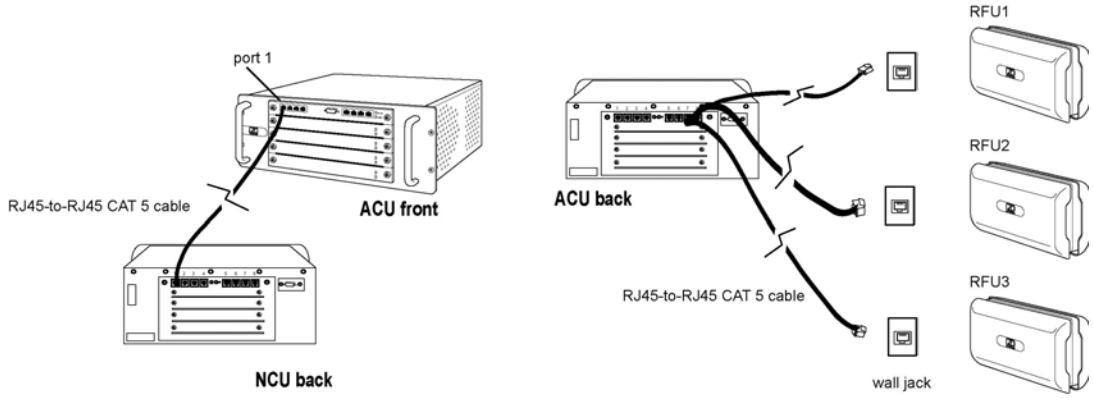


Figure 9 Connect Port 1 on the front of the ACU to the specified port on the back of the NCU, and Ports 1 through 8 on the back of the ACU to each RFU.

Install the RFUs

RadioFrame Units are all installed on a wall or on or above the ceiling. First, mount an RFU, then connect it to the ACU and verify that the RFU is receiving power from the ACU. Then, insert the RadioBlades into the RFU in the configuration specified in the Site Design Specification (SDS).


Warning!

The RadioFrame Unit (RFU) is to be fix-mounted on indoor permanent structures providing a separation distance of at least 20 cm from all persons during normal operation and 10 feet from other RFU mounted assemblies.

Mount the RadioFrame Units (RFUs)

1. Find these items in the RFU shipping container: one RFU, mounting screws and anchors, two mounting templates (wall and ceiling), and one ceiling bracket.
2. Complete one of the following procedures, "Wall Mount" or "Ceiling Mount" for the specified location of the RFU.


Warning!

Do not touch the backplane (board) inside the RFU. A shock may result.

Wall Mount

1. Place the 11" x 17" drawing template (P/N 981-1020-00) on the wall where the RadioFrame Unit is to be mounted.
2. Mark the two locations indicated on the template.
3. Screw the two supplied anchors into the locations as shown.
4. Screw the two supplied screws into the anchors, leaving approximately 1/4" of each screw exposed.
5. Hang the RFU on the anchors and fully tighten both screws.

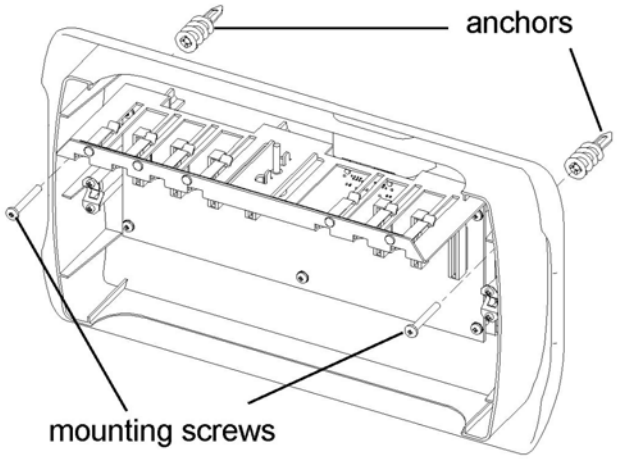


Figure 10 A wall mount requires two screws to anchor the RFU.

