AR2200 RF Module
User Guide

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WARNING TO USERS IN THE UNITED STATES

FEDERAL COMMUNICATIONS COMMISSION (FCC) RADIO FREQUENCY INTERFERENCE STATEMENT
47 CFR §15.105(a)

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the Federal Communications Commission (FCC) rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency (RF) energy and may cause harmful interference to radio communications if not installed and used in accordance with the instruction manual. Operating this equipment in a residential area is likely to cause harmful interference, in which case, depending on the laws in effect, the users may be required to correct the interference at their own expense.

NO UNAUTHORIZED MODIFICATIONS
47 CFR §15.21

CAUTION: This equipment may not be modified, altered, or changed in any way without permission from TransCore, Inc. Unauthorized modification may void the equipment authorization from the FCC and will void the TransCore warranty.

USE OF SHIELDED CABLES IS REQUIRED
47 CFR §15.27(a)

Shielded cables must be used with this equipment to comply with FCC regulations.

A license issued by the FCC is required to operate this RF identification device in the United States. Contact TransCore, Inc. for additional information concerning licensing requirements for specific devices.

TransCore, Inc.
USA

Contents

Contents

1 Before You Begin

2 AR2200 RF Module Overview

3 Installing the AR2200 RF Module

List of Figures

List of Tables

1

Before You Begin

Chapter 1

Before You Begin

This chapter describes this guide's purpose and intended audience. It provides a list of topics covered in each section, a list of related documents, and the symbols and typographical conventions used.

Purpose

This guide provides the information necessary for TransCore-certified personnel to successfully install and test the AR2200 RF Module.

Intended Audience

This guide was written for TransCore-certified personnel who design, configure, install, test, and maintain TransCore systems in the field.

Guide Topics

Table 1-1 lists the information found in this user guide.

Table 1-1 AR2200 RF Module User Guide Information

Chapter 1–Before You Begin	Describes the purpose, intended audience, guide topics, related documentation, and document conventions.
Chapter 2–AR2200 RF Module Overview	Provides an overview of the AR2200 RF Module's features, options, and accessories.
Chapter 3–Installing the AR2200 RF Module	Provides detailed installation instructions for installing a stand-alone RF module, or connecting one or two RF modules to an AI12xx or AI1301 Reader.
Chapter 4–Testing the AR200 RF Module	Provides instructions for testing the installed RF module.
Chapter 5–Indicator Lights	Describes the locations and features of the RF module's indicator lights.
Chapter 6–Adjusting RF Power	Explains how to adjust the RF power, if needed.
Chapter 7–Sensitivity Range Adjustment	Explains how to adjust the range sensitivity to screen unwanted tag signals.
Appendix A–Technical Specifications	Presents reference information on the AR2200 RF Module.

Typographical Conventions

Table 1-2 lists the conventions used in this manual:

Table 1-2 Typographical Conventions

Convention	Indication
	This procedure might cause harm to the equipment and/or the user.
	Concerns about a procedure.
`Code`	Code, including keywords and variables within text and as separate paragraphs, and user-defined program elements within text appear in courier typeface.
Dialog Box Title	Title of a dialog box as it appears on screen.
Function	Start with the characters G4, and are in mixed case with no underscores, and include parentheses after the name, as in G4FunctionName().
Menu Item	Appears on a menu. Capitalization follows the interface.
Note	Auxiliary information that further clarifies the current discussion. These important points require the user's attention. The paragraph is in italics and the word Note is bold.
NUL	Zero-value ASCII character or a zero-value byte.
NULL	Zero-value pointers. Null-terminated string refers to strings of printable ASCII characters with a zero-value byte placed in memory directly after the last printable character of the string.

Health Limits

Within the United States, environmental guidelines regulating safe exposure levels are issued by the Occupational Safety and health Administration (OSHA).

Section 1910.97 of OSHA Safety and Health Standards 2206 legislates a maximum safe exposure limit of 10 milliwatts per square centimeter (mW/cm^2) averaged over 6 minutes at both 915 and 2450 MHz.

Although not binding, other organizations such as the American National Standards Institute (ANSI) have issued similar guidelines that are more restrictive than the OSHA limits (ANSI C95.1). ANSI guidelines recommend a maximum safe power density in mW/cm^2 of:

$$\frac{Frequency \text{ (in MHz)}}{1500}$$

Thus, the maximum permissible exposure for general population/uncontrolled exposure at 915 MHz is 0.61 mW/cm^2. The power limit is a 6-minute average.

The RF power density generated by Amtech® equipment was calculated using a maximum antenna gain of 14 dBi that is equivalent to that typically used in an AR2200 installation.

The antenna gain should not exceed 14 dBi. The antennas used for this transmitter must not be collocated or operated in conjunction with any other antenna or transmitter.

At 1.6 W transmitted power and a distance of 22 inches (55 cm) from the antenna, the maximum power density calculated was 0.6 mW/cm^2. Install the antennas at least 22 inches (55 cm) from the general public. Maintenance personnel must remain at least 9.7 inches (24.5 cm) from antennas when system is operating.

The data confirms that the Amtech® system effectively meets OSHA requirements and thus does not represent an operating hazard to either the general public or maintenance personnel.

2

Overview of AR2200 RF Module

Chapter 2

AR2200 RF Module Overview

This chapter presents an overview of the AR2200 RF Module's features, options, and accessories.

Overview

The AR2200 RF Module, hereafter referred to as the RF module, is a dual-output radio transmitter/receiver that, on command from a TransCore reader, generates a radio frequency (RF) signal in the 865- to 930-MHz radio frequency range, over five bands, and delivers the signal to the antenna for broadcast. Figure 2-1 shows the top view of the RF module I/O interface.

