



RF-Audience!™ Receiver

Installation and Operation

Series: Wireless Messaging System

System Version: Two-Way 3.0
Software Version: 2.7.2

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Foreword

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Introduction

Audience

This manual is intended for use by personnel responsible for the operation and maintenance of the RF-Audience! (RF-A!) receiver. Personnel performing operation and maintenance procedures contained in this manual must have a knowledge of paging systems, electronic systems, and maintenance methods for high-power radio frequency (RF) systems.

About This Manual

This manual provides instructions for the installation, operation, and maintenance of the RF-A! receiver.

- **Chapter One: Introduction**—This chapter provides a brief introduction to this document, along with a list of other relevant documents.
- **Chapter Two: System Description**—This chapter provides an overview of the Wireless Messaging System, an overview of the RF-A!, specifications, and general features of the RF-A! receiver.
- **Chapter Three: Preinstallation**—This chapter provides information that will help you select and establish a site for installing the RF-A! receiver.
- **Chapter Four: Installation**—This chapter provides a list of tools and equipment for installing the RF-A! receiver, step-by-step installation instructions, and power-up procedures and indications.
- **Chapter Five: Configuration and Operation**—This chapter provides the information necessary for configuring the RF-A!, using the service terminal, station parameters, and action commands.
- **Chapter Six: Maintenance**—This chapter provides information for maintaining and troubleshooting the RF-A! receiver, along with instructions for replacing defective Field Replaceable Units (FRUs).
- **Appendix A**—This appendix provides FIPS commands used for the RF-A!.
- **Appendix B**—This appendix describes the acronyms used in this manual.
- **Appendix C**—This appendix provides the rear panel connector pinouts for the RF-A!.
- **Appendix D**—This appendix provides the RF-A! error messages.

Keyboard Conventions

This section describes the software application keyboard conventions used in this manual (see Table 1-1):

Table 1-1: Keyboard Conventions Used in This Manual

Convention	Description
System Input	Text that you must type into the system and screen options appear in bold Helvetica text. Example: partition
Keys	Single keyboard keys used during input appear bold and in carets. Examples: <Enter> , <F2> , <Esc> When one key is to be pressed and held while another key is pressed, the key names appear bold, in carets, and joined by a plus sign. Examples: <Esc+2> , <Ctrl+Y>
Keyboard labeling	Keyboard labeling varies. For example, <Enter> , <Return> , or <Enter/Return> may indicate the key used for information entry. These procedures use <Enter> to represent the various labeling. Unless otherwise noted, the sequence is: Item <Enter> . Also, <Control> or <Ctrl> may indicate the control key. These procedures use <Ctrl> .
Variables	Variables that you must type into the system are set inside vertical brackets []. However, you do not type the brackets. Examples: [Latitude] , [177.12.77.34]
System output	System responses to commands appear as Helvetica text. Example: COMMAND SUCCESSFUL
Function Keys	If you are using a Sun system, and the instruction state to press <F2> , press the function key <F2> . If you are using a VT100 terminal, you must press <Esc> and the number key, not the function key. For example, if the instruction state to press <F2> , the VT100 equivalent is to press <Esc+2> simultaneously.
Highlight	To highlight or select an option, use the arrow keys to position the cursor on the option and press <Enter> . To continue, you must press <F2> .

Related Publications

- *RF-Audience!™ Receiver Service Manual*, Publication 6880495G01
- *RF-Orchestra!™ Transmitter System- Installation and Operation Manual*, Publication 6880493G02
- *RF-Baton!™ Transmitter Controller System- Installation and Operation Manual*, Publication 6880497G01
- *RF-Conductor!™ Choreographer™ Interface- Installation and Operation Manual*, Publication 6880492G07
- *WMG-Administrator™ - System Administration Manual*, Publication 6880492G01
- *WMG-Administrator™ - Database Operation Manual*, Publication 6880492G02
- *WMG-Administrator™ - System Installation Manual*, Publication 6880493G01
- *UCC Port Administrator Manual*, Publication 6880492G03
- *Quality Standards -Fixed Network Equipment Installation Manual R56*, Publication 6881089E50

System Description

Wireless Messaging System Overview

This section provides an overview of the components that make up the RF-A! receiver and how the receiver operates in conjunction with other equipment in the Wireless Messaging System, Motorola's two-way advanced messaging solution.

The WMS uses the FLEX protocol and is compatible with the ReFLEX and InFLEXion protocols.

- FLEX is a high-speed, one-way paging protocol.
- ReFLEX is a high-speed protocol that includes a reverse channel to support two-way messaging.
- InFLEXion is a high-speed, two-way messaging protocol that provides two-way voice and data messaging.

Introduction

The Wireless Messaging System uses the following components:

- The WMG-Administrator! messaging switch (WMG MS)
- The RF-Conductor!TM (RF-C!) controller
- The RF-Baton! (RF-B!) transmitter controller
- The RF-Orchestra!TM (RF-O!) transmitter
- The RF-Audience! (RF-A!) receiver
- The Choreographer! interface
- The Personal Communications Device (PCD)

Figure 2-1 shows the components used in the Wireless Messaging System.

Figure 2-1: Systems Used in the Wireless Message System

The WMG-Administrator! Messaging Switch

The WMG-Administrator! is a two-way messaging switch similar to a traditional paging terminal. The switch acts as a clearinghouse for all messages in the Wireless Messaging System and provides a wide range of messaging and administrative services.

Callers can access the switch through the Public Switched Telephone Network (PSTN) or the Internet (future). The system accepts trunks with per-channel signaling (SS7 common-channel signaling), T1 and E1 spans. Each WMG-Administrator! is connected to other products in the Wireless Messaging System by a network of land lines, satellite links, or both.

The RF-C! Controller

The RF-C! controller is the central controller for the transmitters and receivers in a given region. The RF-C! controller forwards voice and text messages from each WMG-Administrator! to the RF-O! transmitters, and returns responses from the RF-Audience! receivers to the WMG-Administrator!.

The RF-Baton! Transmitter Controller

The RF-B! transmitter controller provides an interface between the RF-O! transmitter and the RF-C! controller. The RF-B! transmitter controller performs secondary voice processing for the InFLEXion messaging protocol, accepts remote software downloads, and transfers software downloads to the Orchestra Control Module (OCM).

The RF-B! transmitter controller can be used to create and modify transmitter parameters using communications software and the RF-B!'s built-in Friendly Interface Protocol Specification (FIPS) protocol.

The RF-O! Transmitter

The RF-O! transmitter is a voice and data linear transmitter that supports up to two subchannels (four planned). Each RF-O! transmitter is optionally equipped with an RF-Baton! transmitter controller that provides an interface to the RF-C! controller, and an optional Global Positioning System (GPS) receiver that provides precise timing information.

The RF-A! Receiver

The RF-A! receiver receives return (inbound) messages transmitted by subscriber PCDs. A group of RF-A! receiver outputs may be *multiplexed* into a single link before they are sent to the RF-C! controller. An RF-A! receiver can be stand-alone or collocated with an RF-O! transmitter. Collocated receivers share a GPS receiver with the RF-B!.

Personal Communications Device

The ReFLEX protocol PCD receives text messages and the Tenor PCD receives voice messages. Both return acknowledgments when the message is accurately received and when the subscriber actually reads or listens to the message. The level of acknowledgment is programmed by the system operator.

The Choreographer!

The Choreographer! software interface is a network manager for voice and data communications for one-way or two-way paging infrastructures. The interface allows management and configuration of network devices.

RF-A! Receiver Overview

RF-A! receivers are required for decoding scheduled and nonscheduled transmissions from the PCDs to the RF-C! controller.

Introduction

Each RF-A! receiver resides in a 19-inch wide, rack-mount chassis that is 3.5 in. (two rack units) high. Each receiver accepts signals on a single 12.5-kHz inbound channel in the 896 - 902 MHz range. The receiver offers the following benefits:

- Receives signals that are compatible with the ReFLEX and InFLEXION protocols
- Uses diversity antennas to maximize signal detection in multipath environments
- Uses advanced Digital Signal Processor (DSP) demodulation techniques for inbound Frequency Shift Key (FSK) messages
- Operates either at 800 or 1600 bps, with future support for 6400 and 9600 bps
- Supports remote software downloading and diagnostic monitoring from the Choreographer!. A front view of the RF-A! receiver is shown in Figure 2-2.

Figure 2-2: RF-A! Receiver Front Panel, Cover Closed

Standard Models

For stand-alone sites, the RF-A! receiver comes in four models:

- PT1080A: One-channel receiver
- PT1081A: Two-channel receiver
- PT1082A: Three-channel receiver
- PT1083A: Four-channel receiver

Peripheral options are also supported (see paragraph, "RF-A! Receiver Peripheral Options").

Note: Multichannel installations must include the RF Distribution peripheral option or equivalent for antenna expansion.

Note: Stand-alone installations require either a GPS Peripheral option or a customer supplied external GPS receiver.

For colocated sites, the RF-A! becomes an option for the RF-O!. The RF-O! manual contains a peripheral options chart. See the RF-Orchestra! System Installation and Operation Manual referenced on page 1-5.

Two possible cabinet layouts are shown in Figure 2-3 and Figure 2-4.

Figure 2-3: RF-Audience! One-channel Receiver, (PT1080A, in a 25 inch Cabinet)

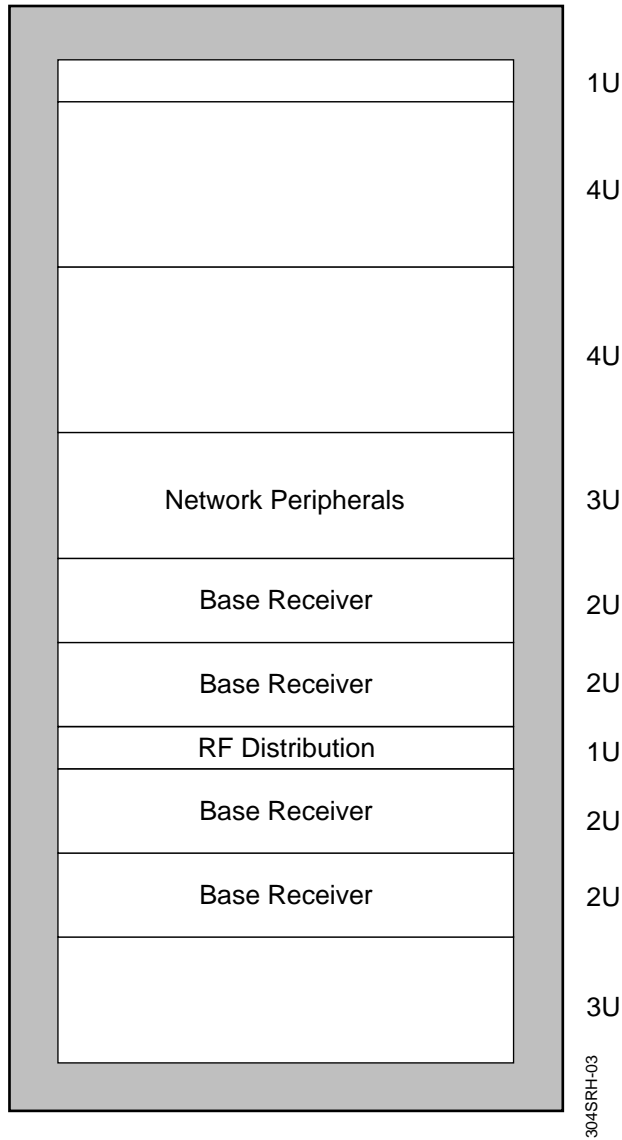


Figure 2-4: RF-Audience! Four-channel Receiver (PT1083A, in a 46 inch Cabinet)

RF-A! Receiver Technical Description

Introduction

A basic RF-A! receiver consists of the following modules (see Figure 2-5).

- Two Radio Frequency Modules (RFMs or RF Modules)
- One Audience Control Module (ACM)
- One AC Power Supply Module
- Passive Backplane and Chassis

Figure 2-5: RF-A! Receiver Front Panel, Cover Open

The two RFMs accept inbound FSK modulated data on a single 12.5-kHz channel and convert them to baseband digital signal samples.

The ACMs DSP demodulates the incoming signals. The ACM selects receiver information with the best quality (microdiversity) and applies IPP formatting before sending the message to the RF-C! controller through its network interface.

The AC power supply converts the line voltage to the levels required by the RF-A! receiver circuitry. The backplane provides interconnections with the various subsystems.

Receiver Modules (RFMs)

The RF-A! receiver contains two RFMs that receive a 896-902 MHz signal from the PCDs. Each RFM converts the RF signal to a digital signal and sends the digital signal to the ACM for further processing (see Figure 2-6).

Figure 2-6: RF-A! Receiver Block Diagram

Controls and Indicators

The receiver modules contain no controls or indicators.

Input/Output

Each RFM has one front-panel and one rear-panel connector. The front-panel connector is a mini-Ultra-High Frequency (UHF) connector that connects the RF input signal to the RFM. The rear-panel, 80-pin board edge connector is the RFM interface to the backplane.

Audience Control Module (ACM)

The ACM provides the following (see Figure 2-7):

- Control of each RFM and DSP
- Interfacing to external devices
- Reformatting of incoming messages to the RF-C! controller-compliant IPP protocol
- Synchronizing all internal timing to GPS signals

The AFM also monitors and processes alarms from the RF-A! receiver equipment and performs diagnostics on itself. Any problems detected are passed to the Choreographer!.

Figure 2-7: Audience Control Module (ACM), Front View, Cover Open

The Diagnostic, Maintenance, and Control (DMC) port is located on the front of the ACM (see Figure 2-7).

LEDs located on the front of the ACM indicate the status of the RF-A! receiver and monitor traffic.

Controls and Indicators

The ACM provides a reset switch and eight LED status indicators (see Figure 2-7 and Table 2-1 and Table 2-2). A detailed description of each indicator and its configuration is provided in this chapter.

Table 2-1: Audience Control Module Controls

Control	Position	Description
RESET switch	pressed momentarily	Initiates an ACM processor restart

Table 2-2: Audience Control Module Indicators

Indicator	Color	Description
CONTROL	Green	Lights when the ACM is on and when it successfully completes its reset sequence. Flashes during remote software download.
Rx A	Green	Lights when Rx A (upper RFM) synthesizer is locked
Rx B	Green	Lights when Rx B (lower RFM) synthesizer is locked
ALARM	Red	Lights when a station alarm has been detected
Time Ref		Flashes when the GPS 1PPS signal is detected (default) or as configured by FIPS w 301
OTA Rx		Flashes when OTA data is correctly decoded
OTA Err		Flashes when OTA data errors are detected
Network		On steady--Flashes off to indicate network activity (normally on) (default) or as configured by FIPS w 300

Input/Output

The ACM front-panel connections consist of a female BNC connector and a female DB9 serial port connector. The BNC connector serves as a diagnostic monitor port for monitoring internal signals. The DB9 connector provides connection to an external service monitor or terminal.

Power Supply Module

The universal power supply module converts the incoming AC power (90 – 265 Vac, 47 – 63 Hz) to the DC power (+14.1 and +5.0 Vdc) used by the internal circuitry of the RF-A! receiver (see Figure 2-8). Power supply output is a maximum of 26 watts plus an available battery charging current of 250 mA.

Figure 2-8: Power Supply Module, Front View, Cover Open

The power supply module provides several control mechanisms and LED status indicators (see Table 2-3 and Table 2-4).

Table 2-3: Power Supply Module Controls

Control	Position	Description
POWER switch	ON	Applies AC power to the power supply module
	OFF	Removes AC power from the power supply module
BATT switch	ON	Connects the backup battery to the power supply module
	OFF	Disconnects the backup Battery from the power supply module

Table 2-4: Power Supply Module Indicators

Indicator	Color	Description
POWER	Green	Lights when the +14 Vdc and +5.1 Vdc outputs are present
BATT. REVT.	Yellow	Lights when the AC power is not present, and the power supply has reverted to battery backup

Backplane

The backplane provides a medium for intermodule communication and connections to external peripheral devices (see Table 2-5). Refer to Appendix C for a detailed description of rear panel connectors and pinouts.

Table 2-5: RF-A! Receiver Backplane Connectors

CONN.	DESCRIPTION	INT/EXT INTERFACE
J1	Power supply module	int
J2	Audience Control Module (ACM)	int
J3	RX A (upper RFM) 896-902 MHz *	int
J4	RX B (lower RFM) 896-902 MHz *	int
J5	Battery Connect	ext
J6	Network RS-232 port	ext
J7	GPS/timing connector	ext
J8	10-MHz reference in	ext
J9	UPS/battery status inputs	ext
J10	External alarm input/output	ext
J11	Phone line connect (not supported)	ext
J12	+5 vdc, +14 vdc peripheral power	ext
J13	+5 vdc, +14 vdc peripheral power	ext
J14	Ethernet AUI (not supported)	ext
J15	Auxiliary input/output (I/O)	ext

Figure 2-9 shows the location of all external interfaces.

Figure 2-9: Backplane Panel (Rear View)

RF-A! Receiver Peripheral Options

This section provides a brief overview of the peripheral options for the RF-A! receiver. An RF-A! receiver requires a GPS receiver and network peripherals to function in a system. While these peripherals are required, the actual peripheral is selectable. (Contact your Motorola representative for more information.) The RF filter option is recommended to reduce RF interference. The RF distribution option is recommended for multi-channel systems.

RF Filter Option

RF filtering is recommended to minimize interference by RF-generating sources within a receiver's range. Two complete sets of cavity bandpass filters (one for each diversity receiver branch) are included with this option. Two versions of the RF-A! receiver RF filter option are available.

- X88AA: RF Filter (901-902 MHz)
- X88AB: RF Filter (901-902 MHz) with GPS receiver

RF Distribution Option

The RF distribution (multicoupler) option allows multiple RF-A! receivers to operate with a single pair of receive antennas. The option includes two complete sets of cavity bandpass filters, low noise amplifiers, and five-output splitter blocks. The RF distribution option allows up to 12 RF-A! receivers to operate with a pair of receiver antennas. See Figure 2-10 for a block diagram of the RF distribution option. Two versions of the RF-A! receiver RF distribution option are available.

- X89AB: RF Distribution (901-902 MHz)
- X356AA: RF Distribution (901-902 MHz) with GPS receiver

Network Peripheral Options

Several network peripheral options are available to allow communications between the RF-A! receiver site and RF-C! controller. Typically, modems and a router, or a VSAT network, are used.

Figure 2-10: RF Distribution Option Block Diagram

GPS Receiver Option

The GPS receiver detects signals from the U.S. Department of Defense NAV STAR GPS satellites. The Wireless Messaging System uses GPS timing for synchronization.

The RF-C! controller network requires a GPS receiver at the following locations:

- Each transmitter site
- Each stand-alone receiver site
- The RF-C! controller

The GPS receiver is configured to provide a highly accurate timing signal at precise, one-second intervals. The 1-pulse-per-second (1PPS) signal has a typical accuracy, with respect to Universal time, of +/- 150 nsec. In addition to the 1PPS signal, the GPS receiver provides the RF-A! receiver with a timestamp (time and date) and additional status information.

A GPS receiver option is available on the RF Distribution and RF Filter options. The GPS receiver is also available as a stand-alone option (Option X243AD) mounted in a single-rack unit chassis. For receiver sites colocated with the RF-O! transmitter on the RF-B! transmitter controller, GPS timing signals can be obtained by appropriate connection to the RF-B! transmitter controller.

Another alternative is for an external connection to a customer provided GPS receiver. Currently, only Motorola and Trimble are supported.

RF-A! Receiver Specifications

The RF-A! receiver's physical, electrical, and environmental specifications are provided in the following paragraphs.

Physical Specifications

The physical specifications for the RF-A! receiver are provided in Table 2-6. Refer to Figure 2-3 and Figure 2-4 for typical racking arrangements.

Table 2-6: RF-A! Receiver Physical Characteristics

Parameter	Specification
Standard mounting configuration	19-in. EIA cabinet
Width	19 in.
Depth	14 in.
EIA height	2 rack units (3.5 in.)
Weight	27.5 lb.
RF filter option	1 rack unit (1.75 in.)
RF distribution option	1 rack unit (1.75 in.)
Network peripherals	3 rack units (5.25 in.) typical

Electrical Specifications

The electrical specifications for the RF-AI receiver are provided in Table 2-7.

Table 2-7: Electrical Specifications (Sheet 1 of 2)

Parameter	Specification
Frequency range	896.000–902.000 MHz
Channel spacing	12.5 kHz
Modulation	4-level FSK @ 800/1600 bps per ReFLEX/ InFLEXion protocol
Sensitivity @ 800 bps ¹	-128 dBm (at 1% packet error rate static)
Sensitivity @ 1600 bps ¹	-125 dBm (at 1% packet error rate static)
Frequency generation	Synthesized in 6.25 kHz steps
Frequency stability	± 1 ppm
Diversity	2-branch antenna diversity
IF frequencies	73.35 MHz, 450 KHz
Selectivity	70 dB @ 12.5 kHz
Intermodulation rejection	70 dB
Spurious and image rejection	90 dB
Off-channel acceptance	± 500 Hz
RF input VSWR	2.0:1 max (50 ohms ref)
Max input level (no damage)	+10 dBm
Max input level (full spec)	-20 dBm
Noise figure ²	7.5 dB typical / 10 dB max at RX input
Emissions	FCC Class B
Input power	90–265 Vac, 47–63 Hz, single phase

Table 2-7: Electrical Specifications (Sheet 2 of 2)

Parameter	Specification
Power supply type	Switched
Battery revert	12 V (optional)
Power consumption	35 watts (40 watts with RF peripheral)

1. RF-A! receivers used with the RF Distribution option typically operate with sensitivities 2 db better than those shown. Diversity reception is assumed.
2. Noise Figure is 6dB maximum when the RF Distribution option is installed.

Environmental Specifications

The environmental specifications for the RF-A! receiver are shown in Table 2-8.

Table 2-8: Environmental Specifications

Parameter	Specification
Temperature range	-30°C to +60°C (-22°F to +144°F)
Humidity	0 to 95% noncondensing @ 50°C
Particulates	90 micrograms per cubic meter

PreInstallation

Site Planning

Note: For colocated sites, see the RF-Orchestra! System Installation and Operation Manual referenced on page 1-4.

Licensing and availability of space help to determine the suitability of a site. Field engineering and program management teams plan the system and site layouts. Advanced planning helps prevent potential on-site and off-site interference from other RF systems. Site layout planning also minimizes the cabling lengths between the RF equipment.

Building Design Considerations

A suitable building contains no windows and must be able to resist extreme weather conditions. The building must comply with the requirements of the American National Standards Building Code Requirements for *Minimum Design Loads in Buildings and other Structures* and/or other similar building code requirements enforced in the local area.

Motorola recommends the following minimum requirements when selecting a building or designing a site:

- The area must have a minimum floor space of at least 20 square feet for each cabinet and allow adequate front and rear access to the equipment cabinets.
- The ceiling structure must be capable of supporting a cable tray assembly for routing cabinet cabling and other site cabling. The cable tray assembly mounts to the site ceiling and walls for each site and must be at least 7.5 feet from the floor to allow for the height of the equipment cabinets.
- Tamper-proof locks should be installed on all exterior doors.

- The interior environment must be maintained between -30°C and +60°C. The RF-A! receiver is not approved or recommended for outdoor use.
- Proper surge protection for all antennas, data circuits, phone lines, and power inputs should be installed to prevent potential damage to the equipment.
- Flooring must be level to within 1/8 in. and strong enough to support the weight of the equipment. Refer to the floor loading information provided in this chapter.