Ceiling Mount

1. Place the 8.5" x 11" drawing template (P/N 981-1010-00) on the ceiling where the RFU is to be mounted.
2. Mark the four locations indicated on the template.
3. Drill four holes with the appropriately sized bit: 3/16" for the provided wood screws, or 9/32" for 1/4" bolts (bolts not provided).

   If using the provided wood screws, ensure that all four screws penetrate wood. Otherwise, use alternative mounting screws or bolts to secure the ceiling bracket.
4. Using four screws or bolts, attach the ceiling bracket to the ceiling as shown.
5. Attach the RFU to the ceiling mount bracket and fully tighten the thumbscrew.

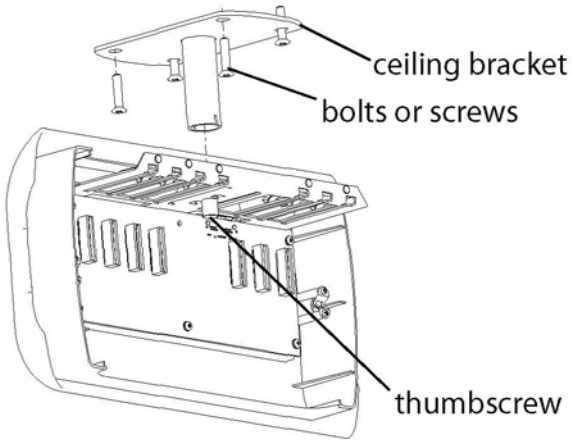


Figure 11 Use the provided bracket when mounting an RFU on the ceiling, ensuring that all bolts or screws penetrate wood.

Connect the RFU to the ACU

1 Connect the RJ45 port labeled MAIN on the top of the RFU to the wall jack using an RJ45-to-RJ45 CAT 5 cable (see the following illustration).

Caution *Do not* remove the protective cover from or use the RFU port labeled AUX. Damage may occur to the RFU, ACU, or both.

2 Verify that the RFU is receiving power and connectivity from the ACU.

The Link and Activity LEDs on the MAIN port should light as green, and the Activity LED should blink rapidly indicating connectivity. The LED on the backplane should also light as green. If any LEDs do not light, refer to "Troubleshooting."

3 Complete the next procedure "Insert the RadioBlades" before placing the front cover on the RFU.

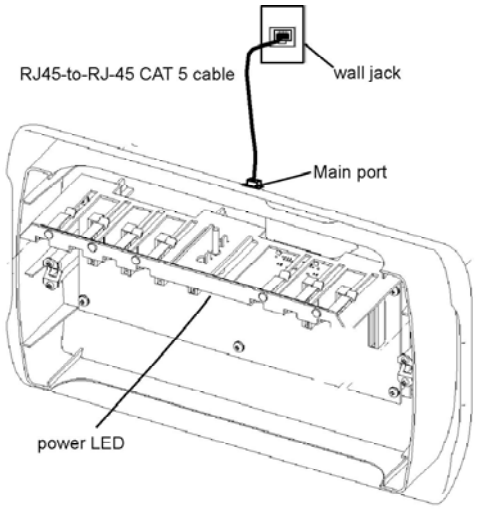


Figure 12 Connect the RFU to the ACU and ensure that the RFU is receiving power and connectivity from the ACU.

Insert the RadioBlades

RadioBlades are shipped several to a box in individually wrapped anti-static packaging. Each box of RadioBlades includes a disposable anti-static wrist strap to be used when inserting the RadioBlades into the RFU. Refer to the SDS for the exact installation location of each RadioBlade in the RFU.

1. Unwrap 30 cm (12″) of the disposable wrist strap and warp the adhesive side around your wrist.
2. Unroll the rest of the band and remove the liner from the copper tape.
3. Attach the copper tape to the metal card cage inside the RFU.
4. Insert the RadioBlades, one at a time, into the specified slots (1 through 7) in the RFU until the connector on each RadioBlade seats firmly into the back of the RFU.