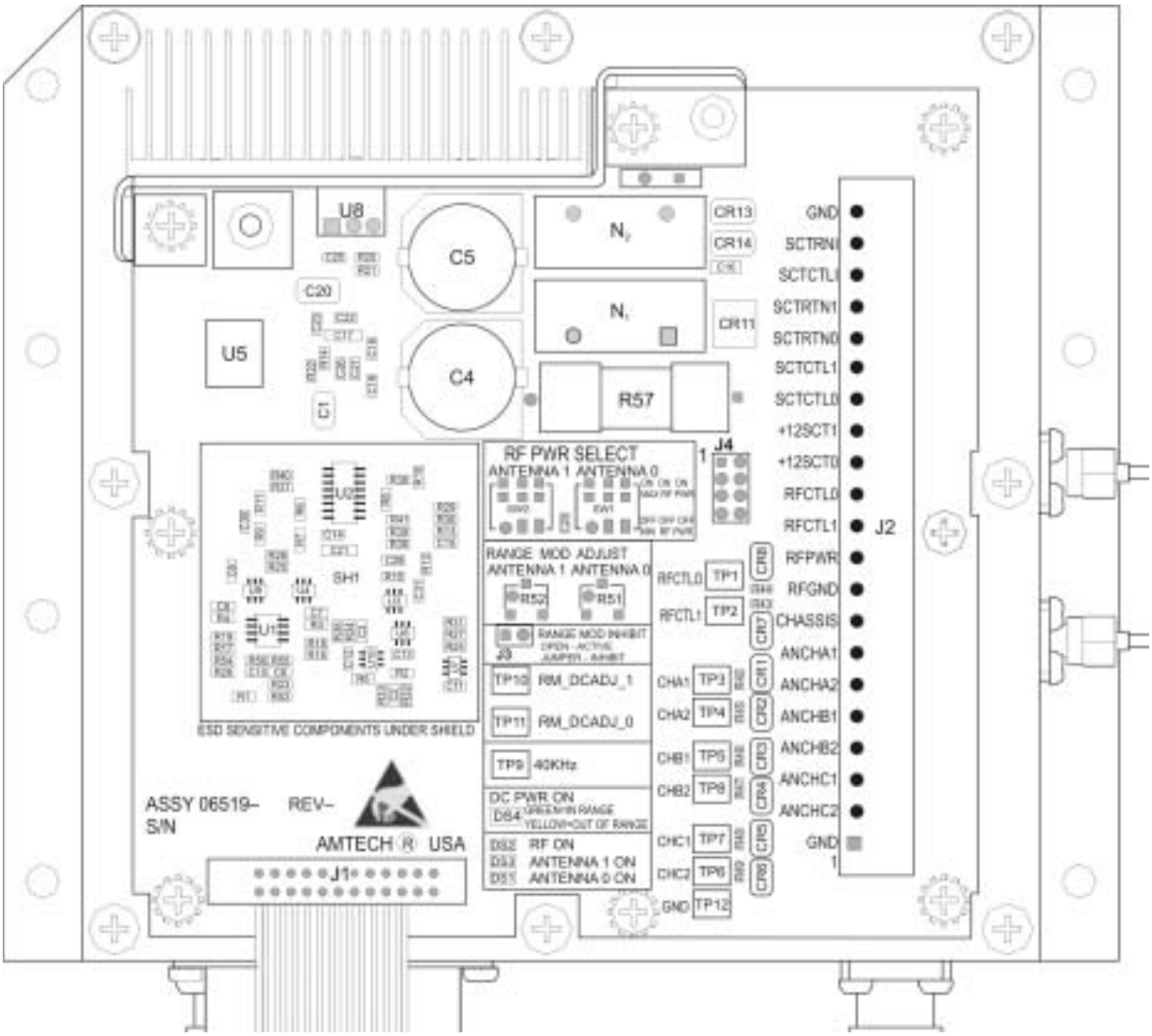

Figure 2-1 AR2200 RF Module I/O Interface

The RF module also receives and demodulates the reflected tag signal returned through the antenna, then preamplifies and conditions the demodulated signal before sending it to the reader. The RF module generates the RF power necessary to read an TransCore tag. It also contains receiver and preamplifier circuitry to preprocess the tag signal returned through the antenna. Once connected to the antenna and reader and tuned, the RF module should require no further mechanical adjustment by the user.

The RF module receives DC power through a cable connection made to the reader. A separate reader-to-RF module cable carries the demodulated tag signal from the RF module to the reader and the on/off control signal from the reader to the RF module

Note: *Long coaxial cable lengths between the RF module and antenna can degrade system performance and should be avoided in system configuration.*

RF output power is on whenever the reader is on. However, RF output power may be switched off through reader firmware commands. RF output power can also be controlled through interfacing proximity sensors with the reader. Proximity sensors allow RF output power to be switched on only in the presence of objects to be identified. Proximity sensors are useful in installations using battery power or where continuous RF output power is not desirable.

Increasing or decreasing the RF signal strength directly impacts the system's reading range. To confine the reading range to its optimal area, RF power can be independently adjusted, in eight steps, from +32.5 dBm to +25.5 dBm, for each antenna. You can adjust the RF power with RF power select switches on the RF module's input/output (I/O) interface.

Caution

Do not attempt to increase the RF signal strength. Contact TransCore if you think that you need to adjust the RF signal strength.

For ease of installation, the RF module is connected to the reader by cable attached to a removable 21-terminal plug.

Features

The RF module includes the features listed in this section.

Range Sensitivity Adjustment

Jumper JP1 can be jumpered to inhibit the effect of the range sensitivity adjustments. When JP1 is jumpered the maximum broadcast range will be ensured. This may be done when the RF module is used in a traffic monitoring system where the maximum size read zone is desired. Sensitivity circuit potentiometers, one for each antenna, access an infinite range of settings from maximum broadcast range (range sensitivity adjustment OFF, no mask signal injection) to maximum signal injection (minimum sensitivity).