Equipment cabinet

Two different height cabinets are available:

- 1- to 4-channel cabinet (46 in.)
- 1- to 2-channel cabinet (25 in.)

Cabinet Spacing

At least two feet of free space in front of and behind each cabinet should be provided to allow access to the cabinet. The equipment cabinet footprint is shown in Figure 3-1.

Figure 3-1: Equipment Cabinet Footprint

Equipment Cabinet Floor Loading

A cabinet with four RF-A! receivers and the RF distribution system weighs approximately 225 pounds with a floor loading of 50 lb/ft². A typical multi-cabinet layout is shown in Figure 3-2.

Figure 3-2: Typical Multi-Cabinet Layout

Telephone Company Line Interface

A surge arrestor must be installed at the data-link service entrance. The design of the arrestor must operate with the data-link service and be wired according to the manufacturer's instructions.

Environmental Considerations

Excessive temperatures reduce the life span of electronic equipment. Extreme temperatures may cause permanent damage.

The relative humidity within the site must be less than 95 percent at +50°C (+122°F), non-condensing. For equipment operating in an area that is not environmentally controlled, the airborne particle level must not exceed 90 ug/m³.

Power Requirements

All electrical wiring for the site must meet the requirements of the National Electrical Code and/or other applicable local codes.

The receiver operates from a 120-Vac, single-phase, 50-60 Hz, 4-wire service. A NEMA 5-15P plug provides a power connection to the RF-A! receiver. All conductors must be made of copper.

A cabinet with four RF-A! receivers and the RF Distribution option draws approximately 1 amp and dissipates 400 BTU/hour of heat (maximum).

Grounding Requirements

An RF-A! receiver site must meet certain requirements to protect the equipment from lightning and other electrically-induced transients. This section provides an overview of grounding considerations and methods. For more information on grounding requirements and installation methods, refer to the Motorola *Quality Standards-Fixed Network Equipment (FNE) Installations Manual (R56)*.

Ground Rings

Separate ground rings must surround the site building and the antenna tower. Place a ground rod at each corner of the site building and additional rods in between as necessary to reduce the distance between the rods to 15 ft. The rods are then bonded together using bare copper wire that is buried at least 18 in. underground.

Place a ground rod at each leg of the antenna tower and bond the rods together with copper wire, also buried at least 18 in. underground.

Building and Equipment Grounding

At stand-alone buildings, a PVC (typically 0.75 in.) conduit must be provided for the interior ground wire to exit the building. For site buildings with floors at ground level, the conduit must exit a side wall at a 45° angle or less. For buildings with space below the floors for a ground connection, the conduit may exit through the floor. The location of the opening must be close to the master ground bar inside the site.

Use of metal conduit is discouraged because the inductive properties raise the impedance of the ground. If local building codes require metal conduit, both ends of the conduit must be bonded to the ground wire by grounding clips or other suitable means to eliminate the inductance of the conduit.

Cabinet Grounding

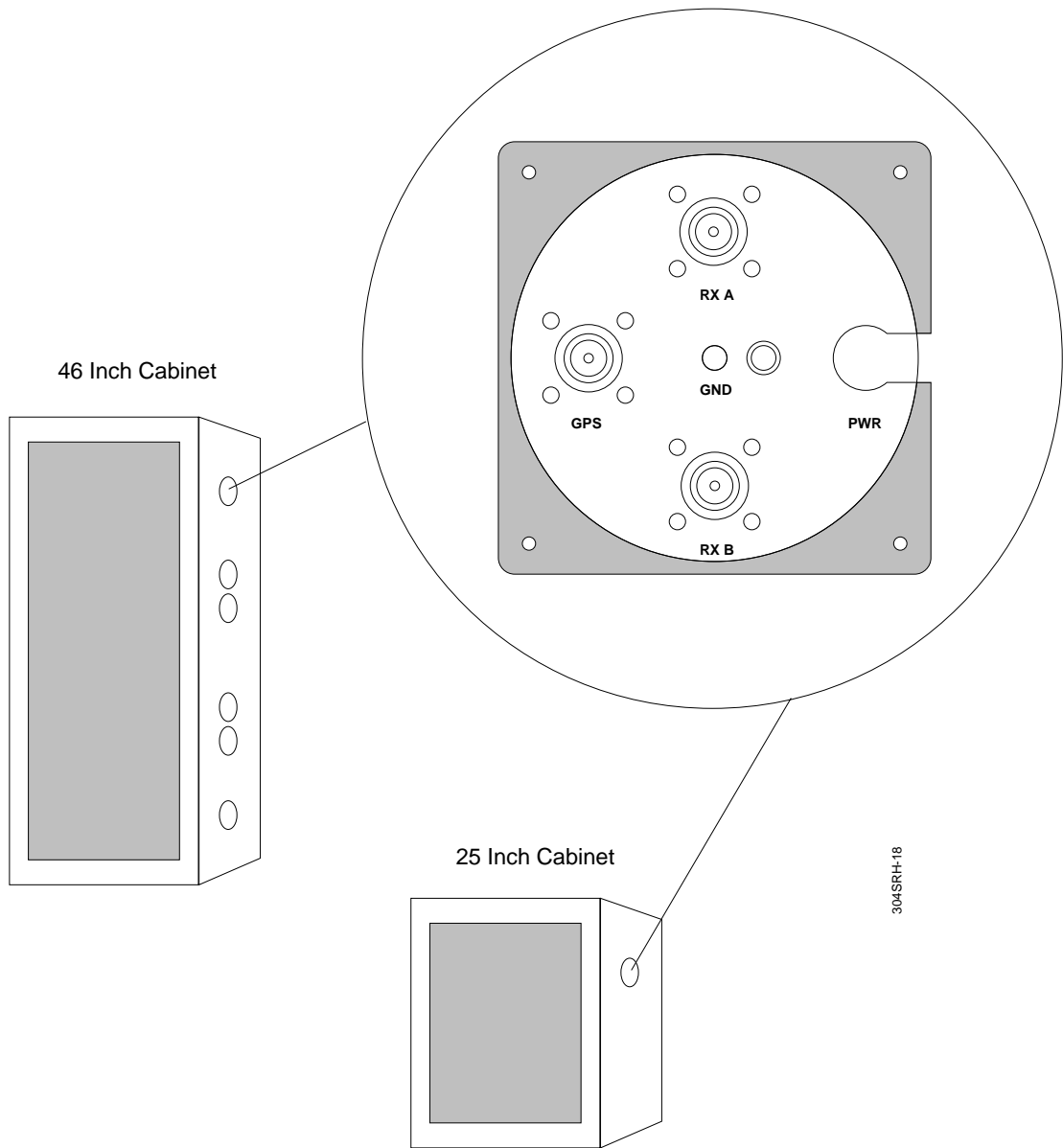
The RF-A! receiver is classified as a surge producer because of external coaxial cable connections. Surges from outside the site can enter the site grounding system through the coaxial cables. To prevent damage to the equipment, each cabinet must connect to a ground through a solid copper wire, with a minimum wire size of at least #2 AWG.

To prevent injury or damage to equipment, never use a bare or damaged wire for the ground connection or other electrical wiring.

Note: The cabinet must connect to the site ground using a single dedicated ground wire. The cabinet ground location is at the side of the cabinet (see Figure 3-3).

The ground wire must attach to the J-plate located on the side of the cabinet (see Figure 3-3).

Do not daisy chain multiple cabinet grounds using a single ground wire. Doing so can cause surge energy to be distributed among the cabinets instead of to the master ground bus.



304SRH-18

Figure 3-3: Side View of Cabinet with J-Plate

Cable Tray Grounding

Install the cable tray assembly so that it does not come into contact with metal conduits, pipes, or other metal objects. The cable tray assembly must connect to the master ground bar through a single dedicated wire. The connecting wire must be an insulated copper wire with a minimum size of #6 AWG.

Any metal-to-metal joints on the cable tray assembly must bond together with a wire jumper to prevent electrical discontinuity, unless the tray is specifically designed to ensure continuity. Scrape painted surfaces clean on the cable tray assembly where the jumper wire attaches to ensure a good electrical connection.

Antenna Planning

This section discusses antenna installation considerations and methods. For more information on antenna installation requirements and methods, refer to the Motorola manual *Quality Standards-Fixed Network Equipment Installations* referenced on page 1-5.

Antenna Feed-Line Requirements

When installing transmission line entries at the site building, use an external metal antenna entry plate for all antenna entries. Keep all entries covered until permanently sealed. Ground the transmission lines to the exterior ground bar below the waveguide entry port. Use only manufacturer-approved grounding kits.

Antenna Feed-Line Identification

Marking all antenna feed lines helps to ensure proper connections. Colored vinyl marking tape designed for outdoor use is recommended.

Note: The color coding scheme identified within this manual is a recommendation only. Identifying specific colors maintains uniformity between sites. Other color schemes may be used.

Table 3-1: Example of Antenna Identification Tape Marking

Color	Description
Blue	RF-A! Receive Antenna A
Green	RF-A! Receive Antenna B
Yellow	Global Positioning System (GPS) Antenna

Antenna Surge Arrestors

Terminate all antenna feed lines with a surge arrestor within 12 inches of the entry window. Connect each arrestor to the master ground bar located below the entry plate.

GPS Antenna Planning

A Global Positioning System (GPS) receiver, used for time synchronization, must locate and track at least three satellites during initial power-up. The GPS uses the three satellites to establish a three-dimensional fix (latitude, longitude, and altitude) for the site. Only one satellite is tracked to maintain the timing signal. The site planner must carefully evaluate proposed antenna locations before installation to ensure an adequate lock can be obtained at all times for the proposed site because this timing is critical for maintaining system synchronization.

The GPS receiver must perform the following:

- Track a minimum of three satellites during start-up
- Experience no periods greater than 10 minutes when no satellites are tracked

GPS Antenna Requirements

The GPS antenna must have an unrestricted aerial up view to within 10° of the horizon (0 to 80 degrees from vertical) in all directions.

The antennas must be mounted high enough to clear the peak of any site roof. For systems in the northern hemisphere, GPS antennas must be mounted so that a clear view of the southern sky is maintained. For systems in the southern hemisphere, GPS antennas must be mounted so that a clear view of the northern sky is maintained.

Adjacent structures, such as trees or buildings, are obstructions because of their wide, solid profiles. Mount the GPS antenna to clear these obstructions and provide the clear path described above. Adjacent antenna towers at the RF site that protrude into the required view have minimal effect on GPS satellite reception and are not obstructions.

Depending on the GPS receiver make and model, the GPS antenna may require DC power on its feed line (typically 5 Vdc).

The GPS receiver can receive interference by high power carriers in the communications bands. The symptom is the failure of the GPS receiver to acquire satellites. The minimum recommended separation distance from any transmitter antenna must provide at least 38 dB of path loss from a 1-Watt isotropic radiator. If in doubt, use at least 12 feet of horizontal separation distance. Long runs of single-braided shielded cable, along with other radio cables, can be subject to jamming. Solid copper outer conductor coax is recommended.

The RF connection of the Motorola GPS receiver provides +5 Vdc power to the GPS antenna. The output is not reverse polarity protected. To run multiple receivers off one antenna, choose one receiver to supply the +5 Vdc to the antenna. Place DC blocks in all other branches to the GPS receivers.

The coaxial cable used to connect the GPS antenna to the GPS input on the GPS receiver must be designed to satisfy the system gain requirements for the GPS receiver at a frequency of 1575.42 MHz (GPS-L1). The standard maximum cable loss allowed between the GPS antenna and the RF-A! receiver is six dB. The standard maximum cable loss is included in a system-gain budget, with additional items like line-of-sight loss and minimum satellite power during satellite acquisition. The total line-of-sight loss (seven dB) includes foliage loss [for example, low density tree tops, (six dB) and ice loss (one dB)]. The foliage loss could be reduced for two other design considerations where foliage is not an issue (such as the top of a building). The cable loss in the clear view case could be increased from the standard loss to 10 dB (6+4). Any additional trade-off is not recommended because of the reduced signal margin during satellite acquisition. Alternatively, the six dB for foliage loss could account for an increase of the RF noise floor level because of nearby (in frequency) transmitter noise floor additions.

Receipt of Equipment

Inspect the equipment while it is still in the delivery truck.

Note: If obvious damage has occurred to the shipping containers before unpacking, reject any damaged materials and equipment. Report damaged or short equipment issues to your Motorola representative.

Observe the guidelines for safe handling of electrostatic sensitive devices and equipment to prevent electrostatic damage.

Inspect the RF-A! equipment for any discrepancies upon receipt of the delivery:

- Receipt of all equipment on the packing list
- Loose or damaged equipment
- Dents, scratches, or other damage to the side of the chassis
- Cabinet wiring out of place
- Modules and boards for physical damage to external controls or external connectors

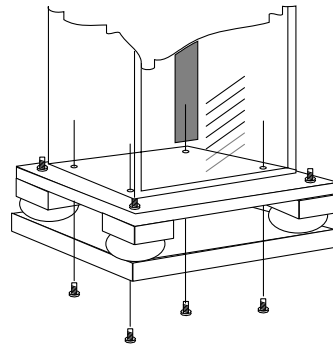
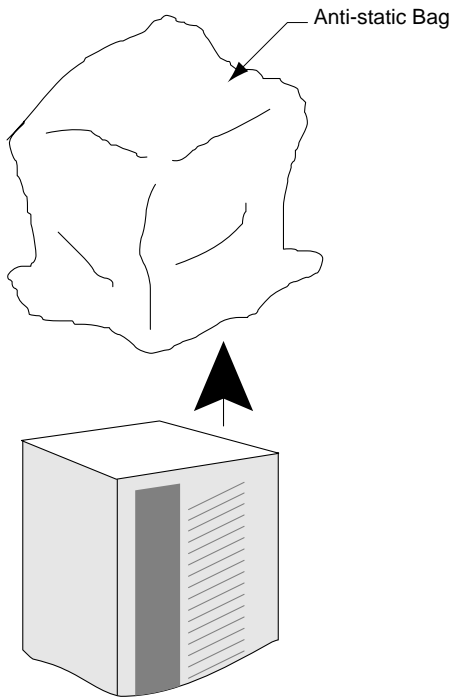
If any equipment is damaged, immediately contact the shipping company, then your Motorola representative (see the Foreword for contact information).

Installation

Unpacking

The RF-Audience! receiver (RF-A!) comes in a 25-in. or 46-in. cabinet. The RF-A! receiver is shipped mounted on a wooden skid and covered with an anti-static bag. See Figure 4-1 for instructions on unpacking the RF-A! receiver.

1. Remove anti-static bag. Do NOT discard bag. It will be re-installed to protect equipment during installation.
2. Depending on cabinet type, either open or remove front and rear doors to gain access to the four (4) bolts securing the station to the wooden skid. Remove the bolts and nuts as shown.



3. Use hoist to lift the station from the skid. Remove skid and return station to the floor.
4. Replace anti-static bag over station to provide protection during installation.

Figure 4-1: Unpacking the RF-A! Receiver

Installation Overview

The following installation procedures assume the field technician or installer has knowledge of the installation techniques in the Motorola *Quality Standards Fixed Network Equipment - Installation Manual (R56)* referenced on page 1-4.

Note: Before performing the installation procedures, prepare the site with all associated antennas, phone lines, and other related site equipment (see Chapter 3, "PreInstallation").

The RF-A! receiver equipment comes in two configurations:

- 1- to 2-channel cabinet (25 in.)
- 1- to 4-channel cabinet (46 in.)

Installation procedures for both cabinets are the same. See Figure 4-2 and Figure 4-3 for cabinet layout.

Figure 4-2: RF-Audience! Receiver One-Channel (25 inch) Cabinet

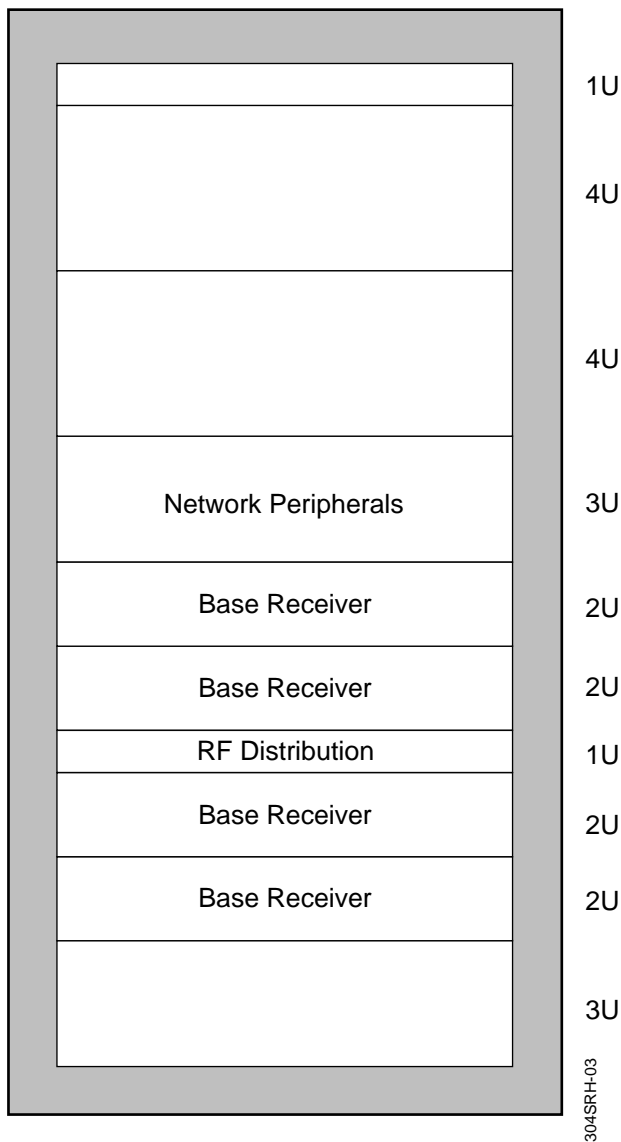


Figure 4-3: RF-Audience! Receiver Four-Channel (46 inch) Cabinet

Required Tools and Equipment

The following tables list the tools, test equipment, and locally procured parts that are required for the installation procedure. The model numbers listed are recommended, but equivalent tools and equipment made by other manufacturers are acceptable. When selecting tools and equipment, always choose those with insulated grips and handles. This insulation helps prevent potential injury from electrical shock.

Recommended Tools

Table 4-1 lists the recommended tools (or equivalent) for installation. These tools are not included as part of the RF-A! receiver shipment and must be procured before installation.

Table 4-1: Recommended Tools for Installation

Tool	Model/Type	Manufacturer	Use
Level		various	For leveling cabinet
Torque wrench	Snap-On™/QP1117 (calibrated to 105 in./lb.) or equivalent	Snap-On	Torque wrench for RF connections
Adjustable wrench	8 inch	various	For cabinet installation
TORX™ driver set	T10, T15, T20, T25, T30 bits	TORX™	Securing equipment and connections loosened during shipment

Recommended Test Equipment

Table 4-2 lists the recommended test equipment for installation. This equipment is not included as part of the RF-A! receiver shipment and must be procured before installation.

Table 4-2: Recommended Test Equipment for Installation

Test Equipment	Model/Type	Manufacturer	Use
Personal Computer	IBM compatible	various	Provides user interface to RFA-! receiver
Communication software	Procomm Plus™ (or equivalent)	DataStorm	Host communication
Straight-through cable with null modem adapter	DB-9 to DB-9 (see Figure 4-4)	various	PC to RF-A! interface
Digital multimeter	Fluke 77	Fluke	Voltage measurements
GPS evaluation kit (optional)	VPEVAL0002, GTEVAL0001, or UTEVAL0001	Motorola, GTE, UTE	Evaluate GPS

Figure 4-4: DB-9 to DB-9 Connector Pin-out for FIPS Interface.

Note: Note: Only TX, RX, and GND need to be connected (pins 2, 3, & 5).

Recommended Parts

Table 4-3 lists the recommended parts for installation. The items that are not part of the RF-A! receiver shipment must be procured locally before installation.

Table 4-3: Recommended Parts for Installation

Part	Type/Size	Manufacturer	use
Anchor kit	#2100-13	Hendry	Cabinet floor anchors
Colored vinyl tape	Red, black, green, brown, yellow, blue and white	various	Wire identification
Ground cables	#2 AWG stranded (green)	various	Cabinet grounding
	#6 AWG stranded (green)	various	Cabinet grounding
Ground wire	#4 AWG bare solid	various	Cabinet grounding
Split nuts	No specific model recommended	various	To join grounds
Lifting eyes		Motorola	
Floor mounting kit		Motorola	Seismic areas or where needed
Ceiling mounting kit		Motorola	Seismic areas or where needed

Hardware Installation

This section contains instructions for the installation of the RF-A! hardware, and grounding and power connections.

Cabinet Installation

The following information provides procedures for permanently mounting cabinets at a site.

Cabinet Bracing Considerations

In seismically active areas, special cabinet bracing may be required. Two optional kits are available for this purpose:

- An optional top cabinet bracing kit
- An optional floor mounting kit

Optional Top Cabinet Bracing

Two angled steel brackets and associated hardware allow cabinet bracing from the top (see Figure 4-6). Mount the brackets to the cabinet top. Use the mounting hole positions to tie into the overhead brace (customer provided).

Figure 4-5: Top Cabinet Bracing

Optional Floor Mounting Kit

The optional floor mounting kit consists of two steel brackets and associated hardware. Perform the following steps to mount the cabinet to the floor:

1. Pre-drill the floor and install four 1/2-in. anchors flush into the floor. (see Figure 4-6).
2. Remove the vanity top from the cabinet to allow access to the side panel.
3. Remove the screws located at the top of the frame.
4. Lift off the side panels.
5. Install the cabinet floor mounts to the cabinet using six 1/4-in. bolts.
6. Install four 1/2-in. bolts into the threaded floor anchors (see Figure 4-6).
7. Re-assemble the side panels and cabinet vanity top.

Note: Electrically isolate the cabinet from any other equipment or materials at the site. Isolate the anchors from the cabinet by using insulating shims between the anchors and the cabinet, and between the mounting hardware and the cabinet. Do not tighten the mounting hardware until the cabinet is leveled.

Figure 4-6: Floor Anchors

Cabinet Lifting

If applicable, hoist the cabinet into position using the optional lifting eyes. Perform the following steps to install the lifting eyes:

1. Place a flat washer over the corner hole in the top vanity cover at the top of the cabinet.
2. Screw the lift eye into the threaded insert. Repeat this step at each corner.
3. Lift cabinets only with weight evenly distributed over these four lift eyes

Never lift equipment without using properly rated safety equipment and safety procedures.

Access Considerations

Allow at least two feet of floor space in front and behind the cabinets for access during installation. Although most maintenance occurs at the front of the equipment cabinets, allow access to the rear for expansion, cabling, antenna connections, and air flow.

Note: Do not place cabinets back to back.

Cabinet Ground Connections

Equipment cabinets have one main ground stud located at the side of the cabinet (see Figure 4-7). Cabinet and site grounding is important for proper safety and operation (see Chapter 3, "PreInstallation", paragraph, "Grounding Requirements"). Attach the cabinet ground cable (customer supplied) to the ground stud and secure with the provided M6 nut.

Figure 4-7: RF-A! Receiver Ground Connections

Cabling

The following procedures provide information for the proper connection of external electrical, antenna, and GPS cables to the RF-A! receiver.

Receiver Connections

The receiver connections are located at the side of the cabinet (see Figure 4-8). Install diversity RX antenna lines to the appropriate N connectors and tighten securely.