5 Remove the anti-static wrist strap and place the front cover on the RFU.

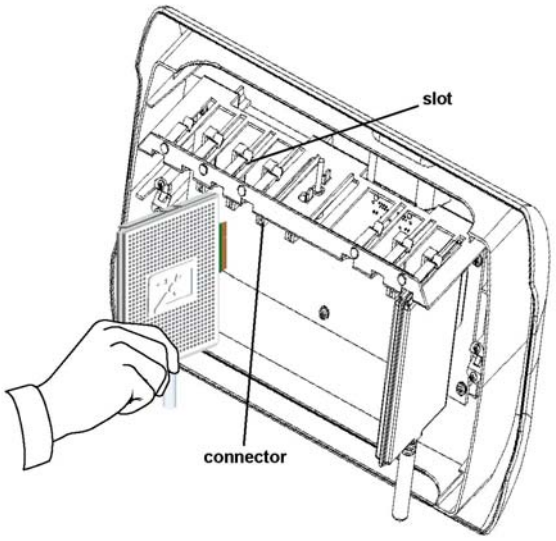


Figure 13 Slide each RadioBlade into the specified slot in the RFU.

Verify the System

During the installation, each component of the system is verified for power and connectivity. Assuming that each system component—NCU, ACU, and RFU—has been properly installed and is receiving power, double check that all Power, Status, Link and Activity LEDs throughout the system are lit and are green (Activity LEDs on all RJ45 ports should be blinking rapidly). For any other condition on any system component or connection, refer to "Troubleshooting." If necessary, refer to "About This Guide: Obtaining Service and Support."

Connect the RFS to the iSC

If the RFS is to be operated in an iDEN configuration, the NCU must be connected to a Motorola integrated Site Controller (iSC). Depending on the system configuration, the RFS will obtain its timing either from the iSC or from a direct connection from the NCU to the building's GPS antenna.

Connect the NCU to the iSC

The iSC is available in two models: iSCII and iSCIII. Complete the appropriate procedure, "Connect the NCU to the iSCII" or "Connect the NCU to the iSCII".

Connecting the NCU to an iSCII

When connecting the NCU to an iSCII, an Ethernet Media Converter must be installed between the iSCII and the NCU. The Ethernet Media Converter is shipped in its own container with all the cables necessary to install it.

1. Lay or mount the Ethernet Media Converter on any flat surface and plug it into an approved power source (see the following illustration).
2. Set the Terminator switch on the front of the Ethernet Media Converter to "On" and set the MDI switch to "MDI-X".
3. Connect Port 1 on the front of the NCU to the 10BaseT port (RJ45) on the Ethernet Media Converter using the provided straight-through CAT 5 cable.
4. Connect the ELP slot on the back of the iSC to the 10Base2 port (BNC) on the Ethernet Media Converter using the provided 10Base2 cable (50 ohm coaxial cable with two male BNC connectors).