ISO Compatible

The RF module meets the criteria for equipment configuration and performance specified by the International Organization for Standardization's DIS 10374 container identification standard.

Patented Design: High-Speed Signal Capture, Noise Immunity

The RF demodulation circuitry consists of a two-channel homodyne receiver patented by TransCore that prevents signal loss, allowing the system to read tags moving at high speeds. The differential aspect of the RF module design improves system immunity to noise.

Frequency Range

The RF module is available in a range of 865–930 MHz band frequencies (see Table 2-1).[1]

Table 2-1 AR2200 RF Module Options and Operating Frequency Bands

RF Module Option	Operating Frequency Band (MHz)
-01	865.0 to 869.5
-02	869.501 to 892.0
-03	892.001 to 908.5
-04	908.501 to 917.0
-05	917.001 to 930.0

The primary manufactured frequency for the RF module is 912 MHz. For multiple RF modules at one site, TransCore recommends using separate frequencies. TransCore can provide units operating at multiple frequencies in the authorized band.

Preamplifier Line Driver Output

The preamplifier provides balanced low-impedance analog signal lines capable of driving up to 1,000 ft (305 m) of cable. The preamplifier output incorporates electrostatic discharge protection.

Note: *Cable lengths over 500 ft (152.4 m) should be used with discretion; longer cables are more susceptible to receiving electrical noise. For more information on cables and cable lengths, refer to Chapter 6 of the AI1200 System Guide, "System Configuration."*

Connections

The RF module is connected to the reader through cable attached to a 21-terminal plug. The 21-terminal plug mates with a 21-terminal jack on the RF module interface board. The plug, removable for servicing, uses captive-screw compression terminals. The antenna coaxial cable connects to the RF module through an N-type connector on the side of the RF subassembly.

Circuit Protection

The RF module interface board filters DC power received from the reader and protects output circuitry from damage caused by transients on the cable between the reader and RF module.

International Safety Standards

The RF module complies with United States and international RF safety standards as specified by ANSI C95.1, IEC Pub 215 and 657, and NRPB.

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1. The authorized frequency bands in the United States are 902–904 and 909.75–921.75 MHz. Contact TransCore if your application requires a different operating frequency.

Output Power

The output power of the RF module is set at the factory to 1.6 W.

Options

The following two options are available for the RF module.

Harsh Environment Option

The RF module has a harsh environment option, which is vibration- and shock-resistant. The vibration specification for the harsh environment RF module is 2 g RMS from 5-500 Hz.

Custom Frequencies

The RF module can be set at the factory to operate at a discrete, narrow band frequency. This option avoids frequency interference from other closely-situated units operating at similar frequencies. If your application requires an operating frequency outside of the 902 to 904 MHz or 909.75 to 921.75 MHz bands, contact TransCore. Local laws apply in the determination of operating frequencies.

Replacement I/O Interface Board

The I/O interface board is the only replaceable part in the RF module. A ribbon cable to connect to the RF subassembly is permanently wired to the RF interface board.

Accessories

The following accessories are available for the RF module.

Attenuators

Five-watt 1- to 24-dB attenuators with N-type connectors are available from TransCore. Other attenuators may be available for specialized applications; contact TransCore for information. Power output can be reduced by up to 7 dB using the RF module's RF power output select feature.

Hex Key

The hex key, used for removal and installation of RF module and reader circuit boards, has a 0.16-in. (4-mm) hex cross-section and a 9.13-in. (230-mm) shaft.

Weatherproof Enclosure

The RF module may be housed in a weatherproof NEMA-4 enclosure ready for custom installation. Enclosure locking loops accept padlocks with a maximum 1/4-in.-(6.3-mm-) diameter shackle.

3

Installing the AR2200 RF Module

Chapter 3

Installing the AR2200 RF Module

This chapter presents information and procedures for mounting and installing a stand-alone RF module, or connecting one or two RF modules to a single AI1200- or AI1301-series Reader.

AR2200 RF Module Installation Options

The AR2200 RF Module can be installed in either of two ways:

- RF module enclosed in a standard NEMA box
- Custom installed using a TransCore standard mounting kit

Differences in Installation Options

NEMA Box — If you install the RF module in a NEMA box, TransCore recommends that the maximum operating temperature outside the NEMA enclosure not exceed 131°F (55°C).

Custom Installation — You may choose a custom installation for your stand-alone RF module. If you do, TransCore ***strongly*** recommends that you contact TransCore's TrAC (the telephone number is listed on page iii of this guide) to have your mounting option evaluated. TransCore recommends that the maximum outside temperature for this mounting option not exceed 158°F (70°C). You must use a baseplate that serves as a heat sink to lower the RF module temperature to an acceptable degree. You must have an air gap of at least 0.45 inches (1.1 cm) underneath the mounting baseplate. If you choose not to leave room for an air gap, you can install an additional metal plate under the baseplate.

Caution

If your custom installation setup does not meet TransCore recommended mounting constraints, temperatures above the maximum operating temperature may occur resulting in premature failure of the RF module.

AI1200 Reader Power Supply Upgrade

If you are using the RF module with an AI1200 Reader with TransCore standard AC power supply (P/N 47049-01, KEPCO ERX 15-4), you must replace that power supply with a new AC standard power assembly that incorporates a power supply with a higher current rating.

Configuring the RF Module

The RF module has a dual-antenna output and may be configured to operate in one of two modes: normal mode or compatibility mode. In normal mode, a single RF module with one or two antennas is connected to the reader through terminals identified as *0* and *1* on the RF module and the reader. In compatibility mode, two RF modules, each

operating one antenna, are connected to one reader with the first RF module connected to the reader through terminals identified as *0* and the second RF module connected to the reader through terminals identified as *1*.

Figure 3-1 depicts system configurations for normal mode and compatibility mode.