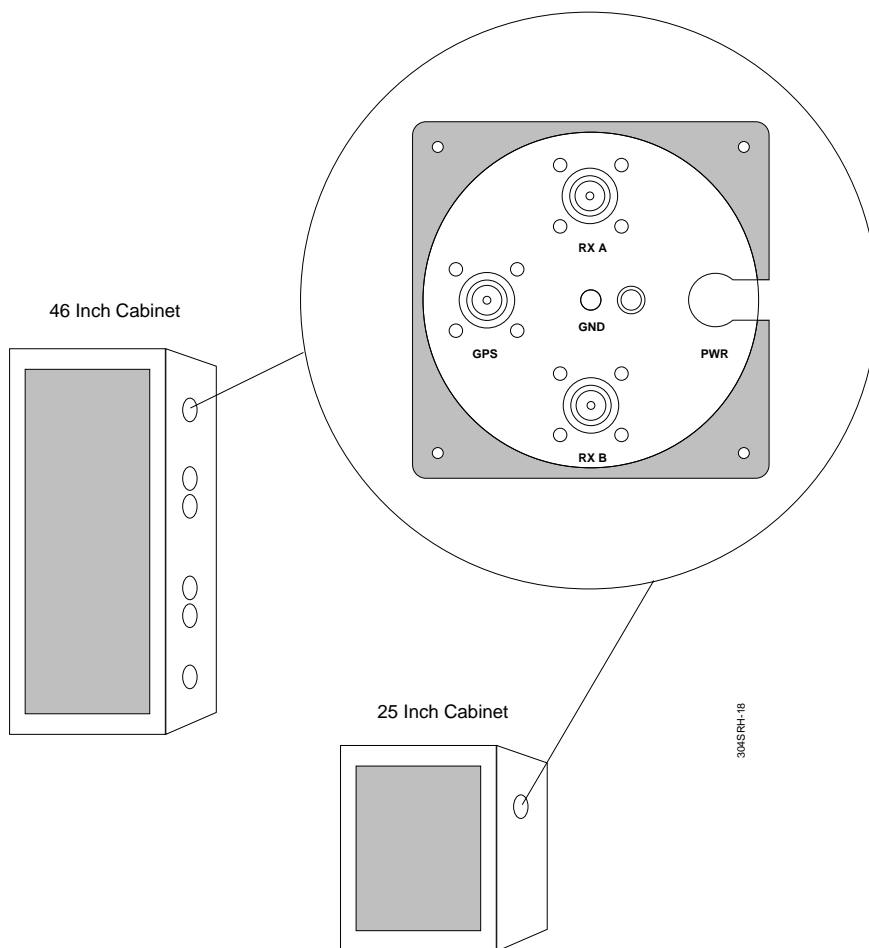


Figure 4-8: Side View of Cabinet with J-Plate

GPS Antenna

The GPS connection is located at the side of the cabinet (see Figure 4-8). Install the GPS antenna connection to the appropriate N connector and tighten securely.

The Motorola GPS antenna coax connector has DC voltage on the center pin.

Network Interface

Make the appropriate network connections as specified at your receiver site. Refer to the site survey document for your particular receiver site.

AC Power Connection

Turn off all equipment in the cabinet before plugging the line cord into the receptacle. Verify the ON/OFF switches for the following equipment are in the OFF position. The AC power cord is fed to the J-plate cutout (see Figure 4-8). A 15-foot cord with a NEMA 5-20P plug provides connection to the station.

- AC power supplies for each RF-A! receiver
- Network equipment

After confirming that all equipment is off, plug the line cord into the appropriate receptacle.

Connect the battery cable to connector J5 on each RF-A! receiver rear panel if the battery backup option is used. A fully charged battery should be used for initial installation.

Powering Up The System

Perform the following steps to verify proper operation of the RF-A! receivers during power-up.

1. Check all required connections according to the preceding section.
2. Open the front cover of each RF-A! receiver and turn each battery switch off.
3. Turn each AC power switch on.
4. Verify that each RF-A! receiver provides the following indications during power-up:
5. All front panel LEDs turn on for approximately three seconds after power is applied.
 - a. All LEDs turn off after three seconds and stay off while the RAM is being initialized.
 - b. STATUS LEDs start turning on as the control module (approx. 40 seconds), then each receiver module (approx. 30 seconds) are initialized and checked.
 - c. The STATUS - Alarm LED (red) will turn on for one second.
 - d. The LEDs go off momentarily, then come back on as the RF-A! receiver is fully initialized. The TRAFFIC - Time Ref LED (amber) starts flashing to indicate the presence of one PPS timing.
 - e. The STATUS - Alarm LED will flash until the RF-A! receiver determines that valid GPS timing signals are present.
 - f. The Alarm LED should then turn off. If not, you may need to clear the error log (see below) if it remains lit.
 - g. The TRAFFIC - Network LED will flash to indicate when the RF-A! receiver is transmitting data to the network.

Note: The Network LED flashing is inverted. The LED is normally on and flashes off with network activity.

6. If an optional RF peripheral with a GPS receiver is installed, the 1PPS LED flashes to indicate timing output, and the GPS LED flashes to indicate data traffic into or out of the GPS receiver. The GPS and 1PPS LEDs should flash approximately at the same time and for the same duration.
7. Turn on the network peripherals (see appropriate vendor manual for proper power-up indications).

Note: If an optional GPS receiver has never been used before, the RF-A! receiver may require up to 30 minutes to initialize. Once the GPS receiver has acquired satellites and has updated its internal almanac, the startup time is normally less than two minutes.

General Setup and First-Time Use

This section explains some of the procedures that are used to enter into a terminal session with the RF-A! receiver through the front-panel Diagnostics, Maintenance, and Control (DMC) port.

Interaction between the service technician and the RF-A! receiver is accomplished by connecting an external personal computer or terminal to the DMC port. A complete set of commands are provided so the user can configure each receiver to unique station parameters, perform hardware and software diagnostic procedures, and facilitate network and station management. The set of commands used are collectively referred to as the Friendly Interface Protocol Specification (FIPS). A summary of FIPS commands is provided in Appendix A.

Table 4-4 provides the conventions used in this manual for FIPS.

Table 4-4: Conventions used in this manual for FIPS

Convention	Description
Keystrokes	Single keyboard keystrokes used during input appear in a palatino font enclosed in angle brackets. Example: Press <Return> to start the update process.
Command input from keyboard	Commands to be entered by the reader appear in helvetica type. Example: Type: a 196 ? Press <Return>
System output	System response to commands appear in helvetica type. Example: COMMAND SUCCESSFUL

Note: Depending on your keyboard, <Return> may be known as <Enter>. This manual uses the <Return> designation. The system response messages in this document are examples only. Your system response messages may vary.

Types of FIPS Commands

This section discusses the command sequences used in FIPS. Commands can be classified into three categories:

- Action commands
- Read commands
- Write commands

An action command causes the RF-A! receiver to change operating modes or interact with an external entity. An action command will often write one or more parameters to the internal RF-A! receiver memory. The action command appears in the following format:

a <command #> <parameter or list>

A read command will return a parameter value as stored in internal RF-A! memory. The read command appears in the following format:

r <parameter #>

A write command will write a single parameter value to the internal RF-A! receiver memory. Some write commands behave similar to an action command and will cause the RF-A! receiver to change operating modes. The distinction is not important and for all practical purposes, no real difference is made between action and write commands. The write command appears in the following format:

w <parameter #> <parameter>

Note: Either upper or lower case may be used with FIPS.

DMC Port Terminal Connection and Setup

Perform the following steps to enter into a terminal session through the front panel DMC interface port.

1. Attach a serial interface cable from the local service monitor (PC) serial port to the RF-A! receiver-front panel DMC port (DB9-female).

Note: See Figure 4-4 for a wiring diagram for the interface cable. The RF-A! receiver serial port connector is configured as data terminal equipment (DTE).

2. Apply power to the terminal device and configure the serial interface to the appropriate parameters (see Table 4-5).

Table 4-5: Service Terminal Interface Parameters

Description	Setting
Baud rate	9600 (Default value)
Parity rate	none
Data bits	8
Stop bits	1
Emulation	VT100

3. If the RF-A! receiver is turned off, turn the AC power switch to the on position. The RF-A! receiver takes approximately three minutes to perform self-testing and initialization.

Note: Although access to a FIPS session is possible before the RF-A! receiver has completed initialization activities, entering station parameters before the RF-A! receiver is fully initialized may cause undesired results. Wait for the SYSTEM READY notice to appear on the FIPS monitor before proceeding:

The system responds:

```
RF-Audience!  
Wireless Messaging System (WMS)  
(c) Copyright 1997 Motorola, Inc.  
All Rights Reserved.
```

```
SYSTEMINITIALIZING
```

```
SYSTEM READY
```

4. Press: **<Return>**

The system responds:

```
ENTER PROTOCOL
```

5. Type: fips

6. Press **<Return>**

The system responds:

```
ENTER PASSWORD
```

7. Type: 6000

8. Press **<Return>**

The system responds:

```
FIPS:  
SYSTEM READY
```

You are now connected to FIPS and ready to perform read, write, and action commands.

Note: The FIPS prompt used in this manual is FIPS:, for software release R2.8.0 and later the FIPS prompt becomes RFA FIPS:

Step-By-Step Startup Procedure

To verify proper operation of the RF-A! receiver before putting the equipment into service, perform the following steps.

1. Enter into a terminal session according to directions in Chapter , "DMC Port Terminal Connection and Setup" procedure in this chapter.
2. Determine the current boot ROM and application software versions.

At the FIPS prompt, type:

r 147 <Return>

The system responds:

RR 147 B3.0.0 (*Boot Software Version*)

3. At the FIPS prompt, type:

r 148 <Return>

The system responds:

RR 148 2.8.0 (*Application Software Version*)

The RF-A! receiver can be configured as a GPS slave or a GPS master. A GPS slave is a listen-only receiver while a GPS master has configuration control over the GPS receiver.

4. View the GPS configuration of each RF-A! receiver.

At the FIPS prompt, type:

r 957 <Return>

The system responds:

RR 957 n (*n = 0 for Motorola slave; n = 1 for Motorola master; n = 2 for Trimble slave*)

The RF-A! will alarm when it cannot establish a network connection. To prevent these alarms, set the network time-out parameter to 0. This causes the RF-A! to ignore the network connection at power-up. It is also necessary to place the RF-A! in BER test mode. If the RF-A! is left in the normal operating mode (r 553 = 1), it will alarm at the end of every frame the network connection is not available.

5. To set the timeout parameter at the FIPS prompt, type:
a 196 ,,,,,,0 <Return>
seven commas (,) followed by 0 and **<Return>**
The system displays the information shown in Figure 4-9.

Figure 4-9: Setting Network Timeout Parameter Screen

6. Set BER test mode a 800 BPS as follows:

At the FIPS prompt, type:

w 552 3 <Return>

The system responds:

RW 552 3

This command should be check with the **r 553** command.

Note: The following procedure is known as a soft reset. To perform a hard microprocessor reset, depress the momentary push-button switch located behind the front panel BNC connector on the control module (ACM).

7. Clear all event logs and soft reset the station as follows:

At the FIPS prompt, type:

a 117 c <Return>

(initiate a software reset and clear all logs)

After soft reset and within one minute, the Alarm indicator should stop flashing and the Time Ref indicator should flash once per second. At the SYSTEM READY notice, re-establish a FIPS session as outlined in Steps 3-6 of Chapter , "DMC Port Terminal Connection and Setup" in this chapter.

After a successful power-up procedure, view the station event log.

8. At the FIPS prompt, type:

a 104 <Return>

The system responds:

FIPS:

```
<STATION_ERROR> <LOG_ERROR> <I_INIT_OTA_MODE_TO_NORMAL_IPP>
<PPFO_INIT> <103> <1997/01/02.17:38:15> <1>
```

FIPS:

```
<STATION_ERROR> <LOG_ERROR> <I_STATION_RESET_R2.8.0> <ROOT> <423> <1997/
01/02.17:38:15> <1>
```

If the event log shows that the GPS time stamp has not been acquired, check all cable connections as outlined in the previous section. The GPS time stamp has not been acquired if the SYSTEM READY message has not appeared within 3 minutes of a reboot/power-up. The GPS may require up to 30 minutes to initialize when the GPS is powered up for the first time at a site. Once the GPS receiver has acquired satellites and updated its internal almanac, the start-up time will normally be less than 90 seconds for a soft reset and 3 minutes for a hard reset. After 45 minutes, with GPS not producing a time stamp the SYSTEM READY message will appear. This indicates a time out and the E_RX_DSP_XILINX_SYNC_NOT_FOUND message will appear in the event log. This means for some reason the GPS is not able to produce a valid time stamp for use by the RF-A! For stand alone receivers, this may occur if the system is not configured for the correct GPS. Stand alone sites require the FIPS 957 command to be set to 1 (Motorola Master) or 2 (Trimble slave).

With the GPS producing good time stamps, the Time Ref LED (amber) on the RF-A! receiver front panel should flash to indicate the presence of 1PPS. If a Motorola GPS receiver is installed, the GPS and 1PPS LEDs on the front panel of the GPS peripheral will flash.

9. Check the RF-A! receiver GPS status (Motorola GPS only) as follows:

At the FIPS prompt, type:

a 208 <Return>

Note: In software releases prior to version R2.4.0, the format of this command is 'a 208 gps-stat'

The system responds with a display similar to Figure 4-10.

Figure 4-10: RF-A! Receiver GPS Status Screen

The RF-A! receiver requires at least three satellites are tracked to acquire an initial time stamp. Once the timestamp has been acquired, tracking fewer than three satellites will generate an alarm.

When the RF-A! receiver finds GPS and synchronizes, it then sets the system clock and date to the current GPS time.

10. Check system (GPS) time and date as follows:

At the FIPS prompt, type:

a 198 <Return>

The system responds:

198 CURRENT SYSTEM TIME: 17:40:25 2-Jan-1997

Note: GPS and RF-A! system time are Greenwich Mean Time (GMT)

11. Verify that the operating frequency has been set properly for the top Rx module as follows:
At the FIPS prompt, type:
r 685 <Return>
The system responds (the Rx A channel frequency in MHz):
RR 685 nnn.nnnnnn
12. If the frequency is incorrect, enter the correct frequency as follows:
At the FIPS prompt, type:
w 685 nnn.nnnnnn <Return>
The system responds:
RW 685 nnn.nnnnnn
13. Verify that the operating frequency has been set properly for the bottom Rx module as follows:
At the FIPS prompt, type:
r 681 <Return>
The system responds (the Rx B channel frequency in MHz):
RR 681 nnn.nnnnnn
14. If the frequency is incorrect, enter the correct frequency as follows:
At the FIPS prompt, type:
w 681 nnn.nnnnnn <Return>
The system responds:
RW 681 nnn.nnnnnn
15. If the battery revert option is installed, turn the BATT switch (located on the RF-A! receiver power supply) to the on position. Turn off the AC power switch momentarily to verify battery backup is operational. The yellow BATT REVT (battery revert) LED illuminates when the battery is supplying power to the RF-A!.

The initial startup procedure is complete. The RF-A! receiver is now ready to be configured for all site-specific operating parameters. The site-specific operating parameter checklist can be used to assist the technician in making a site fully operational (see Table 4-6). This procedure is described in detail in Chapter 2, "System Description". Refer to the site manager or network administrator for all site-specific information.

Table 4-6: Site Specific Operating Parameter Checklist

Parameter	Related FIPS command	Site Specific
Rx A Frequency	r/w 685	
Rx B Frequency	r/w 681	
Station ID	r/w 186	
IPP Empty Frame Control	r/w 551	
IPP Control Bitmask	r/w 510	
IPP Slot Control Bitmask	r/w 511	
IPP SP Control Bitmask	r/w 512	
IPP Channel Control Bitmask	r/w 513	
IPP UDP Port	r/w 547	
RF-C! IP Address	r/w 550	
HSO Warp Value	a 155, r 185	
SNMP Manager IP Address	r/w 65	
Network Baud Rate	a 196	
Local IP Address	a 196	
Peer IP Address	a 196	0.0.0.0
Default Gateway IP Address	a 196	
Subnet Mask	a 196	
IPCP Negotiate	a 196	
PPP Mode	a 196	
Network Init Timeout	a 196	

Configuration and Operation

General Use and Configuration

To enter into a terminal session using the Friendly Interface Protocol Specification (FIPS) protocol, you must enter a password. Passwords must be a one- to eight-character string.

Note: The FIPS printout messages in this section are examples only. Your printout messages may vary.

As an example, here are the instructions to set the password to hello. At the FIPS prompt, type:

```
w 707 hello <Return>
```

The system responds:

```
RW 707 hello
```

If a period of time elapses without activity at the FIPS port, the RF-A! receiver will time out and require the user to re-enter a password before FIPS activity can resume.

As an example, here are the instructions to set the FIPS Inactivity Timer interval to 600 seconds (10 minutes). At the FIPS prompt, type:

```
w 136 600 <Return>
```

The system responds:

```
RW 136 600
```

Note: A summary of FIPS commands is found in Appendix A.

Setting the Proper Channel Frequency

Each RF-A! receiver is configured to a specific channel frequency. Frequency parameters are entered in units of megahertz, and must be a multiple of 0.00625 (6.25 kHz). In diversity mode, both receivers must be programmed to identical channel frequencies.

For example, to change Rx A (top receiver module) frequency to 901.5 MHz, at the FIPS prompt, type:

```
w 685 901.5 <Return>
```

The system responds:

```
RW 685 901.500000
```

Set Rx B (bottom receiver module) to 901.500 MHz., at the FIPS prompt, type:

```
w 681 901.5 <Return>
```

The system responds:

```
RW 681 901.500000
```

Note: Trailing zeros are not required to be typed.

Global Positioning System Configuration

The RF-A! receiver can be configured as a GPS slave or a GPS master. A GPS slave is a listen-only receiver while a GPS master has configuration control over the GPS receiver. The proper configuration is determined by the station type. Colocated RF-A! receivers always operate in-slave mode. The RF-Baton! (RF-B!) transmitter controller is the master. At a stand-alone RF-A! site, only one RF-A! receiver is in master mode unless you are using an external GPS source. In this case, all stand-alone RF-A! receivers are configured in the slave mode.

1. At a stand-alone site, one RF-A! receiver is configured as the Motorola GPS master. At the FIPS prompt, type:

```
w 957 1 <Return>
```

The system responds:

```
RW 957 1
```


2. Configure all other RF-AIs separately as Motorola GPS slaves. At the FIPS prompt, type:

w 957 0 <Return>

The system responds:

RW 957 0

3. At a colocated site using Trimble, configure the RF-A! to Trimble GPS slave. At the FIPS prompt, type:

w 957 2 <Return>

The system responds:

RW 957 2

GPS Reporting

A GPS receiver provides timing signals to the RF-A! receiver that are critical for proper receiver operation and decoding of over-the-air (OTA) data. The RF-A! receiver requires a regular GPS time stamp and 1 pulse-per-second (1 PPS) timing signal. At least three satellites need to be tracked to acquire an initial timestamp. Once the timestamp has occurred, tracking fewer than three satellites generates an entry to the station error log.

Once an initial time stamp is obtained, the RF-A! receiver will tolerate a loss of GPS information for an amount of time related to the reference oscillator stability. Typically, a loss of a GPS signal for up to 10 minutes will cause no degradation in receiver performance.

To check the RF-A! receiver GPS status (Motorola only), at the FIPS prompt, type:

a 208 <Return>

Note: In software releases prior to version R2.4.0, the format of this command is 'a 208 gps-stat'

The system responds with the information shown in Figure 5-1.

Figure 5-1: RF-A! Receiver GPS Status Screen

After a reset, the RF-A! receiver sets its time to 12:00:00 (24-hours clock) and date to Jan 1, 1995 until the GPS gives the RF-A! a valid time stamp. The RF-A! then sets the system clock and date to the current GPS time and date. GPS and system time are Greenwich Mean Time (GMT).

To check the system (GPS) time, at the FIPS prompt, type:

a 198 <Return>

The system responds:

CURRENT SYSTEM TIME: hh:mm:ss day-mon-year

Setting the Operating Mode

The RF-A! receiver can be placed in normal inbound paging protocol (IPP) mode or in one of several test modes described later in this chapter. Every time the RF-A! receiver is powered up or reset, it defaults to the normal IPP mode.

To return the RF-A! receiver to normal IPP mode after being placed into one of several test modes, at the FIPS prompt, type:

w 552 1 <Return>

The system responds:

RW 552 1

Depending on the operating mode and state the receiver was in prior to executing the above command, the receiver may or may not respond instantly.

To read the actual operating mode or to confirm the results of a 'w 552' command, at the FIPS prompt, type:

```
r 553 <Return>
```

The system responds:

```
RR 553 1
```

If the value of r 553 does not reflect the value of 552, try setting w 552 again.

Station Reset

For the results of certain commands to take effect, or in a situation where the RF-A! receiver no longer responds to FIPS commands, resetting the station may be necessary. The RF-A! receiver can be reset in one of three methods:

- Power-on reset
- Hard reset
- Software (soft) reset

Note: None of the above forms of station reset has any effect upon the station event logs. These errors and logs can only be cleared through explicit use of action commands as described later in this chapter.

A power-on reset consists of turning the power off, waiting momentarily, and then turning the power back on. This reset returns the microprocessor and all internal interfaces, peripherals, and circuitry to their defaults. Both a power-on reset and a hard reset causes the RF-A! receiver to initiate a full set of self-test and initialization routines, a process known as boot-up. A summary of the boot process is shown below (see Table 5-1).

Table 5-1: Summary of the Boot Process

Process	Power-on	Hard Reset	Soft Reset
Initial Boot Sequence	X	X	X
RAM Test	X	X	
Network Initialization	X	X	X
GPS Initialization (Master Only)	X	X	X
FIPS Initialization	X	X	X

A hard reset is similar to the power-on reset. To perform a hard microprocessor reset, press the momentary push-button switch located behind the front panel BNC connector on the Audience Control Module (ACM). A hard reset returns only the microprocessor and internal interfaces to their defaults.

A software reset, or soft reset, is accomplished through a FIPS action command. A soft reset bypasses much of the self-testing that is normally done with a power-on or hard reset. With a soft reset, the RF-A! receiver typically resumes normal operation in less than one minute. Whereas, the other forms of reset take considerably longer.

To perform a soft reset at the FIPS prompt, type:

```
a 117 <option> <Return>
```

The system resumes normal operation in approximately one minute.

Setting Network Parameters

The RF-A! receiver must be configured prior to operation. At the physical layer, the RF-A! receiver supports an RS-232 connection using a male DB9 connector on the rear panel. The data-link protocol used for communications with the RF-C! is the TCP/IP Point-To-Point Protocol (PPP). Serial speeds ranging from 9600 to 38,400 bits-per-second (bps) are supported.

At the network layer, the RF-A! receiver uses the TCP/IP to communicate with other systems on the network. At the transport layer, most high-level transport is performed using the User Datagram Protocol (UDP). The following parameters, along with their parameter values, are needed to configure an RF-A! receiver (see Table 5-2):

Table 5-2: RF-A! Receiver Network and Transport Parameters (Sheet 1 of 2)

Parameter	Definition
baud rate (45)	The speed, in bps, of the PPP data link. The data rate of the network peripheral (a router or modem) that directly attaches to the RF-A! receiver must also be configured to the same value.
local IP (46)	The IP address of the RF-A! receiver. This should be unique for each RF-A! receiver in the network.
peer IP (47)	A dynamic IP address, used by PPP, that is assigned to the RF-A! receiver by the router during network initialization, such as when the RF-A! receiver powers up or reinitializes from a reset. Typically, this value is entered as 0.0.0.0.
default gateway (48)	The IP address of the router that attaches to the RF-A! receiver.
subnet mask (49)	The subnet mask of the physical subnetwork that the RF-A! receiver is attached to.
ipcp negotiate addr (52)	<p>This parameter controls how the IP address for network and data-link controls are negotiated. Three choices are available:</p> <ul style="list-style-type: none"> Do Not Negotiate Use Old Method Use New Method per RFC 1332 (default) <p>See FIPS action command description for 'a 196' in Appendix A.</p>
ppp mode (50)	This parameter is set to either active or passive. In the active mode, the PPP data-link software actively seeks a network connection until it is successful or until it times out (see 'network init timeout' parameter below). In the passive mode, the RF-A! receiver monitors the network for activity and connects only when it is initiated by the network.