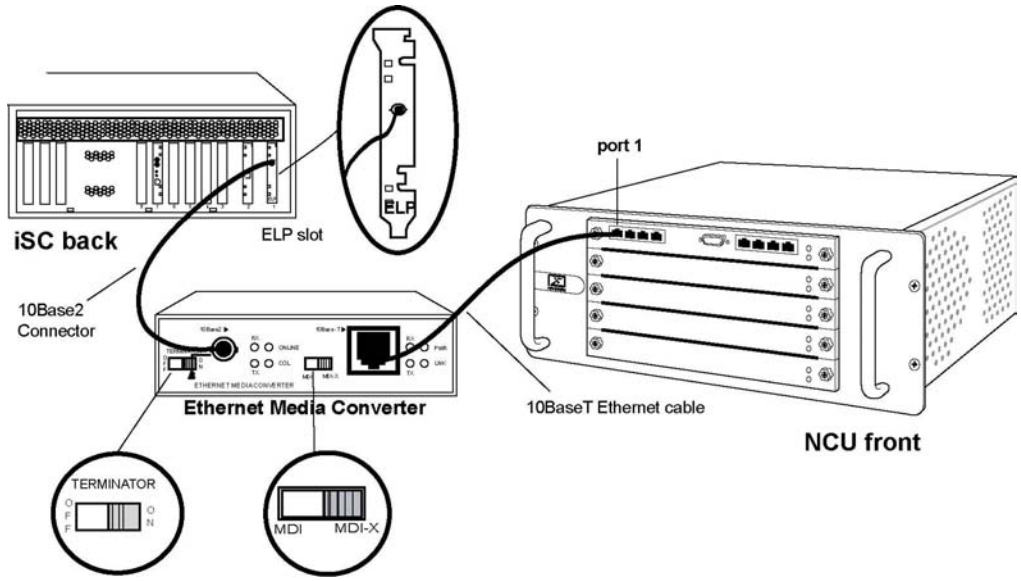


Figure 14 When connecting the RFS to an iSCII, an Ethernet Media Converter is required to connect the NCU to the iSCII.

Connecting the NCU to an iSCIII

1. Insert one end of the provided 50 ohm coaxial cable (with two male BNC connectors) into one of the three 10Base2 ports on the back of the iSCIII (port to be determined by Nextel).
2. Insert the other end of the cable into the 5MHz/1PPS IN port (BNC) on the back of the NCU.

Connect the NCU to the Timing Source

If the NCU and iSC are mounted in the same location (the same building site), the iSC will provide timing to the NCU. However, if the NCU and iSC are located at different sites, the NCU derives its timing from the GPS antenna.

1 Choose one:

If the NCU and iSC are…	Then…
located in the same building	*for an iSCII*, connect the NCU to the SRI card on the back of the iSCII using the provided 1 meter, 50 ohm coaxial cable with two male BNC connectors: 1. Connect one end of the cable to the 5MHz/1PPS "IN" port on the back of the NCU (see the following illustration). 2. Connect the other end of the cable to either BNC "OUT" port of the SRI slot on the back of the iSC.
	for an iSCIII, connect the NCU to the iSCIII using the provided 1 meter, 50 ohm coaxial cable with two male BNC connectors: 3. Connect one end of the cable to the 5MHz/1PPS "IN" port on the back of the NCU (see the following illustration). 4. Connect the other end of the cable to one of the three 5MHz/1PPS "OUT" ports on the back of the iSC. The port will be determined by Nextel.
located at different building sites	the NCU derives its timing from a GPS receiver inside the NCU, which requires a connection to the building's GPS antenna: 1. Insert the GPS antenna cable into the SMB port on the back of the NCU.