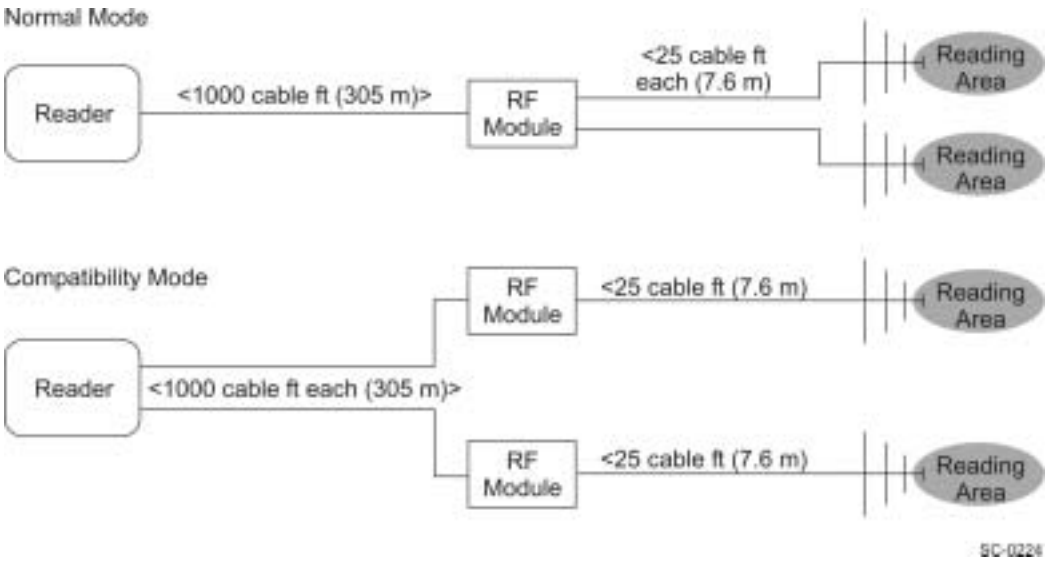

Figure 3-1 Normal Mode and Compatibility Mode Configurations

This section describes the necessary parts and tools, site preparation, and the procedure for installing an interrogator.

Required Wiring

Wire gauges are indicated in Table 3-1. All signal wiring should be twisted pair shielded.

Table 3-1 RF Module Minimum Wire Gauge Vs. Distance from Reader

Distance from Reader	Stranded Copper Wire (minimum gauge)
0 ft to 50 ft (0 m to 15.2 m)	AWG 18
50 ft to 100 ft (15.2 m to 30.5m)	AWG 16
100 ft to 250 ft (30.5 m to 76.2 m)	AWG 12
250 ft to 500 ft (76.2 m to 152.4 m)	AWG 10
500 ft to 750 ft (152.4 m to 228.6 m)	AWG 8
750 ft to 1000 ft (228.6 m to 305 m)	AWG 6

Required Equipment

- Voltmeter
- Oscilloscope, 100 MHz (for monitoring intermediate frequency [IF] signals and discriminate signals)
- Data terminal or computer
- Phillips and flat-blade screwdrivers
- N-type 50-ohm load (placed at the antenna port for testing)
- N-type attenuators (as needed to adjust RF power)

Positioning the RF Module

In permanent installations, position the RF module as close as possible to the antenna and within 1,000 signal cable ft (305 m) of the reader. Long cable lengths will increase system sensitivity to noise. Coaxial cable runs in excess of 50 ft (15.2 m) between the RF module and antenna are not recommended.[1] Longer signal cable connections (up to 1,000 cable ft) (305 m) should be made on the reader-to-RF module link.

Refer to the reader documentation for further information concerning RF module positioning.

Terminal Connections

The RF module plug and jack connector pair have 21 terminals. Connections from the reader are made to the removable plug. After connections are made, the plug can be removed from the jack for interface board servicing or repair/replacement.

Figure 3-2 shows the RF module terminal connections.

1. Based on 2 dB loss, Andrews LDF4-50A 0.5 in. OD coaxial cable. If 3 dB loss is tolerable, cable up to 75 ft (22.9 m) long may be used between the RF module and the antenna.

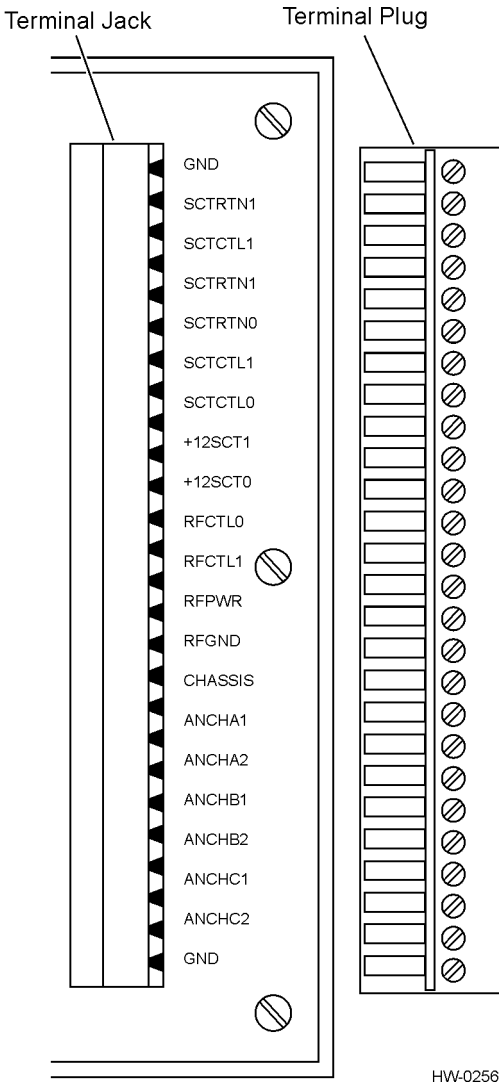

Figure 3-2 RF Module Terminal Connections

Grounding the RF Module

The CHASSIS terminal is electrically connected to case ground at the factory. Case ground must be connected to earth ground. TransCore does not recommend that a conduit connection be used as a grounding point. Ground points must make metal-to-metal connections.