Table 5-2: RF-A! Receiver Network and Transport Parameters (Sheet 2 of 2)

Parameter	Definition
network init timeout (60)	When the RF-A! receiver completes the boot process after a power-up or reset, the receiver attempts to establish a network connection when ppp mode is active. If the RF-A! receiver is unsuccessful, it will continue to try to establish a connection for the period of time defined by this parameter, entered in seconds. Setting this parameter to 0 instructs the RF-A! receiver to only attempt connection once. If the receiver is unsuccessful the first time, it ignores all network traffic and never attempts to establish a connection again.
ipp dest IP (550)	Typically, this parameter is the IP address of the RF-C! controller. This IP address should be identical for each RF-A! receiver connected to the same RF-C! controller.
ipp udp port (547)	An RF-C! controller processes information from a number of entities on the network (RF-A! receivers and RF-B! transmitter controllers). The ipp udp port identifies to the RF-C! controller that the inbound datagram (packet) is an IPP packet from an RF-A! receiver.
snmp mgr0 IP addr (65)	Typically, this parameter is the IP address of the Choreographer! interface.

Note: All IP network addresses are entered in Decimal Dot Notation (DDN), e.g. 180.25.73.255.

All of the parameters shown in Table 5-2 are required by the RF-A! receiver. Typically, these parameters are provided by a network administrator at the time of installation and are seldom changed once a system is operational. However, if a change in a local network peripheral (modem or router) occurs, or if the layout of the network fundamentally changes, then the parameters may be revised.

Network Configuration

The first eight parameters above are configured with a single-action command: 'a 196'. The command has the following format:

```
a 196 <baud rate>, <local IP>, <peer IP>, <default gateway>, <subnet mask>, <ipp negotiate addr>, <ppp mode>, <network init timeout>
```

See Appendix A for a description of the range of legal values each parameter can take.

Re-entering all parameters each time an 'a 196' command executes is not necessary. To leave a parameter unchanged, do not enter a value in the parameter list.

For example, to change the 'baud rate' to 19,200 bps and 'ppp mode' to active, at the FIPS prompt, type:

```
a 196 19200,,,,,1, <Return>
```

Note that a station reset is required for any new configuration using the 'a 196' command to take effect.

External Subsystem Configuration

The IP addresses and ports of the subsystems receiving IPP traffic and/or providing network management or control through Simple Network Management Protocol (SNMP) are considered to be external network parameters. They are not essential for configuring an RF-A! receiver to communicate over its direct physical network. Therefore, the IP addresses and ports are not part of the 'a 196' command.

To set the IP address of the sub-system receiving IPP traffic (RF-C! controller), at the FIPS prompt, type:

```
w 550 <ipp dest IP> <Return>
```

To set the UDP port number of the IPP protocol within the sub-system receiving IPP traffic, at the FIPS prompt, type:

```
w 547 <ipp udp port> <Return>
```

Note: The IPP Protocol Specification required UDP port #5001

To set the IP address of the primary SNMP manager (Choreographer! interface), at the FIPS prompt, type:

```
w 65 <snmp mgr0 IP> <Return>
```

Monitoring the Router/Network Connection Process

Viewing the connection process between the RF-AI receiver and its default gateway (router) is possible by using the 'a 196' command. First, issue an 'a 117' command to reset the station. Next, reestablish a FIPS session.

To view the network status, at the FIPS prompt, type:

```
a 196 ? <Return>
```

The system responds by displaying the information in Figure 5-2.

FIPS: Interface Parameter Settings:

```
45 Baud Rate      = 19200
46 Local IP      = 0x00000000 0.0.0.0 / 0.0.0.0
47 Peer IP       = 0x00000000 0.0.0.0 / 0.0.0.0
48 Default Gateway = 0x00000000 0.0.0.0
49 Subnet Address (net mask) = 0xffff0000 255.255.0.0 / 255.255.0.0
50 PPP Mode      = 0 PASSIVE
51 MYASYNCMAP   = 0x0
```

Negotiation Settings:

```
52 IPCP_NEGADDR = 2 NEW
53 NEGMRU       = 1 ON
54 NEGASYNCMAP = 1 ON
55 NEGMAGIC     = 1 ON
56 NEGACCOMP    = 1 ON
57 NEGIPCOMP    = 1 ON
58 NEGPROTOCOMP = 1 ON
59 VJCOMPmode   = 3 IPCP_VJMODE_RFC1332
60 NETWRKTIMOUT = 0 secs.
```

PPP STATUS = 1 NEGOTIATING

Interface 1 Status:

```
LCP STATE = 2 LISTEN
IPCP STATE = 1 CLOSED
```

Command Format:

```
a 196 <baud rate>, <local IP>, <peer IP>, <default gateway>,
<net mask>, <ipcp negotiate addr>, <ppp mode>, <network init timeout>
```

Figure 5-2: Network Status Screen

Referring to Figure 5-2, when the connection process completes, the router assigns parameter 46 'Local IP' an address different than 0.0.0.0; PPP Status will change to = 2 UP; and both Interface 1 Status states will change to = 6 OPEN.

IPP Channel Control

When inbound messaging traffic (OTA data) enters the RF-A! receiver from the channel, all information regarding each inbound transmission is encapsulated into packets of data conforming to the Inbound Paging Protocol (IPP). IPP provides a mechanism for reliable and efficient delivery of OTA data and control information to be passed between the RF-A! receiver and RF-C! controller. A non-OTA heartbeat message can also be sent periodically to check the network link between the RF-A! and the RF-C!. See FIPS r/w 500 in Appendix A. IPP uses UDP to provide connectionless datagram delivery services at the transport layer of the TCP/IP protocol suite.

The following examples of OTA data and control information use IPP:

- Station ID
- Date and time
- Signaling speed
- Cycle and frame number
- CRC/RS passed flags
- Slot data
- RSSI

Certain parameters are mandatory, such as the Station ID. Others, such as the date and time, are optional. This section explains how to control the information that is encapsulated in each IPP data packet.

Configuring the RF-A! receiver for IPP-specific parameters can be performed by the Choreographer! interface using SNMP. However, local control of IPP parameters is also possible through FIPS by using write commands to enter specific station parameters, or through byte-size bitmasks. The various parameters and bitmasks are defined in the following sections.

General IPP Control

The RF-A! receiver sends an IPP data packet to the IP address and port defined by the 'w 550' and 'w 547' station parameters. IPP packets are typically sent on each frame boundary as defined by the ReFLEX and InFLEXion protocols.

Included in each IPP frame header data packet (RIPP-apdu) are the Station ID, Channel Frequency, Cycle Number, and Frame Number. If slot data is included (RIPP-apdu, slot) in addition to the Slot Data, the Absolute Slot Number, Received Signal Strength (RSSI), and Bit Error Rate (BER) are also sent for each slot.

Channel frequency is determined by the 'w 681/685' station parameters. The cycle number and frame number are unique as determined by absolute GPS time. However, Station ID should be set to a unique value for each RF-A! receiver or each receiver site.

To set the station ID, at the FIPS prompt, type:

```
w 186 <station ID> <Return>
```

For situations where channel traffic is relatively light, a large amount of unnecessary network traffic can be generated by sending an IPP data packet for every frame.

To prevent unnecessary traffic during normal operations, configure the RF-A! receiver to send only IPP frames that include slot data. At the FIPS prompt, type:

```
w 551 0 <Return>
```

The system responds:

```
RW 551 0
```

Otherwise, set this parameter to 1 to send all frames. Sending all frames during installation is recommended. It verifies network connectivity quickly and does not require waiting for OTA traffic.

IPP Control Bitmask

The IPP Control Bitmask controls the reporting of optional generic IPP parameters (RIPP-apdu). This parameter determines whether Signal Speed, and Date and Time are included. The byte (8-bit) bitmask is entered in decimal format (see Table 5-1).

Configure the reporting of generic IPP parameters as follows:

At the FIPS prompt, type:

```
w 510 <byte> <Return>
```

The default value of this parameter is 128 (include signal speed).

Table 5-3: IPP Control Bitmask

Bit Number	Bit Usage
b7	0 = Exclude Signal Speed 1 = Include Signal Speed (default)
b6	0 = Exclude Date and Time (default) 1 = Include Date and Time
b5-0	Reserved

IPP Slot Control Bitmask

The IPP Slot Control Bitmask controls the reporting of optional slot parameters (RIPP-apdu, slot). This parameter determines whether to include CRC and RS Boolean test flags, and the number of RS corrected errors. The byte (8-bit) bitmask is entered in decimal format (see Table 5-4).

Configure the reporting of slot parameters as follows:

At the FIPS prompt, type:

```
w 511 <byte> <Return>
```

The default value of this parameter is 224 (include flags and number of RS errors).

Table 5-4: IPP Slot Control Bitmask

Bit Number	Bit Usage
b7	0 = Exclude CRC Passed Flag 1 = Include CRC Passed Flag (default)
b6	0 = Exclude RS Passed Flag 1 = Include RS Passed Flag (default)
b5	0 = Exclude Number of RS Errors Corrected 1 = Include Number of RS Errors Corrected (default)
b4-0	Reserved

IPP SP Control Bitmask

The IPP SP Control Bitmask controls the reporting of optional slot data parameters specific to single packets (SPs) (RIPP-apdu, slot, singlePkt). The use determines whether to include the signal protocol, CRC bits, and RS parity bits for each SP slot. The byte (8-bit) bitmask is entered in decimal format (see Table 5-1).

To configure the reporting of single packet parameters, at the FIPS prompt, type:

w 512 <byte> <Return>

The default value of this parameter is 128 (include protocol).

Table 5-5: IPP SP Control Bitmask

Bit Number	Bit Usage
b7	0 = Exclude Signal Protocol in IPP Slot Data 1 = Include Signal Protocol in IPP Slot Data (default)
b6	0 = Exclude CRC Bits 1 = Include CRC Bits (default)
b5	0 = Exclude RS Bits 1 = Include RS Bits (default)
b4-0	Reserved

IPP Channel Control Bitmask

The IPP Channel Control Bitmask controls specific channel-related functions. The setting enables and disables the channel, sets OTA signaling speed, and sets CRC/RS screening on or off. The byte (8-bit) bitmask is entered in decimal format (see Table 5-1).

Control channel functions as follows:

At the FIPS prompt, type:

```
w 513 <byte> <Return>
```

The default value of this parameter is 28 (channel on, screening on, 800 bps).

Table 5-6: IPP Channel Control Bitmask

Bit Number	Bit Usage
b7-b5	Reserved
b4	0 = Channel Off 1 = Channel On (default)
b3	0 = CRC Screening Off 1 = CRC Screening On (default)
b2	0 = RS Screening Off 1 = RS Screening On (default)
b1-0	00 = 800 OTA bps (default) 01 = 1600 OTA bps 10 = 6400 OTA bps (presently not supported) 11 = 9600 OTA bps (presently not supported)

Alarms, Errors, and Events

The RF-A! receiver application software is designed to recognize changes to specific internal or external states that require particular action. These situations are defined as events. Certain events create an entry into one of two internal databases—the station event log, or the software event log.

If the event being logged has a high severity, an alarm activates and an SNMP alarm trap issues. Typically, an alarm will trigger the STATUS - Alarm LED to blink or hold steady, and an SNMP trap generates and is sent to all configured SNMP managers.

Note: A list of all event and error types and their default severities can be found in Appendix D.

The most recent entry in either log is always displayed first unless it has already been logged. In that case, only the timestamp and number of occurrences are updated using the existing log entry.

View the station event log as follows:

At the FIPS prompt, type:

a 104 <Return>

The station event logs have the following format for each entry.

<error type> <error request> <error desc> <source> <line#> <timestamp> <number of occurrences>

Each field in the log is defined as follows (Table 5-1):

Table 5-7: Station Event Log Fields

Entry	Definition
Error type	This field can be STATION_ERROR, SWARE_ERROR, and so on.
Error request	For events that appear in the log, <LOG_ERROR> or <RESET_STATION> is always present.
Error desc	This field is a brief description of the event or error condition (see Appendix D).
Source	This field is the source module that logged the event.
Line#	This field is the line number of the source code in the module that produced the event.
Timestamp	This field shows the time of occurrence that the event was logged. In cases where multiple occurrences of the same event occur, the timestamp reflects the most recent event.
Number of occurrences	This field lists the number of times an identical event has occurred since the last time the event log was cleared.

The error desc parameter is preceded by one of the following preambles:

- E_ indicates an error condition.
- I_ indicates an informational log entry.
- In_ indicates a special log entry, n is a number.

The only special log entries currently implemented are generated at time of station initialization. Enabling or disabling special log entries is set by using the 'a 201' command (see Appendix A). The default state of the RF-A! receiver is that special log entries are not generated.

The format for the software event log is the same, except no timestamp occurs.

The following FIPS printout of an event log contains two station errors and two informational log entries (see Figure 5-3).

Figure 5-3: Sample Station Event Log Printout Screen

Note: To clear the station event log or software event log, use the 'a 111' and 'a 113' command, respectively.

Viewing Alarms and Changing Alarm Severity

The FIPS 'a 99' command shows the entries that have been logged to either of the event logs that are configured as alarms. Thus, all errors that are causing STATUS - Alarm LED activity can be viewed. From the FIPS prompt, type:

a 99 <Return>

The following FIPS printout illustrates events that are configured to be active alarms (see Figure 5-4):

Figure 5-4: Sample of Alarm Reporting by FIPS

This printout is similar to the listing shown in the sample station event log listing. Therefore, the 'a 99' command essentially performs a filtering operation on the event log database.

Alarms can be cleared individually ('a 102'), or entirely ('a 103'). For example, to clear an alarm triggered by the E_IPP_LIVE_DATA_XMIT_ERROR (error ID #312) event, at the FIPS prompt, type:

```
a 102 312 <Return>
```

To clear an alarm triggered by the E_LOSS_OF_GPS_TRACKING (error ID #272) event, at the FIPS prompt, type:

```
a 102 272 <Return>
```

Note: Clearing an alarm only effects the STATUS -Alarm LED. The logs are not affected.

The default severity of an error/alarm can be changed by using the 'a 200' action command. See FIPS commands in Appendix A.

A complete listing of error conditions and default alarm severities, along with the corresponding error ID numbers, can be found in Appendix D.

Diagnostic and Maintenance Tools

Viewing Internal Signals Through the Monitor Port

The RF-A! receiver provides an action command to route different types of internal diagnostic signals to the front panel monitor (BNC) port. This feature is useful for system debug, hardware debug, and station maintenance (see Chapter 6, "Maintenance"). The command has the following format:

```
a 195 <signal>
```

The various signal options are defined (see Table 5-8.) The port reverts to the default mode (Frame Start) after a station reset.

Table 5-8: Summary of Internal Diagnostic Signals

<signal>	Signal Name	Description
1-6	----	Reserved
7	Ground	0 VDC
8	Frame Start	TTL - falling edge at FLEX frame boundaries
9	Packet Start	TTL - falling edge at OTA slot boundaries
10	GPS 1PPS	TTL - rising edge at GPS 1PPS ticks
11-12		Reserved
13	2.1 MHz Monitor	TTL - 16.8 MHz internal reference ÷ 8
14	10 MHz Reference	Buffered rear panel 10 MHz input
15	Network TX	TTL - UART (SCC1) network transmission data out
16	Network RX	TTL - UART (SCC1) network transmission data in
17	GPS TX	TTL - (SCC2) GPS transmission data out
18	GPS RX	TTL - (SCC2) GPS transmission data in
19-20		Reserved

Configuring Visual Indicators, Light-Emitting Diodes (LEDs)

A number of visual LED indicators are provided on the RF-A! receiver front panel to provide information about the status of the receiver without requiring additional test equipment (see Figure 5-5). LED functions can be modified through FIPS so that multiple uses can be made of some indicators.

Figure 5-5: RF-A! Receiver Front Panel, Cover Open

Two groupings of four LEDs each are located on the front panel. The group on the left, labeled STATUS, give information about the general health of the hardware, and if any error/alarm conditions exist. The group on the right, labeled TRAFFIC, give information about system activity. The function and operation of each indicator, from left to right, are described below:

- **Control:** The LED displays green when the control module (ACM) is functioning properly. The LED flashes slowly when the RF-A! receiver remote software downloads. The LED turns off when the ACM causes an alarm or error condition.
- **Rx A:** The LED displays green when RF module A (top) is functioning properly. The LED turns off when the RFM causes an alarm or error condition.
- **Rx B:** The LED displays green when RF module B (bottom) is functioning properly. The LED turns off when the RFM causes an alarm or error condition.

- **Alarm:** The LED displays red when an alarm/error condition occurs. The severity of the alarm is indicated by the repetition rate that the LED flashes. A slow flashing LED indicates that a minor alarm has been triggered, a fast blinking LED indicates a major alarm, and a steady on condition signifies that a critical alarm has occurred. Presently, only the normal display mode is supported; the alarm condition is latched and stays on until it is explicitly cleared.
- **Time Ref:** The LED displays amber as a reference to indicate the timing of certain events. FIPS command r/w 301 configures the LED. To control the front panel TRAFFIC-Time Ref LED for the desired indication, at the FIPS prompt, type:

w 301 <time ref vi ind> <Return>

The possible values for the argument are:

- 0 = 1PPS
 - 1 = Frame Start
 - 2 = Reserved
- **OTA Rx:** The LED displays green to indicate that a protocol compliant, inbound OTA packet, has been received without error.
 - **OTA Error:** The LED displays red to indicate that a suspected protocol compliant, inbound OTA packet, has been received with uncorrectable errors. (See paragraph, "Monitoring Local Interference" for a detailed explanation).
 - **Network:** The LED displays amber to monitor data traffic into or out of the various ports of the RF-A! receiver (TX or RX line of the Network port, or GPS/Timing port). These lines typically idle in the ON state and blinking indicates activity.

To control the front panel TRAFFIC-Network LED for the desired indication, at the FIPS prompt, type:

w 300 <network vi ind> <Return>

The possible values for the argument are:

- 0 = Network TX
- 1 = Network RX
- 2 = GPS TX
- 3 = GPS RX
- 4 = Reserved
- 5 = Reserved

Viewing OTA Data

One debug tool that is provided by FIPS, especially during initial system installation, is the ability to view live OTA data, exactly as it is encapsulated in IPP, on the display monitor.

To enter this diagnostic mode, at the FIPS prompt, type:

```
w 953 1 <Return>
```

To exit this mode, at the FIPS prompt, type:

```
w 953 0 <Return>
```

A FIPS printout occurs from an RF-A! receiver set to 800 bps with RS and CRC screening on, and sparse inbound traffic present (see Figure 5-6 and Figure 5-7).

Note: This FIPS printout is a sample only. Your printout may vary.

```
FIPS: w 953 1
FIPS: RW 953 1
FIPS:

----- END OF FRAME #120 -----

----- END OF FRAME #121 -----

----- END OF FRAME #122 -----

chan_id = 0 bit length = 52 status_flags = 0xe041
slot_id = 1 rssi = -136 ber_estimate = +13
Data = [ 0xc00a ][ 0x3ade ][ 0x68ae ][ 0xca3 ][ 0x33eb ][ 0x1f8a ][ 0x7e00 ][ 0x62 ]
      [ 0x8300 ][ 0x6c ][ 0x1700 ][ 0x1b0c ]
chan_id = 0 bit length = 52 status_flags = 0xe041
slot_id = 9 rssi = -125 ber_estimate = +62
Data = [ 0xa35e ][ 0x8080 ][ 0x808e ][ 0x210a ][ 0x32eb ][ 0x1f87 ][ 0x3900 ][ 0x42 ]
      [ 0x3900 ][ 0x4b ][ 0xcd00 ][ 0xd06 ]

----- END OF FRAME #123 -----

----- END OF FRAME #124 -----

----- END OF FRAME #125 -----

----- END OF FRAME #126 -----

chan_id = 0 bit length = 52 status_flags = 0xe041
slot_id = 4 rssi = -114 ber_estimate = +62
Data = [ 0xc00a ][ 0x3ade ][ 0x68ae ][ 0xca3 ][ 0x33eb ][ 0x1f8a ][ 0x7e00 ][ 0x62 ]
      [ 0x8300 ][ 0x6c ][ 0x1700 ][ 0x1b0c ]

----- END OF FRAME #127 -----

----- END OF FRAME # 0 -----

chan_id = 0 bit length = 52 status_flags = 0xe041
slot_id = 8 rssi = -129 ber_estimate = +43
Data = [ 0xa35e ][ 0x8080 ][ 0x808e ][ 0x210a ][ 0x2aeb ][ 0x1f87 ][ 0x7200 ][ 0x56 ]
      [ 0xc00 ][ 0x5f ][ 0xa000 ][ 0x2105 ]

----- END OF FRAME # 1 -----

----- END OF FRAME # 2 -----
```

Figure 5-6: OTA Data Screen (1 of 2)

Figure 5-7: OTA Data Screen (2 of 2)

Note: Entering this mode does not effect the RF-A! receiver's ability to send valid OTA data to the RF-C! controller. However, if the amount of data displayed becomes too great, the internal buffer capacity of the RF-A! will be exceeded causing the RF-A! receiver to reset.

Sending Empty Frames to an RF-C! Controller

Another diagnostic tool that can be performed during initial system installation is to configure the RF-A! receiver to send empty frames to the RF-C! controller. This tool provides a method for testing network connectivity, both at the local site and through the telco system.

1. Configure the TRAFFIC - Network indicator to display 'Network TX'.

w 300 0 <Return>

The system responds:

RW 300 0

2. Configure the RF-A! receiver to send IPP packets to the RF-C! controller at all FLEX frame boundaries. At the FIPS prompt, type:

w 551 1 <Return>

The system responds:

RW 551 1

3. Verify that network activity is observed on the front panel LED, and that "empty" IPP packets are being received at the RF-C! controller.
4. Eliminate unnecessary network traffic and return the RF-A! receiver to its default state to avoid sending empty frames to the RF-C! controller. At the FIPS prompt, type:

w 551 0 <Return>

The system responds:

RW 551 0

Note: Using 'w 551 1' in conjunction with 'w 953 1' can be a helpful diagnostic aid during initial system setup.

Sending Canned Messages to an RF-C! Controller

Another valuable diagnostic tool that is provided by FIPS, especially during initial system installation, is the ability to send canned messages to the RF-C! controller. A number of simple, single packet (SP) type messages can be sent. This tool provides a valuable method to test the RF-C! controller prior to having Personal Communicator Devices (PCDs) functioning in the system.

Note: Ensure that the recipient RF-C! controller is expecting the canned message. The procedure should not be performed without first coordinating all test activity with the system administrator. Also note that all valid inbound OTA data that enters the receiver while the RF-A! receiver is in Canned Message Test mode will be lost.