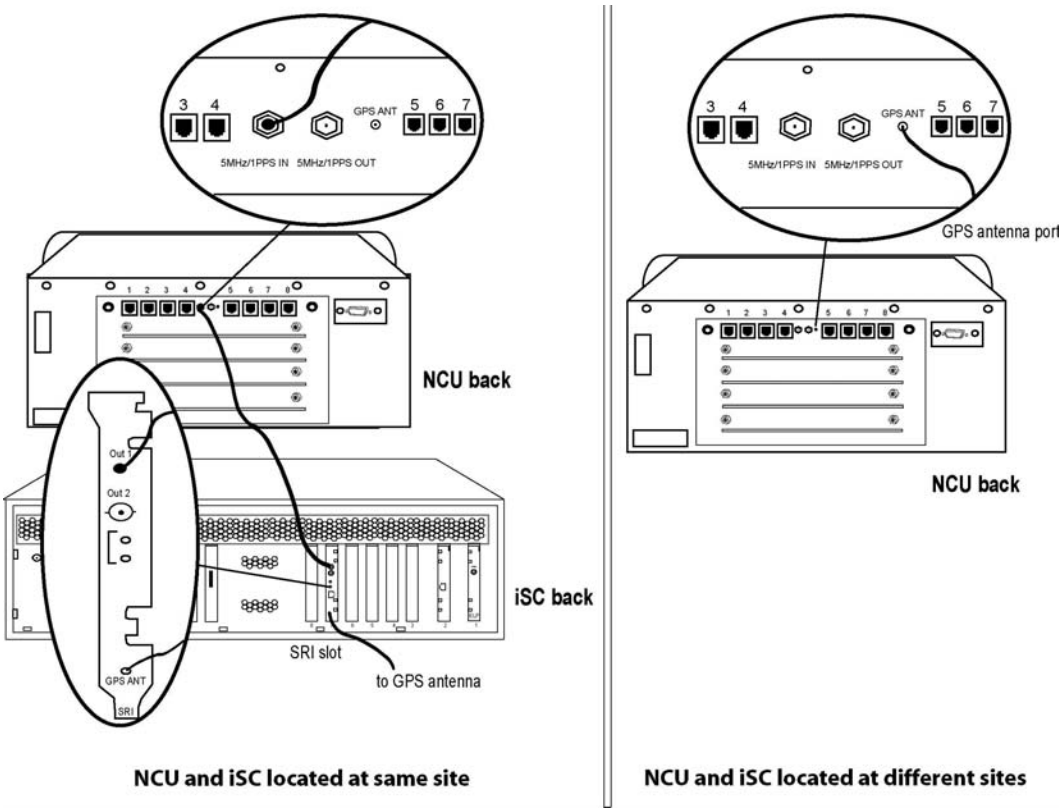
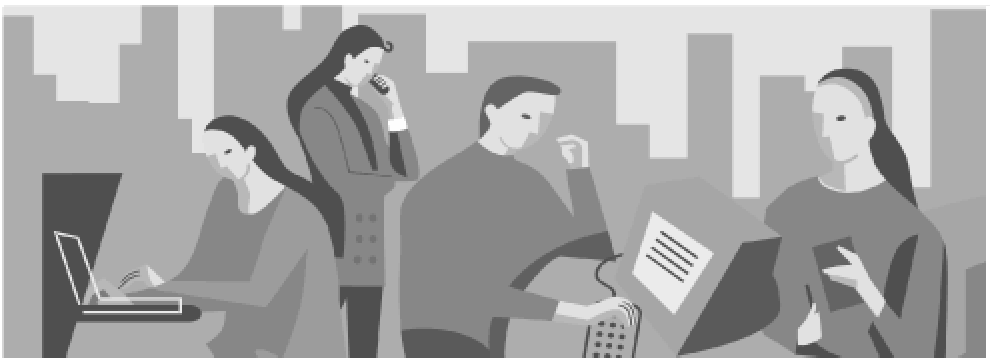


Figure 15 The RFS receives its timing via the iSC or the NCU.



3

Troubleshooting

This section describes troubleshooting information for each component of the RadioFrame System: Network Chassis Unit, Airlink Chassis Unit, and RadioFrame Unit. If the provided solutions do not resolve the problem, contact Customer Support:

Telephone	(425) 883-2088
Website	www.radioframenetworks.com
E-mail	customersupport@radioframenetworks.com

For service and support of a RadioFrame System purchased from a reseller, contact the reseller.

Network Chassis Unit

The front of the Network Chassis Unit (NCU) contains eight RJ45 ports and one EIA-232 9-pin serial port. The back of the NCU has eight RJ45 ports, two BNC ports, and an SMB port. Each port is described in the following table.

NCU front ports	Description
RJ45 Port 1	iSC—iDEN installations only
RJ45 Port 2	Ethernet LAN—network installations only
RJ45 Ports 3-8	additional Ethernet LANs
EIA-232 9-pin serial port	for debugging—Customer Service Representative use only
NCU back ports	
RJ45 Ports 1-8	ACUs—up to 8 ACUs may be connected to the NCU
5MHz/1PPs IN	BNC connector for timing interface
5MHz/1PPs OUT	BNC connector for timing interface
GPS ANT	GPS antenna connection

Each card installed in the front and back of the NCU has two LEDs: Power (top) indicates power, and Status (lower) indicates the status of the card. Each RJ45 port has two LEDs: Link (right) indicates Ethernet connectivity, and Activity

(left) blinks to indicate Ethernet activity. All LEDs should light as green. For all other conditions, refer to the following table.