Note: *TransCore does not recommend grounding the case through nonconducting finishes, such as paint, anodize, or irudite.*

Refer to the reader documentation for further information concerning grounding. The CHASSIS terminal jack is shown in Figure 3-2.

Terminal Designations

The jack and plug terminals are designated for use as listed in Table 3-2.

Table 3-2 Jack and Plug Terminal Designations

Designation	Purpose
GND	Chassis ground terminal
SCTRTNI	System check tag DC return input (RFGND from reader)
SCTCTLI	System check tag control input (AUXIO0 from reader)
SCTRTN1	System check tag DC return (RFGND)
SCTRTN0	System check tag DC return from check tag (RF module 0)
SCTCTL1	System check tag control line (RF module 1) [a]
SCTCTL0	System check tag control line (RF module 1)
+12SCT1	System check tag power for RF module 1 [b]
+12SCT0	System check tag 12 V DC power
RFCTL0	RF output control channel 0 (RF module 0)
RFCTL1	RF output control channel 1 (RF module 1) [b]
RFPWR	RF power
RFGND	RF ground
CHASSIS	Connection to NEMA ground Caution: Do not remove.
ANCHA1	IF signal A1
ANCHA2	IF signal A2
ANCHB1	IF signal B1
ANCHB2	IF signal B2
ANCHC1	IF signal C1
ANCHC2	IF signal C2
GND	Chassis ground terminal

a. Used only in compatibility mode.
b. For +12SCT1 and RFCTL1

Normal Mode Connections

In normal mode, only one RF module (with one or two antennas) is connected to a reader. Figure 3-3 shows the connections used for normal mode.

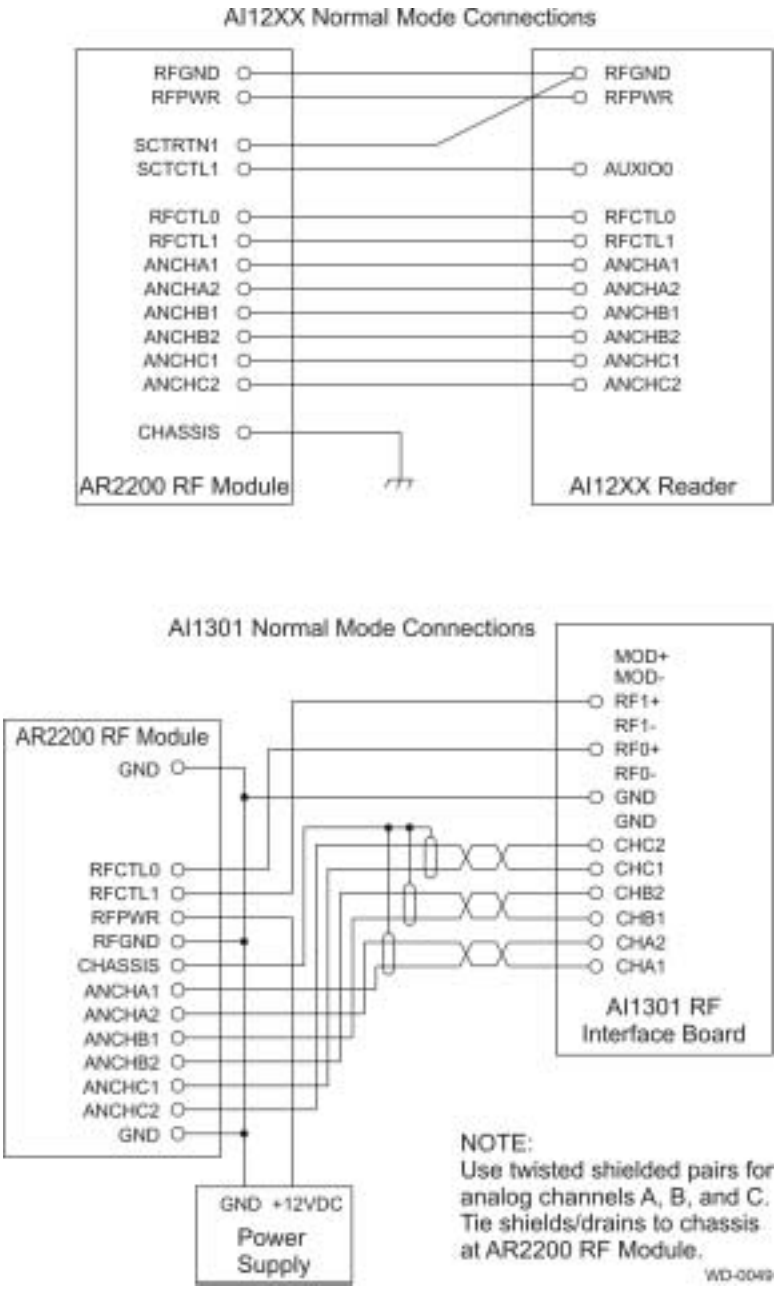

Figure 3-3 Normal Mode Connections

To install your RF module for operation in normal mode, follow these steps:

1. Turn off power to the RF module and the reader.
2. Connect wires between the RF module and the reader interface as shown in Table 3-3. Observe the maximum cable lengths shown in Table 3-4.