For the RF-A! receiver to send canned messages, the RF-A! must be placed in the canned message mode, then a number of parameters must be configured. The parameters that are used, along with their parameter values, are defined below:

- msg choice (555): Six standard ReFLEX25™ message choices are allowed: WRU Response, Standard ACK, Standard NACK, and so on.
- pkt type (556): Presently, only one type is supported: SP (single packet).
- pcd addr (557): The address of the PCD embedded in the IPP packet.
- msg seq # (559): A 15-bit quantity defined in the ReFLEX25 protocol.
- frame # (561): This parameter controls the FLEX frame number that the canned message is sent.
- cycle # (562): This parameter controls the FLEX cycle number that the canned message is sent.
- protocol (564): Presently, only one type is supported: ReFLEX25.

The above parameters can not be set individually using FIPS write commands. They must be set as a group using a single action command: 'a 38 '. The command has the following format:

a 38 <msg choice>, <pkt type>, <pcd addr>, <msg seq #>, <frame #>, <cycle #>, <protocol>, <slot id>, <channel speed>

Note: The correct number of commas are required between parameters. Trailing commas are not required.

See Appendix A for a complete description of the range of legal values of each parameter. Re-entering all parameters each time an 'a 38' command executes is not necessary. To leave a parameter unchanged, do not enter a value in the parameter list.

To send a message immediately, enter 0 for frame and 0 for cycle number. Also, the 'a 38' command has two options that allow a user to quickly configure the RF-A! receiver to a specific set of parameters. For each msg choice, factory preset defaults are hardcoded in the RF-A! receiver firmware.

To configure the RF-A! receiver into the default setting for message choice 3 (WRU Response), at the FIPS prompt, type:

```
a 38 d 3 <Return>
```

To configure the RF-A! receiver to revert to its standard factory defaults, at the FIPS prompt, type:

```
a 38 r <Return>
```

Finally, to queue a canned message to actually be sent, at the FIPS prompt, type:

```
a 38 s <Return>
```

The following illustrates a step-by-step FIPS session of a canned message test procedure that, to an RF-C! controller, appears as if PCD address 3FFFFFFF sent a Standard ACK with message seq number 5C at 1600 bps in slot 16, frame 20, cycle 10:

1. Place the RF-A! receiver in Canned Message Test mode. At the FIPS prompt, type:

```
w 552 2 <Return>
```

The system responds:

```
RW 552 2
```

2. Verify that the RF-A! receiver was able to comply with the request. At the FIPS prompt, type:

```
r 553 <Return>
```

The system responds:

```
RR 553 2
```

3. Configure the RF-A! receiver for the desired message. At the FIPS prompt, type:
 - a **38 4,1,3ffffff,5c,20,10,0,16,1 <Return>**The system responds (see Figure 5-8):

Figure 5-8: RF-A! Receiver OTA Canned Msgs' Screen

4. Send the message. At the FIPS prompt, type:
 - a **38 s <Return>**The system responds (see Figure 5-9):

Figure 5-9: RF-A! Receiver OTA Canned Msgs' Accepted Screen

5. Return the RF-A! receiver to Normal IPP mode. At the FIPS prompt, type:

w 552 1 <Return>

The system responds:

RW 552 1

6. Verify that the RF-A! receiver was able to comply with the request. At the FIPS prompt, type:

r 553 <Return>

The system responds:

RR 553 1

The canned message procedure has been completed.

Monitoring Local Interference

As mentioned in the above section on LED indicators, monitoring OTA data errors on the RF-A! receiver front panel is possible. A flashing TRAFFIC - OTA Err LED indicates that an inbound OTA packet has been received with uncorrectable errors. If local interference is present or excessive signal distortion occurs, then packets may be indicated with OTA errors.

Currently the RSSI threshold is hard coded to -118 dBm. A future software release will support a user defined RSSI threshold, allowing the site manager to fine tune this feature to unique site requirements. Additional enhancements to this feature are also planned. For example, configuring an OTA Err event (or series of events) so that the event is captured in the station event log and reported as an alarm.

Performing Bit Error Rate (BER) Tests

The user can perform bit error rate (BER) testing on an RF-A! receiver if the user has access to the proper test equipment and interface cables. The required equipment, cabling, and test procedure are described in detail in Chapter 6, "Maintenance".

Maintenance

Troubleshooting

The troubleshooting index is a guide to help in isolating failures to a Field Replaceable Unit (FRU). The service technician performs troubleshooting whenever a failure occurs during normal operation that cannot be resolved by the RF-Conductor! controller or (RF-C!).

The index lists several possible failures and the corresponding corrective actions. If a failure is isolated to a FRU, replace the suspected FRU with a new one.

After replacing the suspected FRU, perform the RF-A! receiver power-up checkout procedure to verify that the failure clears. Ship the suspected FRUs to a Motorola repair depot for repair.

More detailed information is available in the RF-A! receiver service manual.

Troubleshooting Index

Table 6-1 and Table 6-2 provide information on indication, possible failure, and corrective action.

Table 6-1: Power Supply Troubleshooting Index

Indication	Possible Failure	Corrective Action
POWER LED not lit	AC input power not present	Check input power
	+14 Vdc or +5.1 Vdc output not present	Replace power supply module

Table 6-2: Control Module Troubleshooting Index

Indication	Possible Failure	Corrective Action
Control ON LED not lit	No input power	Verify power supply module POWER switch is in the ON position
	Control module did not complete power-up sequence	Press RESET push-button. If Control LED is still not lit, replace control module
Rx A not lit	No receiver module in top slot	Place Rx module in top slot
	Rx module has a failure	Replace Rx module
Rx B not lit	No receiver module in bottom slot	Place module in bottom slot
	Rx module has a failure	Replace Rx module
ALARM LED lit	Station alarm has been detected	Interrogate event log (see Chapter 5, Alarms Errors and Events)

Note: In some instances, when an RF Module is suspect, additional information may be obtained by swapping RF Modules A and B.

Removal and Replacement

The following procedures provide FRU removal and replacement instructions.

The RF-A! receiver contains static-sensitive modules. Take precautionary measures to prevent static discharge damage when servicing the RF-A! receiver.

Do not force RF-A! receiver modules into their slots. Connector damage may occur if the modules are not carefully inserted.

RF-A! Receiver Cabinet Doors

The front and rear doors of the RF-A! receiver cabinet must be removed for access to the RF-A! receiver chassis. Perform the following steps to remove and replace the RF-A! receiver cabinet's front or rear door.

Doors Removal

Perform the following steps to remove the cabinet:

1. Unlock the top of the RF-A! receiver cabinet door.
2. Swing the top of the door out.
3. Lift the door up.
4. Set the door to the side.

Doors Replacement

Perform the following steps to replace the doors:

1. Lift the door and insert the bottom of the door into the bottom of RF-A! receiver cabinet.
2. Swing the top of the door in and secure with the key lock.

RF-A! Receiver Unit

Perform the following steps to remove and replace the RF-A! receiver unit in the RF-A! receiver cabinet.

Receiver Unit Removal

Perform following steps to remove the RF-A! receiver unit:

1. Remove the front and rear cabinet doors (see page 7-4).
2. Swing down the RF-A! receiver chassis front panel (see Figure 6-1).
3. Turn off the following equipment:
 - Power supply module
 - Network Peripherals

Figure 6-1: RF-A! Receiver Front Panel, Cover Open

4. Tag and disconnect all cables from the RF-A! receiver backplane (see Figure 6-2). For more detail on the RF-A! receiver backplane connectors, see Appendix C.
5. Using a TORX™ driver handle and a #30 bit, remove the ground wire from the ground (GND) terminal on the backplane.
6. At the front of the RF-A! receiver, remove and retain the four TORX screws securing the RF-A! receiver unit to the RF-A! receiver cabinet using a TORX driver handle and a #T30 bit.

7. Slide the RF-A! receiver unit forward, and remove from the cabinet.

Figure 6-2: Backplane (Rear View)

Receiver Unit Replacement

Perform following steps to replace the RF-A! receiver unit:

1. Slide the new RF-A! receiver unit into the front of the RF-A! receiver cabinet. Align the mounting holes on the cabinet frame with the mounting holes on the RF-A! receiver unit.
2. Using a TORX driver handle and a #30 bit, secure the RF-A! receiver unit to the RF-A! receiver cabinet with four TORX screws.
3. Connect the cables to the backplane according to tags attached to the cables during removal.
4. Turn on the following equipment:
 - Network Peripherals
 - Power supply module
5. Lift the RF-A! receiver unit front panel and secure in place.
6. Replace the front and rear cabinet doors (see paragraph, "RF-A! Receiver Cabinet Doors").

Power Supply Module

Perform the following steps to remove and replace the power supply module.

Power Supply Module Removal

Perform the following steps to remove the power supply module:

1. Remove the front cabinet door (see section on paragraph, "RF-A! Receiver Cabinet Doors").
2. Swing down the RF-A! receiver chassis front panel.
3. Turn off the power supply module.
4. Using a TORX driver handle and a # 15 bit, remove the two TORX screws securing the power supply module to the RF-A! receiver chassis.
5. Pull the power supply module straight out to remove from the chassis.

Power Supply Module Replacement

Perform the following steps to replace the power supply module:

1. Place the new power supply module into the power supply module slot in the RF-A! receiver chassis.
2. Push the power supply module in until its connector mates with the backplane connector.
3. Using a TORX driver handle and a #15 bit, secure the power supply module to the RF-A! receiver chassis with the two TORX screws.
4. Turn on the power supply module and verify that the POWER LED is lit.
5. Swing up the RF-A! receiver chassis front panel and secure in place.
6. Replace the RF-A! receiver cabinet front door (see section on paragraph, "RF-A! Receiver Cabinet Doors").

Receiver Modules

Perform the following steps to remove and replace the top or bottom receiver module.

Receiver Modules Removal

Perform the following steps to remove the receiver modules:

1. Remove the front cabinet door (see paragraph, "RF-A! Receiver Cabinet Doors").
2. Swing down the RF-A! receiver chassis front panel.
3. Turn off the power supply module.
4. Using a TORX driver handle and a #T15 bit, remove the two TORX screws securing the receiver module to the RF-A! receiver chassis.
5. Disconnect the mini-UHF connector from the receiver module front panel connector.
6. Pull the receiver module straight out to remove from the RF-A! receiver chassis.

Receiver Modules Replacement

Perform the following steps to replace the receiver modules:

1. Place the new receiver module into the receiver module slot in the RF-A! receiver chassis.
2. Route the RF cable in the receiver module side channel.
3. Push the receiver module in until its connector mates with the backplane connector.
4. Connect the mini-UHF connector to the receiver module front panel connector.
5. Using a TORX driver handle and a #15 bit, secure the receiver module to the RF-A! receiver chassis with the two TORX screws.
6. Turn on the power supply module.
7. Swing the RF-A! receiver chassis front panel up, and secure in place.
8. Replace the front cabinet door (see paragraph, "RF-A! Receiver Cabinet Doors").

Control Module

Perform the following steps to remove and replace the control module.

Control Module Removal

Perform the following steps to remove the control module:

1. Remove the front cabinet door (see paragraph, "RF-A! Receiver Cabinet Doors").
2. Swing down the RF-A! receiver chassis front panel.
3. Turn off the power supply module.
4. Using a TORX driver handle and a #15 bit, remove the two TORX screws securing the control module to the RF-A! receiver chassis.
5. Pull the control module straight out.

Control Module Replacement

Perform the following steps to replace the control module:

1. Place the new control module into the control module slot in the RF-A! receiver chassis.
2. Push the control module in until its connector mates with the backplane connector.
3. Using a TORX driver handle and a #15 bit., secure the control module to the RF-A! receiver chassis with two TORX screws.
4. Turn on the power supply module.
5. Swing up the RF-A! receiver chassis front panel, and secure in place.
6. Replace the front cabinet door (see paragraph, "RF-A! Receiver Cabinet Doors").

Power Outlet Strip

Perform the following steps to remove and replace the power outlet strip.

Power Outlet Strip Removal

Perform the following steps to remove the power outlet strip from the RF-A! receiver cabinet:

1. Remove the rear cabinet door (see paragraph, "RF-A! Receiver Cabinet Doors").
2. Swing down the RF-A! receiver chassis front panel.
3. Turn off the following equipment:
 - Power supply module
 - Network peripherals
4. Tag and unplug all power cables from the power outlet strip.
5. Using a TORX driver handle and a #30 bit, remove the four TORX screws securing the outlet strip to the RF-A! receiver cabinet.
6. Remove the outlet strip.

Power Outlet Strip Replacement

Perform the following steps to replace the power outlet strip:

1. Place the new outlet strip in the RF-A! receiver cabinet, and align the screw holes.
2. Using a TORX driver handle and a #30 bit, secure the outlet strip to the cabinet with the four TORX screws.
3. Plug the power supply module and network peripherals power cables into the outlet strip.
4. Turn on the following equipment:
 - Network peripherals
 - Power supply module
5. Swing the RF-A! receiver chassis front panel up and secure in place.
6. Replace the rear cabinet door (see paragraph, "RF-A! Receiver Cabinet Doors").

Periodic Maintenance

This section contains maintenance procedures that are done on a periodic basis according to the site supervisor's directions. Perform the maintenance tasks according to the following procedures.

Manual Alignment of Internal HSO

The internal high stability oscillator (HSO) in the RF-A! receiver is calibrated at the factory to be accurate to within 0.2 ppm at room temperature. Unless otherwise compensated, the natural tendency of a quartz crystal oscillator will cause the output frequency to have short-term variations (temperature) and long-term drift (aging). The most common method to avoid this problem is to provide an external reference with the desired degree of accuracy, in this case 0.2 ppm.

In installations where an RF-A! receiver is co-located with an RF-Baton! (RF-B!) transmitter controller, the RF-B! transmitter controller provides an extremely stable 10 MHz reference that can be directly fed into the RF-A! receiver backplane. In stand-alone situations, the software (R2.8.0 and later) will keep the HSO automatically tuned (auto-tuning). Auto-tuning requires that the 10 MHz external reference not be connected and the GPS providing a good 1PPS signal.

A trace of the automatic tuning is available through the FIPS: r/w 955. RFA FIPS: w 955 1 turns the trace on, 0 turns the trace off. The trace reports once every minute. The trace reports new_average_phase, warp_action, and write_warp. If the new_average_phase is significantly large, then a non-zero warp_action will result. The warp_action is added to the current warp, written to pendulum, and reported as write_warp. Sometimes the write_warp will be skipped in order to allow the phase report to stabilize. If the trace is active and the 5/10 MHz external reference is attached, the new_average_phase and warp_action will be zero.

At over-the-air (OTA) data rates of 800 and 1600 bps, no performance degradation will occur for HSO errors up to 2 ppm. To guarantee that the HSO function stays within this range, periodic calibration of the oscillator (warping) may be required, for software versions R2.7.0 and earlier. To perform this adjustment, a frequency counter with accuracy better than 0.25 ppm is required. Also, the calibration should be performed at room temperature after the receiver has been on for at least 1 hour (thermal equilibrium).

In order to train the pendulum manually using the FIPS: a 155 command, the GPS ribbon connector must be detached from the back of the RF-A!. This is because the auto-tuning algorithm will interfere with the manual tuning process (R2.8.0 and later).

The 10 MHz external reference must also be disconnected. Manual frequency adjustments will not be possible with the 10 MHz external reference connected because the HSO will lock to the reference.

Perform the following steps to align the HSO:

1. Connect the frequency counter to the front panel signal monitor port (BNC) and set the diagnostic signal to be the internal 2.1 MHz reference.

At the FIPS prompt, type:

```
a 195 13 <Return>
```

2. Disconnect the GPS ribbon connector from the back of the RF-A!.

3. Read the current setting of the HSO steering value.

At the FIPS prompt, type:

```
r 185 <Return>
```

The system responds:

```
RR 185 151
```

4. The steering value needs to be lowered if the frequency measured at the front panel is less than 2.1 MHz. If the frequency is higher than 2.1 MHz, increase the value. Each increment in the steering value causes the frequency to change by approximately 0.3 Hz.
5. Raise or lower the steering value using the 'a 155' command, as appropriate, until the frequency counter reads within 0.3 Hz of 2.100000 MHz. For example, if the result of a 'r 185' is 151, and the frequency counter reads 2.0999989 (1.1 Hz low). The frequency should be set as close to, but not above, 2.1 MHz.

At the FIPS prompt, type:

```
a 155 147 <Return>
```

6. Reconnect the GPS ribbon connector to the back of the RF-A!.

Further fine tuning may be necessary.

Note: In no case should the HSO steering value be set to a value higher than 215.

Calibrating Received Signal Strength (RSSI)

One of the parameters reported to the RF-C! controller in IPP is an estimate of the received signal strength (RSSI) in dBm. Currently, the value that is reported is dependent on the signal gains and losses present in the RF-A! receiver and at the site. A calibration factor has been hardcoded into the RF-A! receiver to give relatively accurate results when the following parameters are true:

- The RF-A! receiver is in diversity mode.
- An Rx Distribution option (multicoupler) is present.
- The multicoupler power gain is typical (12 dB), receiver analog signal gain is typical.
- The RF-A! receiver/Rx Distribution connection cable has zero loss.

Providing the above assumptions, RSSI is likely to be accurate to +/- 3dB in systems with the Rx Distribution option present. In systems without this option, the RSSI will indicate between 10-16 dB.

Presently, compensating for this error is not possible. However, in a future software release, the user will be able to enter a calibration factor through FIPS, allowing for an accuracy of +/- 1 dB to be achieved.

Bit Error Rate (BER) Testing

The bit-error-rate (BER) test mode of operation is an off-line mode that may be utilized to verify receiver sensitivity that is typically the RF level for 1% BER. In this mode the RF-A! receiver receives a continuous OTA data stream consisting of a known, repeating packet. The RF-A! receiver decodes each packet without performing error correction, compares the results of each packet to the known (expected) data pattern and reports the number of errors through the FIPS interface. It should be noted that the RF-A! receiver does not support sensitivity verification by the use of SINAD monitoring that is often utilized in testing analog receivers with audio outputs.

Recommended Test Equipment

The following test equipment is required to perform BER testing of the RF-A! receiver.

- RF Signal Generator - Hewlett Packard HP8657A
- Arbitrary Waveform Generator - Tektronix AWG2021
- Personal Computer (PC) with RS-232 serial port for FIPS, with terminal emulation software program interface cable (see Figure 6-3).
- 2-way RF Splitter - Mini-Circuits ZAPD-21 or Distribution
- (optional) an RF Power Meter, a Spectrum Analyzer, and a Frequency Counter may be useful for calibration of RF level, FM deviation, and RF frequency
- Test waveform files for the Arbitrary Waveform Generator

Test Equipment Setup

Connect the test equipment to the RF-A! receiver being tested. The test equipment setup is shown in Figure 6-3. The use of the RF-Distribution peripheral is optional. The GPS connection may be external to the setup if a different configuration is desired.

If the RF-A! is being operated in a station containing a co-located transmitter, ensure that all AC power to the transmitter is turned off before connecting to any antenna inputs.

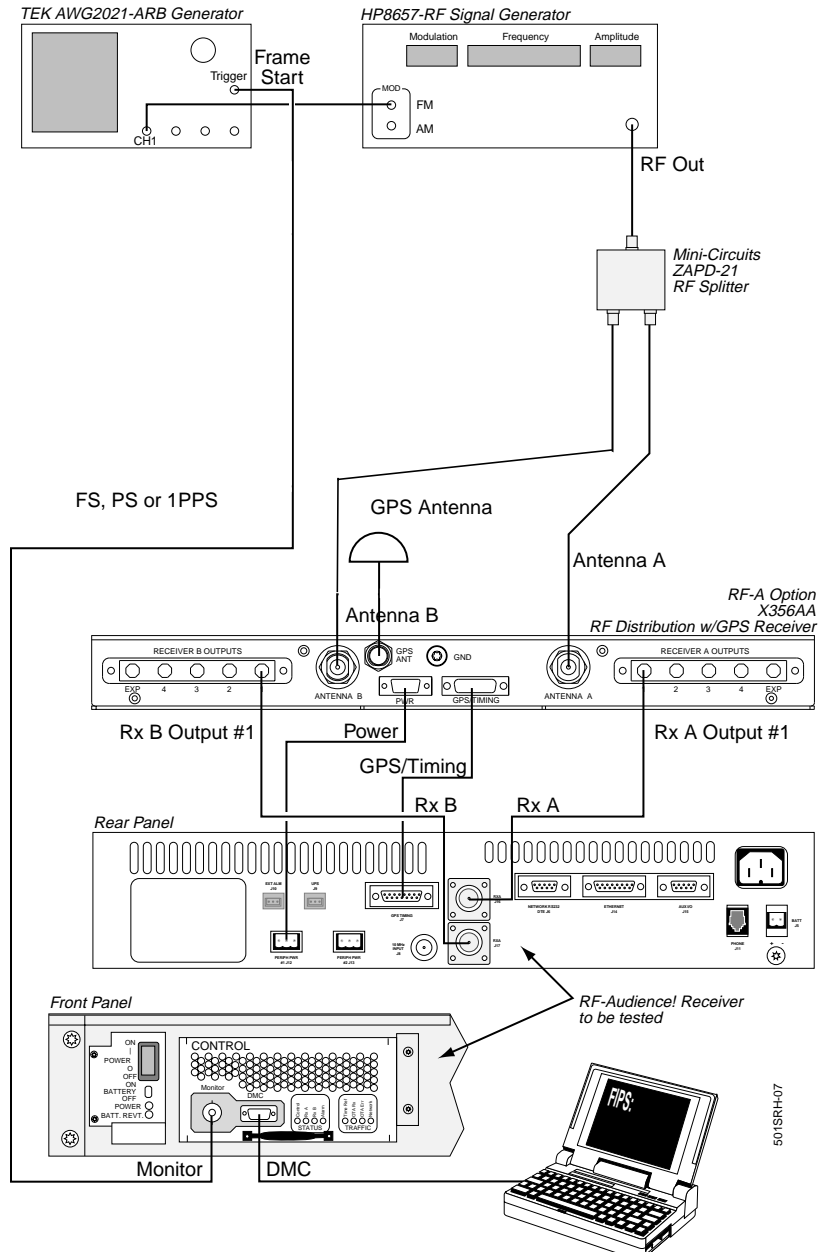


Figure 6-3: RF-A! Receiver Test Equipment Setup

Obtaining Test Waveform Files

The BER test procedure described in this manual recommends using the Tektronix AWG2021 Arbitrary Waveform Generator (ARB) for simulating OTA traffic. This device is used to generate the digital bit pattern that is applied to the FM modulation input port of an RF signal generator. Other types of ARB generators are available for this purpose but the AWG2021 is recommended due to its ease of use and ability to read/write files from PC compatible diskettes. Users are cautioned that if other means are employed to generate the bit pattern signals, care must be taken to ensure timing accuracy of the symbols.

The Tektronix AWG2021 can be programmed by obtaining and loading the appropriate files from its built-in diskette drive. The following files are used:

- filename EQA - waveforms defined by algebraic equations in time
- filename WFM - contains the actual waveform data, point-by-point
- filename SEQ - defines a sequence of WFM files to be executed

The files are not in simple ASCII text format and cannot be easily edited unless first loaded into the AWG2021. In addition, several useful utilities for file construction and conversion are available from Tektronix.

Motorola has several pre-tested, AWG2021 compatible, test waveform files available to aid the user in BER testing. Contact Motorola One-Call Support Center to access these files and for directions on how to download them from the BBS or Internet. Please read the RFA_TEST.TXT file for an explanation of the files and how to use them.

RF-A! Receiver Setup

It does not matter what bits are being sent because no error correction is performed during BER mode. However, if a pattern is used that has all of the correct error detection and correction bits, when a packet is received without errors, the front panel OTA RF LED will flash once to provide a visual indication of the packet throughput.

In this procedure, assume the test packet being used is in the Where-Are-You_Response (WRUR) with all the proper bits, hex A35E8080808E210A6CEC4615ED.