Indication	Possible Cause	What to Do
Power and Status LEDs for cards installed in front or back of NCU are not lit	no power to NCU	• Verify that the power cord is installed and properly seated. • Verify that the power source is operational. • Contact Customer Support.
Status LED is red—top front card *only*	timing source not available	• Connect the timing source. In iDEN installations, this is usually the iSC. In some cases, the timing source is the GPS antenna. • If the timing source is connected, check all connections.
	failed initialization	• Reboot the system: unplug the NCU, and plug it in again. Boot up may take several minutes.
	fan is not working	• Verify that the fan is operational. • If the fan is not working, unplug the NCU and contact Customer Support.
Status LED is red—any card	card is not operational	• Remove and reseat card. • Contact Customer Support for a replacement card.

Indication	Possible Cause	What to Do
RJ45 port Link and Activity LEDs are not lit, or the Activity LED is not blinking	connection is not being made between RFS components	• For the affected port, verify that all cabling between components is properly connected: **NCU front** Port 1 iSC Port 2 Ethernet LAN (WLAN) Ports 3-8 additional WLANs **NCU back** Ports 1-8 ACUs

Airlink Chassis Unit

The front of the Airlink Chassis Unit (ACU) contains eight RJ45 ports and one EIA-232 9-pin serial port. The back of the ACU has eight RJ45 ports. Each port is described in the following table.

ACU front ports	Description
RJ45 Port 1	NCU—connects the ACU to the NCU
RJ45 Ports 2-8	not currently used
EIA-232 9-pin serial port	for debugging—Customer Service Representative use only

ACU back ports	
RJ45 Ports 1-8	RFUs—up to 8 RFUs may be connected to the ACU
5MHz/1PPs IN	not currently used
5MHz/1PPs OUT	not currently used
GPS ANT	not currently used

Each card installed in the front and back of the ACU has two LEDs: Power (top) indicates power, and Status (lower) indicates the status of the card. Each RJ45 port has two LEDs: Link (right) indicates Ethernet connectivity, and Activity (left) blinks to indicate Ethernet activity. All LEDs should light as green. For all other conditions, refer to the following table.

Indication	Possible Cause	What to Do
Power or Status LEDs for cards installed in front or back of ACU are not lit	no power to ACU	• Verify that the power cord is installed and properly seated. • Verify that the power source is operational. • Contact Customer Support.
Status LED is red—any card	card is not operational	• Remove and reseat card. • Contact Customer Support for a replacement card.

Indication	Possible Cause	What to Do
	failed initialization	• Reboot the system: unplug the ACU, and plug it in again. Boot up may take several minutes.
	fan is not working	• Verify that the fan is operational. • If the fan is not working, unplug the ACU and contact Customer Support.
RJ45 port Link and Activity LEDs are not lit, or the Activity LED is not blinking	connection is not being made between RFS components	• For the affected port, verify that all cabling between components is properly connected: **ACU front** Port 1 NCU Ports 2-8 not currently used **ACU back** Ports 1-8 RFUs

RadioFrame Unit

The RadioFrame Unit, or RFU, has two RJ45 ports on the top of the back cover of the unit: MAIN and AUX. *Only the MAIN port is used*. The AUX port has a protective cover that must not be removed. During installation, ensure that the RFU is receiving connectivity from the ACU before inserting RadioBlades into the RFU or placing the front cover on the RFU.

Do not remove the protective cover from the AUX port or insert a connector into the AUX port. This will cause damage to the RFU, the ACU, or both.

The MAIN port has two LEDs: Link (right) indicates Ethernet connectivity, and Activity (left) blinks to indicate Ethernet activity between the RFU and the ACU. For all other conditions, refer to the following table.

Indication	Possible Cause	What to Do
Port LEDs do not light	connection is not being made between the RFU and the ACU	• Verify that all cabling between the ACU and the RFU is properly connected. • Verify that the ACU is powered on. • Contact Customer Support.