Table 3-3 Connecting Wires Between the RF Module and the Reader Interface

RF Module Signal	AI12XX Terminal	AI1301 RF Interface Board Terminal
RFGND	43	NA
RFPWR	42	NA
SCTRTNI	43	NA
SCTCTLI	36	NA
RFCTLO	40	10
RFCTL1	41	12
ANCHA1	45	1
ANACA2	46	2
ANCHB1	47	3
ANCHB2	48	4
ANCHC1	49	5
ANCHC2	50	6

Table 3-4 Maximum Cable Lengths for Power Wiring

Application	Cable Type (or equivalent)	Maximum Length
Power wiring	Belden 9364	120 ft (36.6 m)
Power wiring	Belden 9365	200 ft (61.0 m)
Power wiring	Belden 9366	300 ft (91.4 m)
Power wiring	Belden 9357	500 ft (152.4 m)
Power wiring	Manhattan 33867	500 ft (152.4 m)
Signal wiring	Belden 9775	500 ft (152.4 m)

1. Terminate cable shields at the reader end.
2. For AI1301 readers connect the RF module RFGND and RFPWR terminals to the +12 V RET (-) and +12 V DC terminals, respectively, of the panel terminal strip.

3. Terminate the two antennas output ports (located on the side of the RF subassembly below the internal ribbon cable) with a cable that is connected to an antenna or a 50-ohm, N-type, male load. The antenna output ports must be terminated before turning on power to the reader and RF module. Figure 3-4 shows the antenna output port locations.

Caution

Turning on RF power with an unterminated antenna port could result in damage to the RF module.

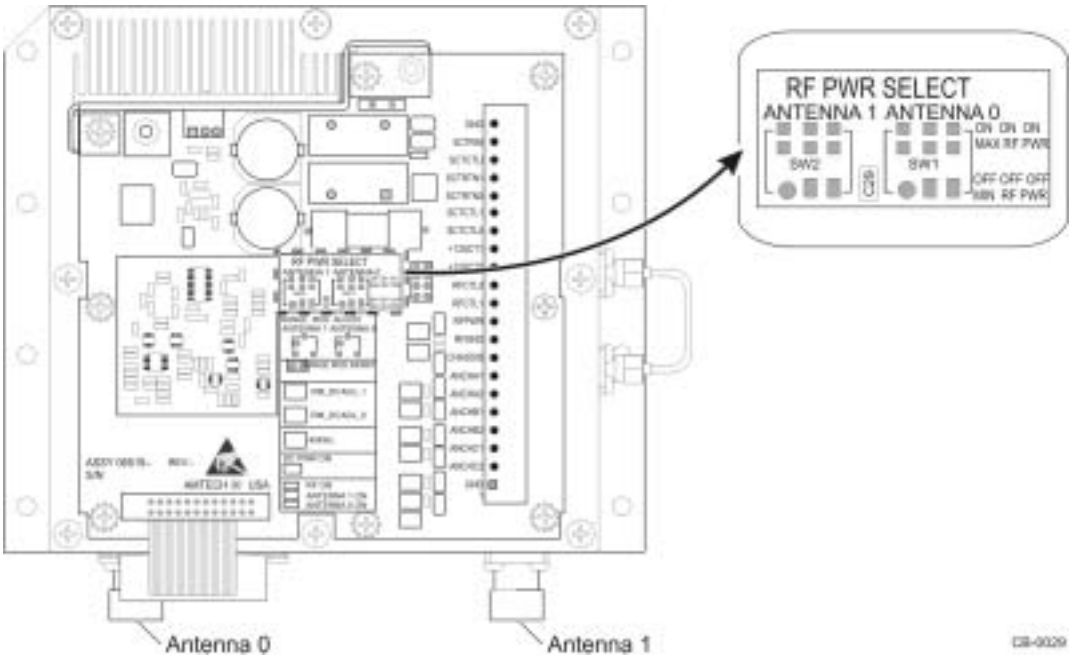

Figure 3-4 Antenna Output Port Locations

4. Connect the system check tag cable shown in Table 3-5. Observe the maximum cable length shown in Table 3-6.

Table 3-5 Connecting the Check Tag Cable

Check Tag Line	RF Module Terminal for AI12XX	AI1301
Red	+12SCTO	+12 V DC via panel terminal board
Black	SCTRTNO	+12 V RET (-) via panel terminal board
White	SCTCTLO	Terminal 8 of the RF interface board
Drain/shield	Do not terminate at RF source end. Cut flush with cable end at RF source.	

Table 3-6 Maximum Cable Length for Check Tag Cable

Application	Cable Type (or equivalent)	Maximum Length
Check tag cable	Belden 9773	100 ft (30.5 m)

Note: *Voltage standing wave ratio (VSWR) measurements at the antenna must be made. Readings should be in line with antenna specifications. See the technical specifications for the antenna for information on appropriate VSWR readings.*

Compatibility Mode Connections

In compatibility mode, two RF modules are connected to a single reader. In compatibility mode each RF module operates only one antenna.

All compatibility mode connections are made in parallel, with the exception of the RF control connections. Only one RF control line from the reader (RFCTL0 or RFCTL1) is connected to each RF module.

Figure 3-5 shows compatibility mode connections.