Perform the following steps to setup the RF-A! receiver for BER test mode:

Note: The network may be disconnected while performing these tests.

1. Turn on the RF-A! and wait for the ready prompt. After the ready prompt is displayed, establish a FIPS session. Verify that the GPS receiver is tracking at least 3 satellites by using the FIPS 'a 208' command. Clear the error and alarm logs.
2. Determine the proper test frequency if the station is to be tested on a customer frequency. If no customer-specific frequency is mandated then use a default test frequency of 901.5 MHz. For purposes of the standard test this procedure uses 901.5 MHz (for example the center of the NPCS band; otherwise substitute the customer frequency wherever you see 901.5 in this procedure).

3. Set the RF signal generator to 901.5000 MHz at -80 dBm. Set the RF-A! accordingly:

At the FIPS prompt, type the following FIPS command to set the top RF module receive frequency (receiver module A):

w 685 901.5 <Return>

At the FIPS prompt, type the following command to set the bottom RF module receive frequency (receiver module B):

w 681 901.5 <Return>

4. Enter the following command to select the Frame Start signal to be output on the RF-A! receiver front panel BNC:

At the FIPS prompt, type:

a 195 8 <Return>

Connect this signal to the trigger input on the arbitrary waveform generator.

5. Determine which 800 bps data pattern to use and select the corresponding waveform sequence file on the arbitrary waveform generator. Ensure that the signal output is turned on (this is accomplished manually on the Tek2021).
6. Verify that the ARB generator is being triggered at the 1.875 sec rate by observing the 'waiting for trigger' message on the screen. Ensure that the FM modulation has been turned on and properly calibrated on the RF generator.

7. The green LED labelled “OTA RX” should begin flashing at the packet rate indicating that error free packets are being received. If the red ‘OTA ERR’ LED is flashing, it is an indication that RF energy is being received but uncorrectable errors are occurring. This usually means that the wrong OTA speed is selected, the RF frequency is more than 1KHz off, or the bit pattern is incorrect.
8. Disconnect or turn off the output of the arbitrary waveform generator.
The red LED labelled ‘OTA ERR’ should begin flashing indicating that the RF-A! receiver is sensing RF power but no packets are being received without errors.
9. Tun the signal on.
The ‘OTA RX’ LED will start to flash again, indicating proper operation.

Enter BER Test Mode

1. At the FIPS prompt, type:

w 553 <Return>

A system response value of 1 indicated that the RF-A! is in normal operating mode.

2. Enter the following command to request the RF-A! receiver to switch to the 800 bps BER test mode (mode 3):

At the FIPS prompt, type:

w 552 <Return>

3. Wait approximately 10 seconds and enter the following to verify that the request is granted and the test mode is active:

At the FIPS prompt, type:

r 533 <Return>

If the returned value is not the same as requested, wait long and type **r 533 <Return>**, again, until the mode switches over. This task can take up to a minute, especially if the network is connected.

4. Read the current BER test pattern the RF-A! receiver uses to determine errors as follows

At the FIPS prompt, type:

a 34 r <Return>

Enter the following command to enter the WRUR test pattern that the ARB generator is producing:

At the FIPS prompt, type:

a 34 w A35E8080808E210A6CEC4615ED <Return>

Note: Lower case or uppercase characters can be used. In addition, a separate BER test pattern must be entered for each of the BER test modes (one pattern for 800 bps, mode 3, and one pattern for 1600 bps, mode 4).

Enter the following command to perform a BER test:

At the FIPS prompt, type:

a 35 F S N <Return>

(Where F = the number of frames to test, S = the starting slot number, and N = the number of slots.

Typically, a full frame is used (all slots are filled with packets). The command at 800 bps might appear as **a 35 5 0 11 <Return>**, since there are 11 slots per frame.

5. Enter the following command to ensure that the test mode is 800 bps:

At the FIPS prompt, type:

w 552 3 <Return>

6. Enter the following command to verify the test mode:

At the FIPS prompt, type:

r 553 <Return>

High Level BER Test

1. Enter the following command to measure the number of errors over 5 frames:

At the FIPS prompt, type:

a 35 5 0 11 <Return>

2. The response should verify that 0 errors were received.
 - If the number of errors is approximately half the number of received bits, it is likely that no RF signal is being received.
 - If a message is received stating that the DSP cannot be configured, the response means that the BER test mode has not yet been established.
 - Note that the green 'OTA RX' LED will flash even if the BER test pattern is being generated by the ARB does not match the pattern entered using the FIPS 'a 34' command. The LED is triggered by the DSP whenever the error-check bits in the received data indicate that no errors occurred, irrespective of the actual data.

Sensitivity Goals using BER Test Mode

Table 6-3 can be used to determine the appropriate RF signal level to be used for 1% BER verification.

Note that the addition of the RF Distribution shelf will typically improve the sensitivity of the RF-A! receiver by 2 dB, while the addition of the RF Filter shelf will generally degrade sensitivity by 3 dB.

Note that the values listed in Table 6-3 assume no additional filtering or input cable losses are present.

Table 6-3: RF Levels (dBm) for 1 Percent BER Static

	RF-A! Receiver	RF-A! Receiver With RF-Distribution Shelf X356AA, X89AA and X88AB	RF-A! Receiver With RF-Filter X356AA, X88AA, X88AB, and X89AA
At 800 bps			
Non-Diversity Mode	-126	-128	-123
Diversity Mode	-129	-131	-126
At 1600 dBs			
Non-Diversity Mode	-123	-125	-120
Diversity Mode	-126	-128	-123

Channel A Sensitivity at 800 bps Non-Diversity

Verify the RF sensitivity for channel A (upper receiver module) using the following steps:

1. Set the RF level according to the specific RF-A! receiver configuration using the values in Table 6-3 (as listed for non-diversity mode).
2. Enter the following command to verify that receiver A is on the correct test frequency of 901.5 MHz:

At the FIPS prompt, type:

```
r 685 <Return>
```

3. Enter the following command to set receiver B off-channel so that it does not receive the signal:

At the FIPS prompt, type:

```
w 681 900 <Return>
```

4. Enter the following command to set the BER test time to approximately 10 seconds. Test 5 frames x 11 packets/frame x 104 bits/packet = 5720 bits:

At the FIPS prompt, type:

a 35 5 0 1 <Return>

The system responds with a message stating how many bits were tested and how many were in error. The test for receiver A passes if less than 57 bits were in error (this is equivalent to 1 percent BER rate, that is $57/5720 = 1\%$).

Channel B Sensitivity at 800 bps Non-Diversity

Verify the RF sensitivity for channel B (lower receiver module) using the following steps:

1. Enter the following command to set receiver B on the correct test frequency:

At the FIPS prompt, type:

w 681 901.5 <Return>

2. Enter the following command to set receiver A off-channel so that it does not receive the signal:

At the FIPS prompt, type:

w 685 900 <Return>

3. At the FIPS prompt, type:

a 35 5 0 11 <Return>

The system responds with a message stating how many bits were tested and how many were in error. The test for receiver A passes if less than 57 bits were in error (this is equivalent to 1 percent BER rate, that is $57/5720 = 1\%$).

Overall Sensitivity at 800 bps with Diversity

Verify the RF sensitivity with diversity using the following steps:

1. Set the RF level according to the specific RF-A! receiver configuration (as listed for diversity mode) using the values in Table 6-3.
2. Enter the following command to set receiver A to the correct test frequency (now both A and B are on the correct frequency):

At the FIPS prompt, type:

```
w 685 901.5 <Return>
```

3. At the FIPS prompt, type:

```
a 35 5 0 11 <Return>
```

The test passes if less than 57 bits were in error.

Measuring Sensitivity at 1600 bps

The procedure for measuring sensitivity at 1600 bps is essentially the same as for 800 bps.

1. Enter the following command to change the RF-A! receiver operating mode to the 1600 bps BER test mode:

At the FIPS prompt, type:

```
w 552 4 <Return>
```

Verify by entering the following command:

At the FIPS prompt, type:

```
r 553 <Return>
```

2. Enter the following command to verify or enter the correct BER test pattern. The pattern used at 1600 bps is stored separately from the pattern used for 800 bps, so they both must be entered:
 - a. Type **a 34 <Return>** to check the current pattern, and
 - b. Type **a 34 a35e80808e210a6cec4615ed <Return>**

Note: This is the same pattern used for 800 bps BER, however, you may use a different pattern.

3. Select the corresponding waveform on the arbitrary generator. Verify the output is in and set the RF level to -80dBm. If the system is working properly, the front panel 'OTA RX' LED will be flashing at a much higher rate than observed for the 800 bps BER testing.
4. Set the RF level according to the specific RF-A! receiver configuration and current mode using the values in Table 6-3.
5. Perform the BER test in the same manner as the 800 bps BER test, except that now the number of packets per frame is different.

At the FIPS prompt, type:

```
a 35 5 0 23<Return>
```

This sets the BER test time to approximately 10 seconds, and should test 5 frames x 23 packets/frame x 104 bits/packet = 11960 bits.

The system responds with a message stating how many bits were tested and how many were in error. The test for receiver A passes if less than 57 bits were in error (this is equivalent to 1 percent BER rate, that is 119/11960).

Upgrading Software

At some point, the RF-A! receiver application software stored within the internal flash EPROM will need to be upgraded. To anticipate this the RF-A! has two banks of memory to store its software, an active bank and a dormant bank. The dormant bank can be used to hold new software until while code in the active bank is running.

Typically, the upgrading will be performed remotely from a TFTP server containing an image file that will be downloaded into the dormant flash bank. After confirmation that the download was successful, a cutover to the new image will be performed and the upgrade process will be complete.

Configuring for Remote Software Download

A number of parameters must be configured properly to prepare for a remote software download. This configuration process is usually performed remotely by an SNMP manager. However, the configuration can also be done locally through FIPS. Table 6-2 defines the parameters that are used, along with their read/write parameter values.

From a remote location, the parameters in Table 6-2 are configured using the SNMP Set command. The above parameters can also be set as a group using the 'a 197' action command.

The command has the following format:

```
a 197 <tftp server IP>, <tftp app vi ind>, <1st file>, <2nd file>, <3rd file>, <4th file>, <xfer  
file format>, <time to start xfer>, <udp pkt recd update freq>, <s-rec write update freq>,  
<algorithm>
```

See Appendix A, for a complete description of the range of legal values for each parameter.

Re-entering all parameters each time an 'a 197' command executes is not necessary. To leave a parameter unchanged, do not enter a value in the parameter list. For example, to enter the name of a download source file formatted using Motorola S-records, at the FIPS prompt, type:

```
a 197 „new_filename_goes_here <Return>
```

Note: Leave the 'time to start xfer' parameter null until ready to initiate the download. Entering 0 or 0:0:0 will cause an immediate triggering of the download process to occur (see paragraph, "The Download Process: Step-By-Step").

Table 6-4: Remote Software Download Configuration

Parameter	Definition
tftp server IP addr (403)	This parameter is the IP address of the remote TFTP server. In this context, the parameter is the IP address of the server that stores the software image source file to be downloaded. However, the same TFTP server will manage synchronous sets and multiple gets when these operations are supported by the RF-A! receiver software.
tftp app vi ind (402)	When a TFTP session is active, this parameter selects the concurrent TFTP activity that controls the front panel STATUS-Control LED. Presently, only the software download mode is supported. However, future enhancements are planned to add support for synchronous sets and multiple gets.
1st file (427)	This parameter is the filename of the source file transferred by the TFTP server during a remote software download.
2nd file (428)	This parameter is presently not supported. Future software upgrades may allow for breaking an entire software image into multiple files.
3rd file (429)	This parameter is not supported (see above).
4th file (430)	This parameter is not supported (see above).
xfer file format (431)	This parameter controls the format of the software download source file. Presently, only the Motorola S-Record format is supported.
time to start xfer (434)	This parameter controls when a software download should begin and is entered in 24-hour format (hh:mm:ss). Setting this parameter to 0 configures the host for an immediate software download.
udp rx update freq (433)	As the RF-A! receiver downloads UDP packets from the network, an internal counter keeps track of the number of packets received. This parameter controls how often the counter, 'udp rx' (parameter 432), is updated.
s-rec write update freq (411)	When a software download completes, an install procedure within the RF-A! receiver begins to write S-records into the dormant flash EPROM bank. An internal counter keeps track of the number of S-records written. This parameter controls how often the counter, 's-rec written' (parameter 410), is updated.
sdl algorithm (412)	This parameter determines the algorithm used during a software download. Presently, only one method, Native Host Mode, is supported.

In addition to the above configuration parameters, the following parameters must be configured before starting the software download process:

- Software download (sdl) ending state (425):
This parameter signifies the ending state of a software download. When this parameter changes, a trap is sent to the SNMP manager(s).
- sdl status (426):
This parameter provides real-time updates on the status of a software download and can be polled while a download is in progress. When this parameter changes, a trap is sent to the SNMP manager(s).
- sdl abort cntrl (436):
This parameter has two states. The default state is 'Manager Confirm,' or do not abort, whereas, 'Manager Abort' instructs the RF-A! receiver to abort a software download currently in progress. This parameter is checked internally each time 's-rec written' (parameter 410) or 'udp rx' (parameter 432) is updated.

The above parameters are set individually, locally using FIPS, or remotely using an SNMP manager.

The Download Process: Step-By-Step

The following procedure illustrates a step-by-step FIPS session of a software download procedure. An SNMP managed process would proceed in a similar fashion through the use of Set and Get commands.

1. Set all parameters EXCEPT the trigger time.

At the FIPS prompt, type:

```
a 197 180.20.64.206,0,newfile,,,,,10,50,1 <Return>
```

2. Set 'sdl ending state' parameter to Undefined.

At the FIPS prompt, type:

```
w 425 1 <Return>
```

3. Set 'sdl status' parameter to System Not Active.

At the FIPS prompt, type:

```
w 426 1 <Return>
```

4. Set 'sdl abort cntrl' parameter to Manager Confirm.

At the FIPS prompt, type:

w 436 2 <Return>

5. Set the download trigger time to immediate.

At the FIPS prompt, type:

w 434 0 <Return>

The system responds:

RW 434 0.000000

6. When the download commences, the STATUS - Control LED on the RF-A! receiver front panel begins to flash, indicating that a software download is in progress. The time to complete a download is proportional to network bandwidth. Typically, the process takes 20-30 minutes. To monitor progress, periodically read the 'udp rx' parameter.

At the FIPS prompt, type:

r 432 <Return>

The system responds:

RR 432 nnn (*the number of UDP packets received*)

Continue monitoring this parameter until 'udp rx' reaches its final value (approximately equal to the size of the file, in bytes, divided by 512).

7. When the download finishes, the S-record file is installed into the dormant flash EPROM bank. To monitor this progress, periodically read the 's-rec write' parameter.

At the FIPS prompt, type:

r 410 <Return>

The system responds:

RR 410 nnn (*the number of S-records written in flash*)

Continue monitoring this parameter until 's-rec write' reaches its final value (equal to the number of lines in the file, minus 3).

8. In addition to monitoring the 'udp rx' and 's-rec write' parameters, status can be monitored using the 'sdl status' parameter.

At the FIPS prompt, type:

r 426 <Return>

The system responds:

RR 426 2 (*2 = download in progress*)

9. When the install completes, the STATUS - Control LED stops flashing and 'sdl status' returns showing Download Success.

At the FIPS prompt, type:

r 426 <Return>

The system responds:

RR 426 64 (*64 = download and install successful*)

Note: Currently, the software download will only work reliably with a serial network baud rate of 19,200 bps. Ensure that the router and RF-A! receiver (using 'a 196') are configured properly.

This process completes the software download procedure. To use the new software image just downloaded in the dormant bank of the flash EPROM, follow the procedures outlined in the following section.

Cutover to a New Software Image

After completing a successful software download, the new image can be invoked by executing a cutover command. Initiate a cutover using FIPS or through SNMP. A cutover can be scheduled to occur either immediately or anytime within the next 24 hours.

Note: A delayed cutover time will stay in effect as long as the RF-A! is not rebooted/reset before the cutover occurs.

1. Take note of the current active flash bank using the 'r 901' command and the active application software version.

At the FIPS prompt, type:

```
r 901 <Return>
```

The system responds:

```
RR 901 2 or RR 901 1
```

2. At the FIPS prompt, type:

```
r 148 <Return>
```

The system responds:

```
RR 148 Rx.y.z
```

Note: x, y, and z will be numbers corresponding to the active software version.

3. Set the cutover trigger time to zero to trigger immediate cutover.

At the FIPS prompt, type:

```
w 435 0 <Return>
```

The system responds:

```
RW 435 0.000000
```

The RF-A! receiver will respond to immediate cutover within 30 seconds. The RF-A! will first verify that a successful download did occur (the SNMP manager can confirm a successful download), and then reset the station so the new application software will be active.

4. Verify that the active flash bank and active application software version have both changed.

At the FIPS prompt, type:

r 901 <Return>

The system responds:

RR 901 1 or RR 901 2 (*opposite of step 1 above*)

5. At the FIPS prompt, type:

r 148 <Return>

The system responds:

RR 148 Rn.n.n (*the new software version*)

FIPS Commands

RF-A! Receiver Commands

Table A-1 contains RF-A! receiver action commands and Table A-1 read/write commands.

Table A-1: RF-A! Receiver Action Commands (Sheet 1 of 7)

Command/Usage	Description
BER PATTERN	
a 34 r	This command reads or sets the OTA data pattern used during a Bit Error Rate (BER) test.
a 34 w <hex pattern>	Legal Values: any 26-character hex value
a 34 ? - - to view command usage	
<hr/> This action command initiates a BER test, comparing the OTA data with that stored in the RF-A! receiver using the 'a 34' command. The results of the test are printed at the FIPS monitor port.	
INITIATE BER TEST	
Legal Values:	
a 35 <# of frames> <start slot> <# of slots>	# of frames: 1-9999
a 35 ? - - to view command usage	start slot: 0-10 @ 800 bps 0-22 @ 1600 bps
	# of slots: 1 to (11 - start slot) @ 800 bps 1 to (23 - start slot) @ 1600 bps

Table A-1: RF-A! Receiver Action Commands (Sheet 2 of 7)

Command/Usage	Description
	This command initiates an IPP message to be sent from the RF-A! receiver to the RF-C! controller. Actual OTA data is ignored while this command is in process
	Legal Values:
	1 = Zone Registration 2 = Subzone Registration 3 = WRU Response 4 = Standard ACK 5 = Msg Read ACK 6 = Standard NACK
SEND CANNED IPP MESSAGE	msg choice:
a 38 <msg choice>, <pkt type>, <pcd addr>, <msg seq #>, <frame #>, <cycle #>, <protocol>, <slot id>, <channel speed>	pkt type: 1 = SP (single packet)
a 38 r - - to revert to default setting	pcd addr: 1000000 - 3FFFFFFF
a 38 d <msg choice> - - set default for this msg choice	msg seq #: 8-7F frame #: 0-127
a 38 s - - sends the canned message	cycle #: 0-14
a 38 ? - - to view current settings or command usage	protocol: 0 = ReFLEX 25 0-10 @ 800 bps 0-22 @ 1600 bps 0-75 @ 6400 bps (not supported) 0-115 @ 9600 bps (not supported)
	channel speed: 0 = 800 bps 1 = 1600 bps 2 = 6400 bps (not supported) 3 = 9600 bps (not supported)
READ ALARMS	This action command reads the entries in the error log that have been configured as alarms. The command only displays those alarms that have occurred since the last 'a102' or 'a 103' command or since the last station reset.
a 99	
CLEAR ALARM	This action command is used to clear a single alarm. Doing so does not remove the entry that triggered the alarm from the event log.
a 102 <error ID>	
CLEAR ALL ALARMS	This action command is used to clear all alarm indications (LED). Clearing alarms does not remove the entry or entries that triggered the alarm from the event log(s).
a 103	

Table A-1: RF-A! Receiver Action Commands (Sheet 3 of 7)

Command/Usage	Description
READ STATION EVENT LOG a 104	This action command prints the station (hardware) event log to the FIPS monitor.
READ SOFTWARE EVENT LOG a 110	This action command prints the software error log to the FIPS monitor.
CLEAR STATION EVENT LOG a 111	This action command clears the contents of the station event log.
CLEAR SOFTWARE EVENT LOG a 113	This action command clears the contents of the software event log.
BEGIN FIPS SOFTWARE DOWNLOAD a 114	This action command prepares the RF-A! receiver for a local software download from the FIPS port. This type of software download will load a new application software image into flash EPROM bank 2.
STATION RESET a 117 <option> a 117 ? - - to view command usage	<p>This action command initiates a station reset and reboot. All self-test routines normally performed at start up are bypassed.</p> <p>reboot options:</p> <ul style="list-style-type: none"> n = Normal soft reset c = Clear all logs d = Software emulated dipswitch 2 after reboot o = Override parameters with ROM settings after reboot
ALIGN HSO a 155 <arg>	<p>This action command sets the high stability oscillator (HSO) steering value to provide frequency warp capability.</p> <p>Legal Values: 0-215</p> <p>Default: 151</p> <p>Note: Setting the HSO steering value outside of this range will cause loss of reference accuracy.</p>

Table A-1: RF-A! Receiver Action Commands (Sheet 4 of 7)

Command/Usage	Description
SELECT DIAGNOSTIC SIGNAL	This action command is used to route different types of internal diagnostic signals to the front panel monitor (BNC) port. The signal reverts to the default after a station reset
a 195 <signal>	<p data-bbox="858 378 1029 812"> 6 = Reserved 7 = Ground (0V) 8 = Frame Start 9 = Packet Start 10 = GPS 1PPS 11 = Reserved 12 = Reserved 13 = 2.1 MHz Monitor 14 = 10 MHz Reference 15 = Network TX 16 = Network RX 17 = GPS TX 18 = GPS RX 19 = Reserved 20 = Reserved </p> <p data-bbox="611 586 753 611">Legal Values:</p> <p data-bbox="611 843 694 868">Default: 8</p>

Table A-1: RF-A! Receiver Action Commands (Sheet 5 of 7)

Command/Usage	Description
	<p>This action command sets all internal RF-A! receiver network parameters. Note: The results of this command do not take effect until the next station reset.</p> <p>Legal Values:</p>
NETWORK CONFIGURATION	<p>baud rate: 9600 19200 (default) 38400</p>
a 196 <baud rate>, <local IP>, <peer IP>, <default gateway>, <net mask>, <ipcp negotiate addr>, <ppp mode>, <network init timeout>	<p>local IP: x.x.x.x</p> <p>peer IP: x.x.x.x</p> <p>default gateway: x.x.x.x</p>
a 196 ? - - to view current settings or command usage	<p>net mask: x.x.x.x</p>
	<p>ipcp negotiate addr: 0 = do not negotiate 1 = use old method 2 = use new method (default)</p> <p>ppp mode: 0 = passive 1 = active</p>
	<p>network init timeout: 0-10000 (seconds)</p>

Table A-1: RF-A! Receiver Action Commands (Sheet 6 of 7)

Command/Usage	Description
	This command is used to configure an RF-A! receiver for a remote software download.
	Legal Values:
SOFTWARE DOWNLOAD CONFIGURATION	tftp server IP: x.x.x.x
a 197 <tftp server IP>, <tftp app vi ind>, <1st file>, <2nd file>, <3rd file>, <4th file>, <xfer file format>, <time to start xfer>, <udp pkt recd update freq>, <s-rec write update freq>, <algorithm>	tftp app vi ind: 0 = Software Download 1 = Synchronous Sets 2 = Multiple Gets 3 = No Local Indication
a 197 ? - - to view current settings or command usage	1/2/3/4 file: 5, 6, or 7 char STRING
	xfer file format: 2 = Motorola S-Records
	time to start xfer: hh:mm:ss
	udp rx updt freq: 5-65535
	s-rec wr updt freq: 50-150
	algorithm: 1 = Native Host Mode
READ CURRENT TIME	This command displays system time. This time should equal GPS time in normal operation. GPS and system time are Greenwich Mean Time.
a 198	
ALARM CONFIGURATION	This command is used to view/set a severity level for a specific alarm.
a 200 r <error #>	Legal Values:
	error #: SSee Appendix D for alarm IDs
a 200 w <error #> <severity>	0 = No Alarm 1 = Warning
a 200 ? - - to view command usage	2 = Minor 3 = Major 4 = Critical

Table A-1: RF-A! Receiver Action Commands (Sheet 7 of 7)

Command/Usage	Description
EVENT LOG CONTROL	This action command is used to control which events are captured to the event logs. Only 'init msgs on' is currently supported.
a 201 <init msgs on>, <GPS msgs on>, <FRU msgs on>, <HW version msgs on>	Legal Values: 0 = Message Off 1 = Message On
a 201 ? - - to view command usage	Default: 1
DISPLAY GPS STATUS	This command displays GPS status information to the FIPS monitor. The information includes time, date, number of satellites visible, and number of satellites tracked.
a 208 *	
* Note: In software releases prior to version R2.4.0, the format of this command is 'a 208 gps_stat'.	