Glossary

ACU	Airlink Chassis Unit—Provides the baseband airlink processing for up to 8 RFUs, providing a coverage span up to 250,000 square feet, and is the interface between the RFUs and the NCU.
iSC	integrated Site Controller—Motorola's proprietary equipment required for all iDEN installations.
iDEN	integrated Digital Enhanced Network—Motorola's proprietary digital technology that combines the capabilities of a standard analog dispatch system with that of a cellular interconnect system. iDEN uses an advanced proprietary modulation technology consisting of a speech compression scheme enabling three or six communication paths over a single 25 kHz RF channel.
GPS antenna	global positioning system antenna—A system that uses geostationary satellites to triangulate the position of a GPS receiver located on the face of the earth.
LAN	local area network—A group of computers connected together within a building or campus.
NCU	Network Chassis Unit—The main controller of the RFS, providing external network interfaces and the baseband network processing for the associated ACUs and RFUs. Also, the NCU is the interface between the RFS and the telecommunications switching entities.

RFS	RadioFrame System—A configurable indoor wireless system capable of supporting multiple air interfaces simultaneously.
RFU	RadioFrame Unit—The access interface between signals received from mobile terminals, via a standard air interface, and the airlink processing performed in the ACU.
SDS	Site Design Specification—A set of documentation provided by RadioFrame Networks specifying the design, layout, and installation requirements of a RadioFrame System.
WLAN	wireless LAN—802.11 Ethernet wireless local area network.

Hardware Specifications

Network Chassis Unit/Airlink Chassis Unit

Operating Environment

- Operating Ambient Temperature: 0°C to +40°C (+32°F to +104°F)
- Storage Temperature: -40°C to +70°C (-40°F to +158°F)
- Relative Humidity: 10-90% non condensing
- Altitude: -200 to +8000 feet above mean sea level; above 8000', reduce maximum operating ambient temperature by 2°C per 1000' to a maximum of 13000'
- Shock: 40 g's
- Vibration: Level 3 earthquake
- Keep product free from dust, wind, salt, liquids

Agency Compliance

FCC Class A CSA 22.2 No. 60950
ISTA 2A transit

Physical Specifications

- Dimensions: 19" wide x 7" high x 13" deep (approx.)
- Weight: 15 lbs (approx., no cards)

Input Power

- 100-240 Volts AC, 47-63 Hz, 8-3.5A, or

Cabling Pinouts

- For 120VAC power, use the power cord provided (use of a different cord may void the warranty and/or cause electrical fire and damage).

RadioFrame Unit

Certified to 47 CFR Part 90. Licensed operation required. Radiofrequency exposure approved for fixed installations only. The antenna used for this transmitter is integral to the unit. The radio and its associated antenna are to be fixed-mounted on indoor permanent structures providing a separation distance of at least 20 cm from all persons during normal operation and 10 feet from other RFU mounted assemblies. The maximum radiated output power at the antenna must satisfy the MPE Categorical Exclusion Requirements of 2.1091. The maximum radiated output power of any antenna shall not exceed 100mW. RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of 1.1307(b)(3).

Operating Environment

- Operating Ambient Temperature: 0°C to +40°C (+32°F to +104°F)
- Storage Temperature: -40°C to +70°C (-40°F to +158°F)
- Relative Humidity: 10-90% non condensing
- Altitude: -200 to +8000 feet above mean sea level; above 8000', reduce maximum operating ambient temperature by 2°C per 1000' to a maximum of 13000'
- Shock: 40 g's
- Vibration: Level 3 earthquake
- Keep product free from dust, wind, salt, liquids

Agency Compliance

FCC Part 90 CSA 22.2 No. 60950
ISTA 2A transit

Physical Specifications

- Dimensions: 13.5" wide x 8" high x 5" deep (approx.)
- Weight: 3 lbs (approx., no cards)

Input Power

- Negative 36-56 Volts DC, 0.8A

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