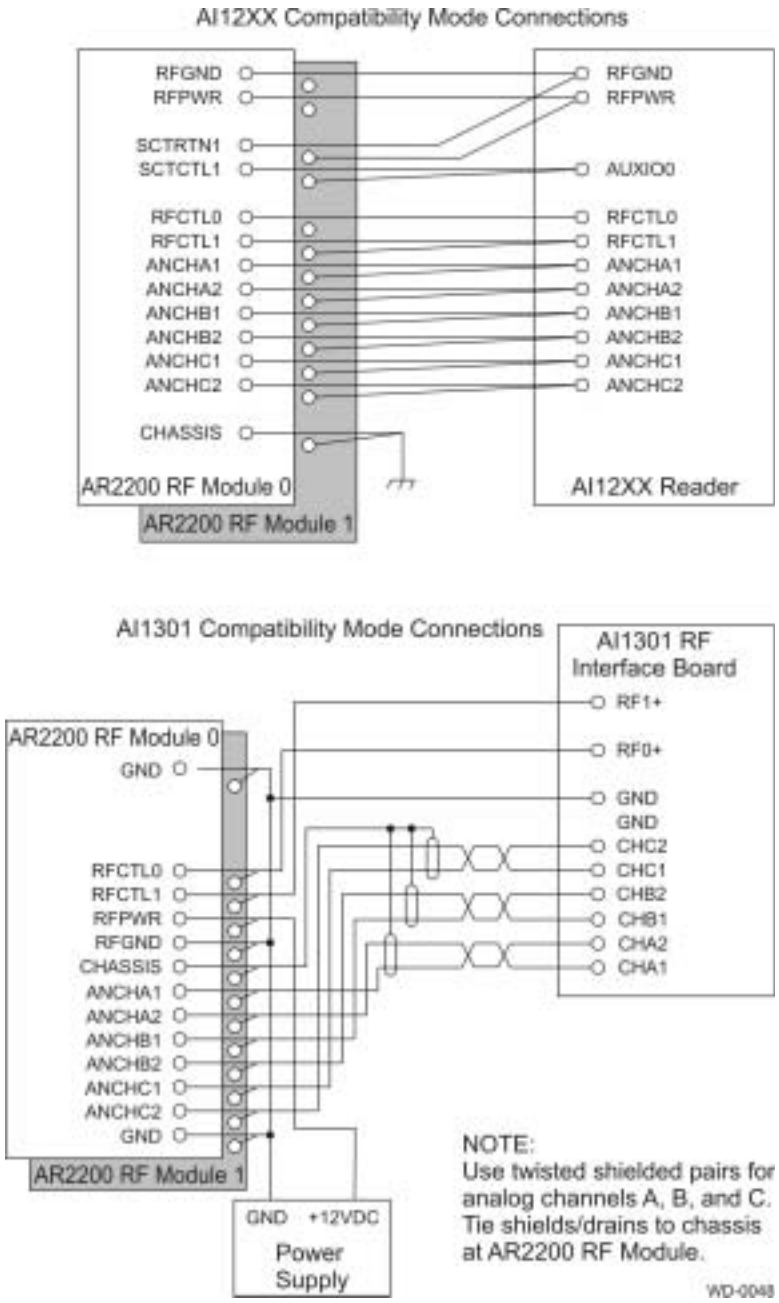

Figure 3-5 Compatibility Mode Connections

To install your RF module in compatibility mode, follow these steps:

1. Turn off power to the RF module and the reader.
2. Connect wires between the RF modules and the reader interface shown in Table 3-7. Observe the maximum cable lengths shown in Table 3-8.

Table 3-7 Connecting Wires Between the RF Modules and the Reader Interface

RF Module Signal	AI12XX Terminal	AI1301 RF Interface Board Terminal
RFGND	43	NA
RFPWR	42	NA
SCTRTNI	43	NA
SCTCTLI	36	NA
RFCTLO	40 (RF module 0 only)	10 (RF module 0 only)
RFCTL1	41(RF module 1 only)	12 (RF module 1 only)
ANCHA1	45	1
ANACA2	46	2
ANCHB1	47	3
ANCHB2	48	4
ANCHC1	49	5
ANCHC2	50	6

Table 3-8 Maximum Cable Lengths for Power Wiring and Signal Wiring

Application	Cable Type (or equivalent)	Maximum Length
Power wiring	Belden 9364	120 ft (36.6 m)
Power wiring	Belden 9365	200 ft (61.0 m)
Power wiring	Belden 9366	300 ft (91.4 m)
Power wiring	Belden 9357	500 ft (152.4 m)
Power wiring	Manhattan 33867	500 ft (152.4 m)
Signal wiring	Belden 9775	500 ft (152.4 m)

1. Terminate cable shields at the reader end.

2. For AI1301 readers connect the RF module RFGND and RFPWR terminals to the +12 V RET (-) and +12 V DC terminals, respectively, of the panel terminal strip.
3. Terminate the two antenna output ports (located on the side of the RF subassembly below the internal ribbon cable) with a cable that is connected to an antenna or a 50-ohm, N-type, male load as shown below.

RF module 0: ANTENNA 0 to antenna cable
ANTENNA 1 terminated with 50-ohm load

RF module 1: ANTENNA 0 terminated with 50-ohm load
ANTENNA 1 to antenna cable

The antenna output ports must be terminated before turning on power to the reader and RF module. Figure 3-4 on page 3-10 shows the antenna output port locations.

Caution

Turning on RF power with an unterminated antenna port could result in damage to the RF module.

1. Connect the system check tag cables as shown in Table 3-9. Observe the maximum cable length shown in Table 3-10.

Table 3-9 Connecting the System Check Tag Cables

Check Tag Line	RF Module Terminal for AI12XX	AI1301
Red	+12SCTO	+12 V DC via panel terminal board
Black	SCTRTNO	+12 V RET (-) via panel terminal board
White	SCTCTLO	Terminal 8 of the RF Interface Board
Drain/Shield	Do not terminate at RF source end. Cut flush with cable end at RF source.	

Table 3-10 Maximum Cable Lengths for Check Tag Cable

Application	Cable Type (or equivalent)	Maximum Length
Check tag cable	Belden 9773	100 ft (30.5 m)

Note: *Voltage standing wave ratio (VSWR) measurements at the antenna must be made. Readings should be in line with antenna specifications. See the antenna technical specifications for information on appropriate VSWR readings.*

4

Testing the RF Module

Chapter 4

Testing the RF Module

This chapter provides instructions for testing the installed RF module.
(Need required equipment, tools section here.)

After connecting terminals between the RF module and the reader, you should test the RF module. You will need an oscilloscope and a data terminal or computer connected to the AI1200 or AI1301 reader.

The RF module has 12 test points, numbered TP1 through TP12 as shown in Figure 4-1.