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 1 of 13)

Command/Usage	Description
SNMP MANAGER IP ADDRESS 0	This parameter specifies the IP address of the primary SNMP manager.
r 65	Legal Values: x.x.x.x
w 65 <snmp mrg0 IP>	Default: 0.0.0.0
SNMP MANAGER IP ADDRESS 1	This parameter specifies the IP address of a secondary SNMP manager.
r 66	Legal Values: x.x.x.x
w 66 <snmp mgr1 IP>	Default: 0.0.0.0
SNMP MANAGER IP ADDRESS 2	This parameter specifies the IP address of a secondary SNMP manager.
r 67	Legal Values: x.x.x.x
w 67 <snmp mgr2 IP>	Default: 0.0.0.0

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 2 of 13)

Command/Usage	Description
SNMP MANAGER IP ADDRESS 3	This parameter specifies the IP address of a secondary SNMP manager.
r 68	Legal Values: x.x.x.x
w 68 <snmp mgr3 IP>	Default: 0.0.0.0
SNMP MANAGER IP ADDRESS 4	This parameter specifies the IP address of a secondary SNMP manager.
r 69	Legal Values: x.x.x.x
w 69 <snmp mgr4 IP>	Default: 0.0.0.0
PASSWORD STATUS	This read-only parameter indicates the password verification status.
r 135	Legal Values: 1 = Enabled 2 = Disabled
READ ONLY	
FIPS INACTIVITY TIMER	This parameter reads/sets the timeout setting, in seconds, before FIPS requires the user to re-enter a password.
r 136	Legal Values: 60 - 3600 (999 reserved for internal use)
w 136 <seconds>	Default: 300
FIPS BAUD RATE	This parameter reads/sets the front panel FIPS com port speed (baud rate)
r 137	Legal values: 1 = 1200 2 = 2400 3 = 4800 4 = 9600 5 = 19200
w 137 <fips baud>	Default: 4 = 9600
BOOT SOFTWARE VERSION ID	This read-only parameter indicates the RF-A! receiver host processor's boot software version stored ROM. The ROM and version ID are programmed at the factory and cannot be changed.
r 147	Legal values: Any 6-character STRING
READ ONLY	

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 3 of 13)

Command/Usage	Description
ACTIVE APPLICATION SW VERSION ID r 148	This read-only parameter indicates the RF-A! receiver host processor's application software version stored in the active flash EPROM bank.
READ ONLY	Legal values: Any 6-character STRING
DORMANT APPLICATION SW VERSION ID r 152	This read-only parameter indicates the RF-A! receiver host processor's application software version stored in the dormant flash EPROM bank.
READ ONLY	Legal values: Any 6-character STRING
ALIGN HSO READ r 185	This read-only parameter is used to view the high stability oscillator (HSO) steering value. Note: The 'a 155' command is used to set this parameter.
READ ONLY	Legal values: 0-215 Default: 151
STATION ID r 186 w 186 <station id>	This parameter provides a means of receiver identification and is required by IPP.
	Legal values: 0-4294967295 Default: 55
NETWORK VI INDICATOR MODE r 300 w 300 <network vi ind>	This parameter controls the front-panel TRAFFIC-Network LED usage.
	Legal Values 0 = Network TX 1 = Network RX 2 = GPS TX 3 = GPS RX 4 = Reserved 5 = Reserved Default: 0

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 4 of 13)

Command/Usage	Description
TIME REF VI INDICATOR MODE r 301 w 301 <time ref vi ind>	<p>This parameter controls the front-panel TRAFFIC-Time Ref LED usage. The parameter reverts to the default value after a station reset.</p> <p>Legal Values: 0 = 1PPS 1 = Frame Start 2 = Reserved</p> <p>Default: 0</p>
ALARM VI INDICATOR MODE r 302 w 302 <alarm vi ind>	<p>This parameter controls the front panel STATUS-Alarm LED usage.</p> <p>Legal Values: 0 = Normal Alarm Display Mode 1 = Pulsed Alarm Display Mode 2 = Last Alarm Display Mode</p> <p>Default: 0</p>
TFTP APP VI INDICATOR MODE r 402 w 402 <tftp app vi ind>	<p>When a TFTP session is active, this parameter selects the concurrent TFTP activity to control the front-panel STATUS-Control LED.</p> <p>Legal Values: 0 = Software Download 1 = Synchronous Sets 2 = Multiple Gets 3 = No Local Indication</p> <p>Default: 0</p>
TFTP SERVER IP ADDRESS r 403 w 403 <tftp server IP >	<p>This parameter specifies the TFTP server IP address. This node stores the file that the local TFTP application is trying to retrieve (used during a remote software download session).</p> <p>Legal Values: x.x.x.x</p> <p>Default: 0.0.0.0</p>
S-RECORDS WRITTEN r 410 READ ONLY	<p>This read only parameter contains the number of S-records written to the (dormant) host flash EPROM bank. The parameter resets to 0 upon the triggering of a remote software download.</p> <p>Legal Values: 0-65535</p> <p>Default: 0</p>

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 5 of 13)

Command/Usage	Description
S-RECORDS WRITTEN UPDATE FREQUENCY	This parameter controls how often S-RECORDS WRITTEN (parameter 410) is updated.
r 411	Legal Values: 50-150
w 411 <s-rec write update freq>	Default: 150
SOFTWARE DOWNLOAD ALGORITHM	This parameter determines the algorithm used during a remote software download. Presently only one method is supported.
r 412	Legal Values: 1 = Native Host Mode
w 412 <sdl algorithm>	Default: 1
SOFTWARE DOWNLOAD ENDING STATE	This SNMP control parameter signifies the ending state of a software download. When this parameter changes, a trap is sent to the SNMP manager(s).
r 425	0 = Ending State Not Initialized 1 = Undefined
w 425 <sdl ending state>	Legal values: 2 = Download Install Success 3 = Cutover Success 4 = Cutback Success 5 = Network Activity Abort
	Default: 0

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 6 of 13)

Command/Usage	Description
SOFTWARE DOWNLOAD STATUS	<p>This parameter provides real-time updates on the status of a software download and can be polled while a download is in progress. This parameter is bound to the same trap as SOFTWARE DOWNLOAD ENDING STATE (parameter 425).</p>
r 426	<p>0 = Status Not Initialized 1 = System Not Active 2 = Download in Progress 3 = Install In Progress 4 = Download Install in progress 5 = Download Aborted 6 = Install Aborted 7 = Download Install Aborted 8 = Download Success 9 = Install Success 10 = Cutover In Progress 11 = Cutover Aborted 12 = Cutover Schedule Pending 13 = Cutback In Progress 14 = Cutback Aborted</p>
w 426 <sdl status>	<p>Legal Values: 15 = Cutback Scheduled At Time 64 = Device Accepted Xfer 65 = Device Rejected Contents 66 = Device Aborted Install 67 = Bad Parameter Set 68 = Download Abort Ack 69 = Install Abort Ack 70 = Cutover Abort Ack 71 = Flash Bank Switch Success 72 = Flash Bank Switch Failed 73 = Device Cutover Failed 74 = Device Cutover Success 75 = Bad Time SDL In Progress 76 = Bad Time Install In Progress 77 = Accepted No Reboot Required 78 = Accepted Reboot Required</p>
	<p>Default: 0</p>
FILE1 NAME	<p>This parameter specifies the filename of the source file used during a remote software download.</p>
r 427	<p>Legal Values: 5, 6, or 7 char STRING</p>
w 427 <1st file >	<p>Default: N/A</p>

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 7 of 13)

Command/Usage	Description
FILE2 NAME	Not Supported.
r 428	Legal Values: N/A
w 428 <2nd file >	Default: N/A
FILE3 NAME	Not Supported.
r 429	Legal Values: N/A
w 429 <3rd file >	Default: N/A
FILE4 NAME	Not Supported.
r 430	Legal Values: N/A
w 430 <4th file >	Default: N/A
SOFTWARE DOWNLOAD FILE FORMAT	This parameter controls the format of the remote software download source file.
r 431	Legal Values: 2 = Motorola S-Records
READ ONLY	Default: 2
SOFTWARE DOWNLOAD UDP PACKETS RECEIVED	This read only parameter contains the number of UDP packets received by the host. The parameter resets to 0 upon the triggering of a remote software download.
r 432	Legal Values: 0-65535
READ ONLY	Default: 0
SOFTWARE DOWNLOAD UDP PACKETS RECEIVED UPDATE FREQUENCY	This parameter controls how often UDP PACKETS RECEIVED (parameter 432) is updated.
r 433	Legal Values: 5-65535
w 433 <udp rx updt freq>	Default: 5

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 8 of 13)

Command/Usage	Description
SOFTWARE DOWNLOAD TRIGGER TIME r 434 w 434 <time to start xfer>	<p>This parameter controls when a software download should begin. The parameter is entered in 24-hour format (hh:mm:ss). Entering 0:0:0 (or 0) for this parameter configures the host for an immediate software download. NOTE: Trigger time is relative to system time.</p> <p>Legal Values: 0-23:0-59:0-59</p> <p>Default: 00:00:00</p>
SOFTWARE DOWNLOAD CUTOVER TRIGGER TIME r 435 w 435 <cutover time>	<p>This parameter controls when a cutover to a new active flash EPROM bank should occur after a software download. The parameter is entered in 24-hour format (hh:mm:ss). Entering 0 for this parameter configures the host for an immediate cutover to a new active flash EPROM bank.</p> <p>Legal Values: 0-23:0-59:0-59</p> <p>Default: 00:00:00</p>
SOFTWARE DOWNLOAD ABORT CONTROL r 436 w 436 <sdl abort cntrl>	<p>This parameter is used to abort a software download or install that is presently in progress. The parameter checks internally every time S-RECORDS WRITTEN (parameter 410) or (UDP PACKETS RECEIVED (parameter 432) updates.</p> <p>Legal Values: 0 = Abort Control Not Initialized 1 = Manager Abort 2 = Manager Confirm</p> <p>Default: 0</p>
LINK QUALITY HEARTBEAT TIMER r 500 w 500 <heartbeat time>	<p>This parameter controls how often a link quality message is sent to the RF-C!. The value corresponds to the number of seconds between messages.</p> <p>Legal Values: 0-65535</p> <p>Default: 0</p>

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 9 of 13)

Command/Usage	Description
<p>IPP CONTROL BITMASK</p> <p>r 510</p> <p>w 510 <byte></p>	<p>This parameter controls generic IPP encapsulation functions. This parameter is a byte (8-bit) bitmask entered in decimal format.</p> <p>Bit Usage:</p> <p>b7: 0 = Exclude Signal Speed 1 = Include Signal Speed (default)</p> <p>b6: 0 = Exclude Date/Time (default) 1 = Include Date/Time</p> <p>b5-0: Reserved</p> <p>Default: 128</p>
<p>IPP SLOT CONTROL BITMASK</p> <p>r 511</p> <p>w 511 <byte></p>	<p>This parameter controls miscellaneous slot data IPP encapsulation functions. This is a byte (8-bit) bitmask entered in decimal format.</p> <p>Bit Usage:</p> <p>b7: 0 = Exclude CRC Passed Flag 1 = Include CRC Passed Flag (default)</p> <p>b6: 0 = Exclude RS Passed Flag 1 = Include RS Passed Flag (default)</p> <p>b5: 0 = Exclude Number of RS Errors Corrected 1 = Include Number of RS Errors Corrected (default)</p> <p>b4-0: Reserved</p> <p>Default: 224</p>

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 10 of 13)

Command/Usage	Description
IPP SP CONTROL BITMASK r 512 w 512 <byte>	<p>This parameter controls slot data IPP encapsulation functions specific to SPs (single packets). This parameter is a byte (8-bit) bitmask entered in decimal format.</p> <p>Bit Usage:</p> <p>b7: 0 = Exclude Protocol 1 = Include Protocol (default)</p> <p>b6: 0 = Exclude CRC Bits (default) 1 = Include CRC Bits</p> <p>b5: 0 = Exclude RS Bits (default) 1 = Include RS Bits</p> <p>b4-0: Reserved</p> <p>Default: 128</p>
IPP CHANNEL CONTROL BITMASK r 513 w 513 <byte>	<p>This parameter controls channel related IPP encapsulation functions. This parameter is a byte (8-bit) bitmask entered in decimal format.</p> <p>Bit Usage:</p> <p>b7-5: Reserved</p> <p>b4: 0 = Channel Off 1 = Channel On (default)</p> <p>b3: 0 = CRC Screening Off 1 = CRC Screening On (default)</p> <p>b2: 0 = RS Screening Off 1 = RS Screening On (default)</p> <p>b1-b0: 00 = 800 OTA bps 01 = 1600 OTA bps 10 = 6400 OTA bps (not supported) 11 = 9600 OTA bps (not supported)</p> <p>Default: 28</p>

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 11 of 13)

Command/Usage	Description
IPP UDP PORT	This parameter specifies the UDP port used for IPP traffic.
r 547	Legal Values: 1-65535 (not supported)
w 547 <ipp udp port>	Default: 5001
IPP DESTINATION IP ADDRESS	This parameter specifies the IP address of the sub-system receiving IPP data. Typically, this parameter is the network IP address of the RF-C! controller.
r 550	Legal Values: x.x.x.x
w 550 <ipp dest IP >	Default: 180.20.64.205
IPP EMPTY FRAME CONTROL	This parameter controls how empty IPP frames are handled.
r 551	Legal Values: 0 = Do Not Send Empty Frames 1 = Send All Frames
w 551 <ipp frame cntrl>	Default: 0
OPERATING MODE	This parameter determines the operating mode of the RF-A! receiver. It is reset to 1 after a station reset.
r 552	Legal Values: 1 = Normal IPP Mode 2 = IPP Canned Message Mode 3 = BER Mode - 800 bps 4 = BER Mode - 1600 bps
w 552 <op mode>	Default: 1
CONFIRM OPERATING MODE	This internally controlled parameter reads the actual operating mode of the receiver. The parameter confirms the mode set using parameter 552.
r 553	Legal Values: 1-4
READ ONLY	Default: 1
RX B CENTER FREQUENCY	This parameter reads/sets the inbound channel frequency of the RX B (lower RF module) branch receiver. Frequency is entered in MHz in multiples of 0.00625 (6.25 kHz channel spacing).
r 681	Legal Values: 896.0000 - 902.0000
w 681 <freq B>	Default: N/A

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 12 of 13)

Command/Usage	Description
RX A CENTER FREQUENCY r 685 w 685 <freq A>	<p>This parameter reads/sets the inbound channel frequency of the RX A (upper RF module) branch receiver. Frequency is entered in MHz in multiples of 0.00625 (6.25 kHz channel spacing).</p> <p>Legal Values: 896.0000 - 902.0000</p> <p>Default: N/A</p>
FIPS USER PASSWORD r 707 w 707 <password>	<p>This parameter reads/sets the user password. This password must be entered to gain local FIPS access at start-up and after expiration of the FIPS INACTIVITY TIMER (parameter 136).</p> <p>Legal values: Any 1 to 7 character STRING</p> <p>Default: 6000</p>
ACTIVE FLASH BANK r 901 w 901 <bank>	<p>This parameter reads/sets which flash EPROM bank the RF-A! receiver host processor uses for its application software program. Note: Changing this setting will not take effect until the next station reset.</p> <p>Legal Values: 1 = Inner Flash Bank 2 = Outer Flash Bank</p> <p>Default: 2</p>
DISPLAY OTA DATA w 953 <arg>	<p>This parameter controls an online debug tool. The debug tool allows live OTA data to be displayed on the FIPS monitor. Using this tool does not effect the RF-A! receiver's ability to send valid OTA data to the RF-C! controller. However, if the amount of data displayed becomes too great, the internal buffer capacity of the RF-A! will be exceeded causing the RF-A! receiver to reset. Note: This parameter is reset to the default after a station reset.</p> <p>Legal Values: 0 = Disable Output 1 = Enable Output</p> <p>Default: 0</p>

Table A-2: RF-A! Receiver Read/Write Commands (Sheet 13 of 13)

Command/Usage	Description
HSO WARP TRACE (R2.8.0 and later)	This parameter enables the warp trace. It allows the FIPS user to view HSO auto-tuning.
r 955	Legal Values: 0 = Disable Output 1 = Enable Output
w 955 <arg>	Default: 0
GPS MODE	This parameter reads/sets the current GPS Master/Slave status.
r 957	Legal Values: 0 = Motorola Slave 1 = Motorola Master 2 = Trimble Slave 3 = Trimble Master (not supported)
w 957 <mode>	Default: 0
GPS DATA BUFFER TRACE	This parameter enables the raw GPS data buffer to be sent to the FIPS terminal.
r 959	Legal Values: 0 = Disable Output 1 = Enable Output
w 959 <mode>	Default: 0

Acronyms

List of Acronyms and Abbreviations

Table B-1: Acronyms (Sheet 1 of 3)

Acronym	Definition
AC	Alternating Current
ACK	Acknowledgment
ACM	Audience Control Module
AM	Amplitude Modulation
ANSI	American National Standards Institute
AUI	Attachment Unit Interface
AWG	American Wire Gauge
BER	Bit Error Rate
bps	bits per second
BTU	British Thermal Units
CRC	Cyclic Redundancy Check
dB	decibel
DC	Direct Current
DDN	Digital Data Network
DMC	Diagnostic, Maintenance, and Control
DOP	Dilution of Precision
DSP	Digital Signal Processor
DTE	Data Terminal Equipment
FIPS	Friendly Integrated Paging System

Table B-1: Acronyms (Sheet 2 of 3)

Acronym	Definition
FRU	Field Replaceable Unit
FSK	Frequency Shift Key
ft	feet
GPS	Global Positioning System
HVAC	Heating/Ventilation/Air-Conditioning
Hz	Hertz
in.	inches
IP	Internet Protocol
IPP	Inbound Paging Protocol
ISDN	Integrated Services Digital Network
kHz	Kilohertz
LED	Light-Emitting Diode
MHz	Megahertz
NACK	Acknowledgement
OTA	Over The Air
PCD	Personal Communicator Device
PDOP	Position Dilution of Precision
PER	Packet Error Rate
PMU	Personal Messaging Unit
ppm	parts-per-million
PPP	Point-to-Point Protocol
PPS	Pulse-Per-Second
PSTN	Public Switched Telephone Network
RF	Radio Frequency
RF-A!	RF-Audience!

Table B-1: Acronyms (Sheet 3 of 3)

Acronym	Definition
RF-B!	RF-Baton!
RF-C!	RF-Conductor!
RFM	Receiver Module
RF-O!	RF-Orchestra!
RLQM	Receiver Link Quality Message
RSSI	Received Signal Strength Indicator
RX	Receiver
SNMP	Simple Network Management Protocol
TCP	Transmission Control Protocol
TTL	Transistor Transistor Logic
TX	Transmitter
UDP	User Datagram Protocol
UHF	Ultra-High Frequency
UPS	Universal Power Supply
Vac	Volts AC
Vdc	Volts DC
VSAT	Very Small Aperature Terminal
WMG!	Wireless Message Gateway!

Backplane Connectors

This appendix provides rear panel connector pinouts for the RF-A! receiver as shown in Figure C-1 and Figure C-2.

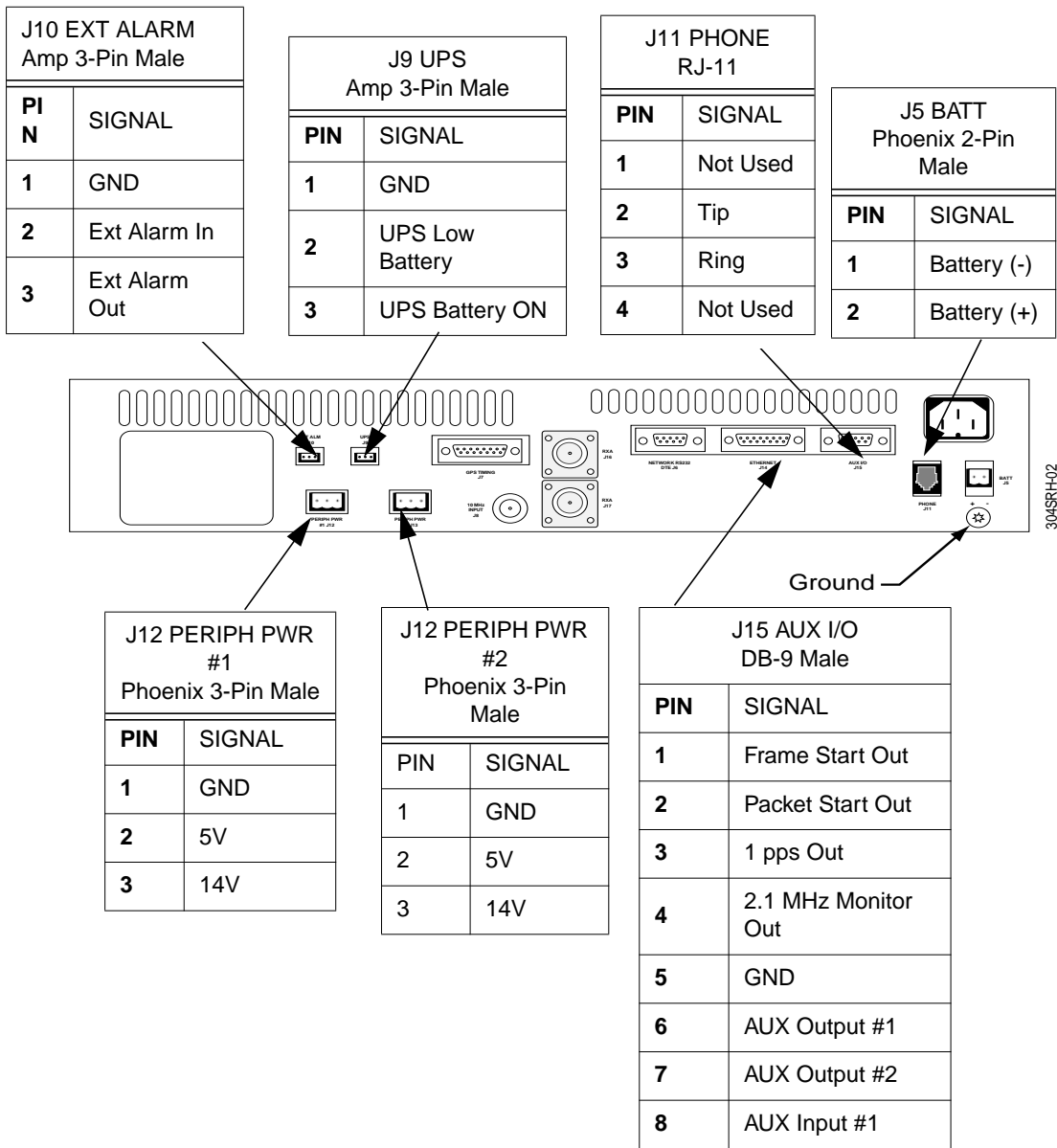
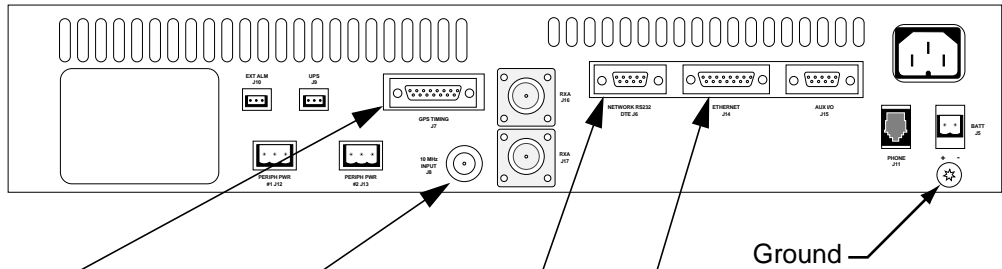


Figure C-1: RF-A! Receiver Connector Pinouts



304SRH-02

J7 GPS TIMING DB-15 Female	
PIN	SIGNAL
1	GPS RX 485+
2	GPS RX 485-
3	GPS TX 485+
4	GPS TX 485-
5	GPS 1pps 485+
6	GPS 1pps 485-
7	EXT Frame Sync 485+
8	EXT Frame Sync 485-
9	EXT DMC 485+
10	EXT DMC 485-
11	GPS Alarm
12	Reserved
13	Cable Sense
14	GND
15	GND

J8 10 MHz INPUT BNC Female	
PIN	SIGNAL
1	10 MHz in

J6 NETWORK RS232 DTE DB-9 Male	
PIN	SIGNAL
1	Network DCD
2	Network RX
3	Network TX
4	Network DTR
5	GND
6	Network DSR
7	Network RTS
8	Network CTS
9	Network RI

J14 ETHERNET AUI DB-15 Female	
PIN	SIGNAL
1	GND
2	AUI ACX+
3	AUI ATX+
4	GND
5	AUI ARX+
6	GND
7	Not Used
8	GND
9	AUI ACX-
10	AUI ATX-
11	GND
12	AUI ARX-
13	AUI +12V
14	GND
15	Not Used

Figure C-2: RF-A! Receiver Connector Pinouts

RF-A! Receiver Error Messages

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 1 of 12)

Error	Alarm Severity	ID	Usage
E_BAD_CKSUM	Warning	223	N/A
E_BAD_FLASH_WRITE	Major	224	N/A
E_BAD_FUTURE_TIME	Off	329	Could not decode requested time to start software download.
E_BAD_IMAGE_CRC	Warning	220	Entire software image's checksum is bad.
E_BAD_ISR_ADDRESS_POINTER	Warning	343	ISR address pointer is NULL
E_BAD_ISR_BUF_SIZE	Critical	344	pSOS buffer is not large enough to accomodate the data stream
E_BAD_NETWORK_FILENAME	Minor	278	Required file-name for a tftp xfer is not known.
E_BAD_RX0_CHANNEL	Major	216	Occurs during initialization when RF modules are not sensed by software to be present
E_BAD_RX1_CHANNEL	Major	217	
E_BAD_SREC_COUNT	Warning	225	Number of s records sent does not match number burned in flash
E_BAD_S_REC	Warning	221	Individual s-record checksum is bad
E_CMD_DATA_OUTSIDE_RANGE	Warning	348	FIPS action command data is out of range
E_DB_OUT_OF_BOUNDS	Critical	321	Database of alarm severities ran out of room in EEPROM
E_DETERMINE_OBJECT_ID_NOT_FOUND	Off	179	Internal logic error pertaining to pSOS identification of tasks, queues, semaphores, etc.

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 2 of 12)

Error	Alarm Severity	ID	Usage
E_DEVICE_ABORTED_INSTALL	Minor	281	
E_DEVICE_ABORTED_XFER	Minor	281	SNMP control msg bound to SNMP trap regarding a tftp activity
E_DEVICE_ACCEPTED_XFER	Minor	279	
E_DEVICE_REJECTED_CONTENTS	Minor	280	
E_DIPSWITCH_2_READING_ERROR	Critical	350	Could not read non-volatile memory
E_EEPROM_WRITE_FAULT	Major	174	Hardware error
E_EXT_ALM	Major	227	External Alarm (backplane J10).
E_EXT_REF_UNLOCKED	Minor	356	
E_FIPS_CMD_EXT_IO	Off	298	When the user is trying to use a test command and the RF-A! receiver is not in an OTA test mode
E_GPS_CHECKSUM_FAILED	Off	266	
E_GPS_MSG_NOT_PROCESSED	Warning	346	GPS data message could not be interpreted
E_GPS_RECEIVER_INIT_FAILURE	Minor	267	This message occurs when the RF-A! receiver is in GPS master mode during initialization and it cannot sense a GPS receiver.
E_ILLEGAL_IPS_COMMAND	Warning	178	Software detected an illegal IFIPS command.
E_ILLEGAL_PARAMETER_WRITE	Warning	188	Parameter Database Management detected an illegal parameter
E_INACTIVE_IPS_PROTOCOL	Warning	167	Inactive FIPS command
E_INVALID_ERROR_CODE	Warning	189	Internal logic error
E_INVALID_IPS_PORT	Warning	168	N/A
E_INVALID_MODE	Off	207	
E_INVALID_TYPE	Off	208	N/A
E_IPP_CANNED_MSG_DATA_ERROR	Off	309	Occurs when an IPP encapsulation or transmission error occurs with canned messages
E_IPP_CANNED_MSG_XMIT_ERROR	Off	310	
E_IPP_CONTROL_ERROR	Minor	313	Illegal IPP control parameter entered

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 3 of 12)

Error	Alarm Severity	ID	Usage
E_IPP_HALT	Off	287	N/A
E_IPP_LINK_QUALITY_MSG_XMIT_ERROR	Major	360	IPP encapsulation or transmission error for receiver link quality messages (RLQMs)
E_IPP_LIVE_DATA_ERROR	Major	311	When an IPP encapsulation or transmission error occurs with live OTA traffic
E_IPP_LIVE_DATA_XMIT_ERROR	Major	312	
E_IPP_UNABLE_TO_CHANGE_TO_BER	Minor	290	Noting when RF-A! receiver changes to different OTA operating modes. This information is bound to an SNMP trap sent to the SNMP Manager when a change occurs.
E_IPP_UNABLE_TO_CHANGE_TO_IPP	Minor	294	
E_IPP_UNABLE_TO_CHANGE_TO_MER	Minor	292	
E_IPP_UNABLE_TO_SEND_CANNED_MSGS	Minor	297	
E_LOSS_AC_POWER_ONAN	Major	332	Occurs when the RF-A! receiver senses UPS external power source going active.
E_LOSS_AC_POWER_UPS	Major	226	Occurs when the RF-A! receiver senses Battery Revert going active.
E_LOSS_OF_GPS_TIME_STAMP	Warning	273	Occurs when the RF-A! receiver has not received a timestamp for 5 seconds
E_LOSS_OF_GPS_TRACKING	Minor	272	Occurs when the number of satellites being tracked drops below 3.
E_NETWORK_PARAM_NOT_INIT	Off	277	N/A
E_NOT_ENOUGH_MEMORY	Warning	169	
E_OSS_ACCESS_SERIAL_ERR	Off	251	Used to detect errors in software that encapsulates IPP data structures.
E_OSS_BAD_ENCRULES	Off	248	N/A
E_OSS_BAD_VERSION	Off	254	N/A
E_OSS_CANT_OPEN_TRACE_FILE	Off	244	N/A
E_OSS_CONSTRAINT_VIOLATED	Off	252	N/A

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 4 of 12)

Error	Alarm Severity	ID	Usage
E_OSS_ENCODE_BAD_ARG	Off	242	N/A
E_OSS_ENCODE_BAD_CHOICE	Off	241	N/A
E_OSS_ENCODE_BAD_OBJID	Off	240	N/A
E_OSS_ENCODE_BAD_PTR	Off	239	N/A
E_OSS_ENCODE_BAD_TABLE	Off	235	N/A
E_OSS_ENCODE_BAD_TIME	Off	238	N/A
E_OSS_ENCODE_FAILURE	Off	231	N/A
E_OSS_ENCODE_FATAL_ERROR	Off	233	Used to detect errors in software that encapsulates IPP data structures.
E_OSS_ENCODE_MEM_ERROR	Off	236	N/A
E_OSS_ENCODE_NEG_LEN	Off	237	N/A
E_OSS_ENCODE_TOO_LONG	Off	234	N/A
E_OSS_INIT_FAILURE	Off	232	N/A
E_OSS_LOAD_ERR	Off	245	N/A
E_OSS_MORE_BUF	Off	256	N/A
E_OSS_NULL_FCN	Off	249	N/A
E_OSS_NULL_TBL	Off	250	N/A
E_OSS_OUT_MEMORY	Off	253	N/A
E_OSS_PDU_RANGE	Off	255	N/A
E_OSS_TRACE_FILE_OPEN	Off	243	N/A
E_OSS_UNAVAIL_ENCRULES	Off	247	N/A
E_OSS_UNIMPLEMENTED	Off	246	N/A

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 5 of 12)

Error	Alarm Severity	ID	Usage
E_PARAMETER_ATTRIBUTE_FAULT	Warning	187	
E_PARAMETER_DATABASE_OUT_OF_RANGE	Minor	317	
E_PARAMETER_MANAGER_BAD_STATUS	Critical	181	Parameter database management
E_PARAMETER_READ_ONLY	Minor	320	
E_PARAMETER_UNKNOWN	Minor	318	
E_PARAMETER_UNKNOWN_ACCESS_REQUEST	Minor	319	
E_PARAMETER_WRITE_OUT_OF_RANGE	Warning	180	User request to update parameter is out of range.
E_PARTIAL_S_RECORD	Warning	222	N/A
E_PASSED_PARAMETER_OUT_OF_RANGE	Off	206	
E_PPFO_BAD_ACTION_ARRAY	Off	304	An asynchronous user request to the RF-A! receiver's OTA operating mode was not processed properly.
E_PPFO_ILLEGAL_OP	Off	303	The RF-A! receiver's OTA operator received an opcode it does not support.
E_PPFO_MGR_CANNOT_START	Major	308	The RF-A! receiver's OTA operator could not complete its initialization without error; OTA processing capability should be in question.
E_PPFO_NOT_IPP_IO	Off	305	Internal logic error
E_PPP_ROUTE_FAILED	Warning	358	PPP link could not be established
E_RCH_OUT_OF_RANGE	Off	209	N/A
E_REF_EXT_LOCKED_FAILURE	Minor	323	Occurs when the RF-A! receiver cannot lock to internal oscillator reference.
E_RESET	Minor	170	

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 6 of 12)

Error	Alarm Severity	ID	Usage
E_RESET_OCCURRED_DURING_DOWNLOAD	Major	326	If during a remote sw download the station has cause to reset itself, the detailed status variable is read during the reboot to determine if this reset caused the download to fail.
E_RSDM_TIMEOUT	Off	265	Obsolete
E_RX0_BAND_LOOKUP_FAILURE	Major	210	RX0 does not exist
E_RX0_FREQ_ERROR	Major	341	RX0 received bad frequency change request from FIPS or SNMP MIB
E_RX0_LOCK_ALARM	Major	218	RX0 attempted to lock synthesizer and failed
E_RX0_STARTUP_FAILURE	Major	212	Secondary event that occurs with band look up failure
E_RX0_UNLOCK_ALARM	Major	335	RX0 unlocked during normal operation
E_RX0_UNLOCK_ERROR	Minor	228	RX0 synthesizer was locked, then unlocked.
E_RX1_BAND_LOOKUP_FAILURE	Major	211	RX1 does not exist
E_RX1_FREQ_ERROR	Major	342	RX1 received bad frequency change request from FIPS or SNMP MIB
E_RX1_LOCK_ALARM	Major	219	RX1 attempted to lock synthesizer and failed
E_RX1_STARTUP_FAILURE	Major	213	Secondary event that occurs with band look up failure
E_RX1_UNLOCK_ALARM	Major	336	RX1 unlocked during normal operation
E_RX1_UNLOCK_ERROR	Minor	229	RX1 synthesizer was locked, then unlocked.
E_RX_DSP_ARITHMETIC_ERROR	Off	195	
E_RX_DSP_BAD_FPLD_ERROR	Off	203	
E_RX_DSP_DOWNLOAD_FAILURE	Critical	192	
E_RX_DSP_INSTRUCTION_ERROR	Off	197	
E_RX_DSP_INTFC_HDW_ERROR	Off	202	
E_RX_DSP_INT_RAM_ERROR	Off	201	
E_RX_DSP_INVALID_RX_MSG	Off	194	

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 7 of 12)

Error	Alarm Severity	ID	Usage
E_RX_DSP_SCI_RX_ERROR	Off	200	
E_RX_DSP_SSI_RX_ERROR	Off	198	
E_RX_DSP_SSI_TX_ERROR	Off	199	
E_RX_DSP_STACK_ERROR	Off	196	
E_RX_DSP_STARTUP_FAILURE	Critical	215	
E_RX_DSP_TIMEOUT_ON_OUTPUT	Off	193	
E_RX_DSP_UNKNOWN_ERROR	Off	205	
E_RX_DSP_XILINX_SYNC_NOT_FOUND_ERROR	Major	204	Logged if GPS times out during initialization and host cannot send a pulse to the Xilinx
E_SIZE_DOES_NOT_MATCH_LOCAL_VARIABLE	Minor	316	Software misuses parameter database interface. Database cannot be updated if the request to change the database does not match its understanding of the size of the parameter being changed.
E_SNMP_COMMUNITY_NAME	Off	270	
E_SNMP_DECODE_FAILURE	Major	331	The SNMP agent could not interrupt the latest SNMP packet received by the RF-A! receiver.
E_SNMP_SETUP_MIB_FAILURE	Off	268	
E_SNMP_TRAP_ENCODE_FAILURE	Off	271	
E_SPI_TIMEOUT	Off	166	
E_SRAM_READ_FAULT	Major	176	
E_SRAM_WRITE_FAULT	Major	175	
E_SWITCH_DEFAULT	Off	171	As per AMG division coding standards.
E_TFTP_ILLEGAL_OPCODE	Off	264	
E_TFTP_INVALID	Off	260	
E_TFTP_MSG_ERR	Off	263	
E_TFTP_NOSPC	Off	262	

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 8 of 12)

Error	Alarm Severity	ID	Usage
E_TFTP_OBJNF	Off	261	
E_TFTP_PROTO	Off	257	
E_TFTP_SYNC	Off	259	
E_TFTP_TMOUT	Off	258	
E_UNABLE_TO_START_TASKS	Critical	214	pSOS returns something other than PSOS_OK when trying to create tasks and queues.
E_UNEXPECTED_ELSE	Off	172	As per AMG Division coding standards
E_UNEXPECTED_IPS_COMMAND	Warning	191	Reached end of a switch statement for ips commands and did not process the one received by these modules noted to the right
E_UNEXPECTED_OPCODE	Off	173	Reached end of a switch statement for inter-task communication opcodes and did not process the one received by these modules noted to the right.
E_VARIABLE_OUT_OF_RANGE	Warning	177	Processing minimum and maximum range limits on parameters
I1_INIT_DSP_OK	Off	183	
I1_INIT_GPS_OK	Off	184	
I1_INIT_PPFO_OK	Off	185	Used to step through time as the RF-A! receiver runs its initialization processing. These errors appear in the event log in the order that they occur in real time.
I1_INIT_RX0_OK	Off	165	
I1_INIT_RX1_OK	Off	182	
I1_INIT_RXDI_OK	Off	190	
I1_INIT_RXDO_OK	Off	186	
I_CLEAR_ALL_ALARMS	Critical	328	Required to be logged and trap sent when the RF-A! receiver reboots or whenever all alarms are cleared.
I_CUTOVER_ABORT_ACK	Off	284	SNMP control message bound to SNMP trap. Will occur when a decision to cutover to a new software image has been aborted by the SNMP Manager.

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 9 of 12)

Error	Alarm Severity	ID	Usage
I_DIPSWITCH_2_ACTIVATED_BY_CUTOVER	Off	357	If reboot is due to software cutover, the user will know that parameter defaults for non-critical parameters have been set.
I_DOWNLOAD_ABORT_ACK	Off	282	SNMP control message bound to SNMP trap. Will occur when a decision to transmit a new software image has been aborted by the SNMP Manager.
I_EXT_REF_LOCKED_10MEG	Off	354	
I_EXT_REF_LOCKED_5MEG	Off	355	
I_GPS_1PPS_OUTSIDE_FPGA_WINDOW	Off	351	1PPS is not where the FPGA calculates it should be
I_HATR_BAD_INIT	Off	345	Initialization of the external time reference did not occur. This is a secondary message, primary failure mode should be logged
I_INTERNAL_PENDULUM_CLOCK	Off	353	
I_INIT_OTA_MODE_TO_NORMAL_IPP	Off	288	Used to log OTA operating mode in the RF-A! receiver that initializes
I_INSTALL_ABORT_ACK	Off	283	SNMP control message bound to SNMP trap. Will occur when a decision to install (burn flash) a new software image has been aborted by the SNMP Manager.
I_IPP_CHANGED_TO_BER	Minor	289	Noting when RF-A! receiver changes to different OTA operating modes. This information is bound to an SNMP trap sent to the SNMP Manager when a change occurs.
I_IPP_CHANGED_TO_IPP	Minor	293	
I_IPP_CHANGED_TO_MER	Minor	291	
I_IPP_FIELD_NOT_SUPPORTED_BY_RFC	Minor	306	Invalid IPP configuration
I_IPP_SENDING_CANNED_MSGS_TO_RFC	Minor	296	Recording the fact that an SNMP trap was sent to the SNMP Manager denoting a change in the method the RF-A! receiver is processing IPP data.
I_IPP_SENDING_CANNED_MSGS_TO_SIMULATOR	Minor	295	

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 10 of 12)

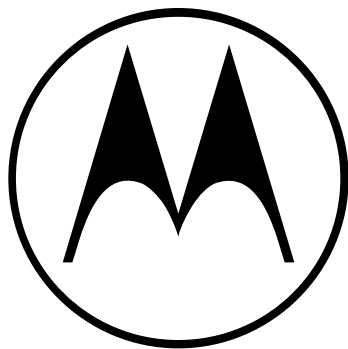
Error	Alarm Severity	ID	Usage
I_IPP_SP_DSP_CONFIGURATION_MISMATCH	Off	361	Issued when IPP configuration specified by the user conflicts with the DSP slot data message
I_LOSS_AC_POWER_ONAN_CLEARED	Off	334	RF-A! normal AC power was restored while on Battery Revert
I_LOSS_AC_POWER_UPS_CLEARED	Off	333	RF-A! normal AC power was restored while on UPS power
I_MISSING_GATEWAY_FOR_ROUTE	Off	359	Default gateway IP is not filled in
I_NETWORK_CUTOVER_ABORT	Off	276	Used by the tftp interface and is bound to an SNMP trap to the SNMP Manager when a tftp application needs to abort.
I_NETWORK_DOWNLOAD_ABORT	Off	274	
I_NETWORK_INSTALL_ABORT	Off	275	
I_NETWORK_INITIALIZATION_FAILED	Off	315	Used during initialization only to let the user know if the network came up.
I_NETWORK_INITIALIZED	Off	314	
I_NO_IMAGE_IN_DORMANT_BANK	Off	324	This information message generates if the flash_verify() routine fails during initialization on the dormant bank.
I_OTA_FUNC_NOT_INITIALIZED	Warning	327	Indicates that P_PSTN_INACTIVITY_TIMER was set to 999 and only the minimal task set has been started.
I_PPFO_BER_TEST_IS_ACTIVE	Off	301	User could try and ask for a BER test not knowing that the RF-A! receiver is in the middle of one already.
I_PPFO_COULD_NOT_ACT_ON_PARM_CHANGE	Minor	299	This message generates if the user asks the RF-A! receiver to change an OTA parameter that is not relevant to the current OTA operating mode.
I_PPFO_MER_TEST_IS_ACTIVE	Off	302	User could try and ask for a BER test not knowing that the RF-A! receiver is in the middle of one already.

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 11 of 12)

Error	Alarm Severity	ID	Usage
I_PPFO_OPCODE_NOT_ALLOWED	Off	300	User is trying to change the OTA operating mode when the RF-A! receiver cannot respond. The RF-A! receiver can refuse a user's request to change states during time critical synchronous activities.
I_PPFO_SLOT_DATA_IGNORED	Off	307	Generated when the RF-A! receiver is processing IPP canned messages. The dsp may be updating the front panel's LEDs denoting OTA traffic, but the host ignores dsp messages during this test mode.
I_REBOOTED_USING_BANK_1	Off	285	When the RF-A! receiver successfully recovers from the request to use the new software image and switches the active flash bank to use Bank 1.
I_REBOOTED_USING_BANK_2	Off	286	When the RF-A! receiver successfully recovers from the request to use the new software image and switches the active flash bank to use Bank 2.
I_REGAINED_GPS_TIME_STAMP	Off	347	Regained valid GPS time message
I_REGAINED_GPS_TRACKING	Critical	322	Once the RF-A! receiver loses GPS tracking, time steps until it is able to regain it. This entry denotes the time when the RF-A! receiver regains GPS tracking capability. The difference in the time stamps between this message and E_LOSS_OF_GPS_TRACKING denotes the amount of time GPS was not active.
I_RX0_LOCK_ALARM_CLEARED	Off	339	RX0 was able to lock to new frequency
I_RX0_STARTUP_FAILURE	Off	212	A secondary message reporting RX0 band lookup failure
I_RX0_UNLOCK_ALARM_CLEARED	Off	337	RX0 was able to re-lock to the same frequency
I_RX1_LOCK_ALARM_CLEARED	Off	340	RX1 was able to lock to new frequency
I_RX1_STARTUP_FAILURE	Off	213	A secondary message reporting RX1 band lookup failure
I_RX1_UNLOCK_ALARM_CLEARED	Off	338	RX1 was able to re-lock to the same frequency

Table D-1: RF-A! Receiver Event/Error Messages and Definitions (Sheet 12 of 12)

Error	Alarm Severity	ID	Usage
I_STATION_RESET_OCCURS_NOW	Off	325	An attempt inside the watch dog to log the moment in time when the station is told to reset itself. The attempt is logged to the STATION EVENT log, so the time stamp will be visible.
I_STATION_RESET_Rx.y.z	Critical	230	Logged at the end of each initialization. x, y, & z will be the current software version number.
I_SWDL_FOUND_NO_S8_RECORD	Off	330	Software download never received the end of software image indicator.
I_UNAUTHORIZED_SNMP_MGR	Critical	269	The source of an SNMP packet has come from an authorized SNMP manager. The RF-A! receiver can receive valid SNMP packets from up to 5 managers.
MAX_NUMBER_OF_ERROR_CODES	N/A	361	Used to size an array. Is not used as an error code, but defines a data definition size.



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