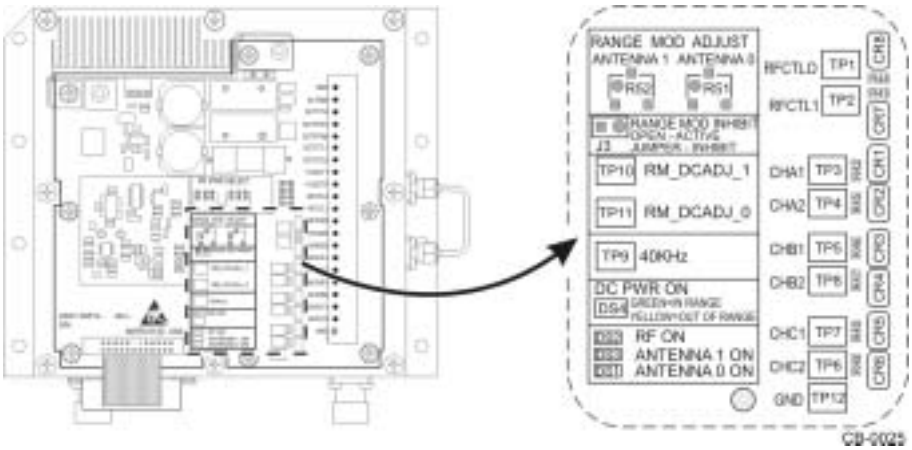

Figure 4-1 RF Board Test Points

The test points are defined in Table 4-1.

Table 4-1 Test Point Definition

Test Point	Purpose
3, 4 (CHA1, CHA2)	RF module analog signals A
5, 8 (CHB1, CHB2)	RF module analog signals B
7, 6 (CHC1, CHC2)	RF module analog signals C
9 (40 kHz)	Range modulator (unattenuated), 5-V square wave, 40 KHz
10 (RM_DC_ADJ1)	RF1 range adjust level, 5.0–4.0 VDC, with 4.0 VDC minimum sensitivity and 5.0 VDC maximum sensitivity
11 (RM_DC_ADJ0)	RF0 range adjust level, 5.0–4.0 VDC, with 4.0 VDC minimum sensitivity and 5.0 VDC maximum sensitivity
12 (GND)	Oscilloscope or digital multimeter ground point
2 (RCCTL1)	RF control line 1, output time on duration
1 (RFCTL0)	RF control line 0, output time on duration
J3 (RANGE MOD INHIBIT)	Shorted with jumper to disable modulation feature

For optimal RF module performance, verify the following criteria.

1. Power output is 1.6 W ±0.1 W measured when module is powered up and after 15 minutes.

Steps 4 & 5 values TBD according to J. Owerko.

2. IF signal noise is less than 90 mV and output port is terminated.
3. Measured output frequency is ±25 PPM of factory-tuned frequency.
4. IF signal range injection is set to approximately 180 mV, measured at IF signals.
5. DC level range injection is between 0 V DC and 1 V DC, measured at test points 8 and 9.

Setting Voltage

During initial testing, set the DC voltage level at the RF module to a minimum of 11.0 V DC with RF power on and a maximum of 13.5 VDC with RF power off. Make the adjustment to achieve this DC level at the reader power supply. Adjusting the DC voltage level compensates for the voltage drop within the DC power cable.

5

Indicator Lights

Chapter 5

Indicator Lights

This chapter describes the RF module's indicator lights.

The RF module has four LED indicators on the RF interface board, labeled as shown in Figure 5-1.

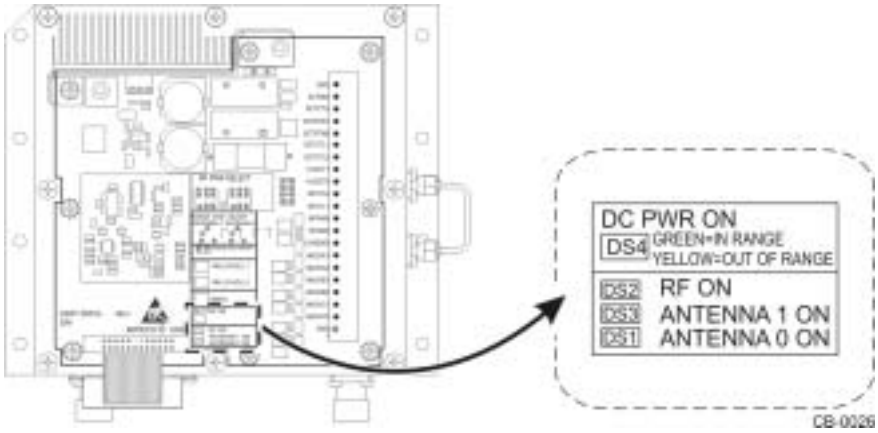

Figure 5-1 RF Module LED Indicators

Each indicator and its message are described in Table 5-1.

Table 5-1 LED Indicators and Messages

Indicator	Function	Color(s)	Message
DS4	DC PWR ON	Green/Yellow	DC input power Green–Input in range of 11.5 VDC to 13.5 VDC Yellow–Input out of range (<11.5 VDC, >13.5 VDC) OFF–PWR is off
DS2	RF ON	Red	12 VDC applied to RFPWR and RFGND
DS3	RF1 ON	Red	RF output channel 1 on * Do not disconnect antenna transmission line to RF output channel 1 when DS3 is on.
DS1	RF0 ON	Red	RF output channel 0 on * Do not disconnect antenna transmission line to RF output channel 0 when DS1 is on.

6

Adjusting RF Power

Chapter 6

Adjusting RF Power

This chapter explains how to adjust the RF power, if needed.

RF power may be independently reduced, when necessary, for each antenna port by selecting the desired output RF power level setting for the RF PWR Select dipswitches (SW2 or SW1) for Antenna 1 or Antenna 0. Figure 6-1 shows dipswitch locations.

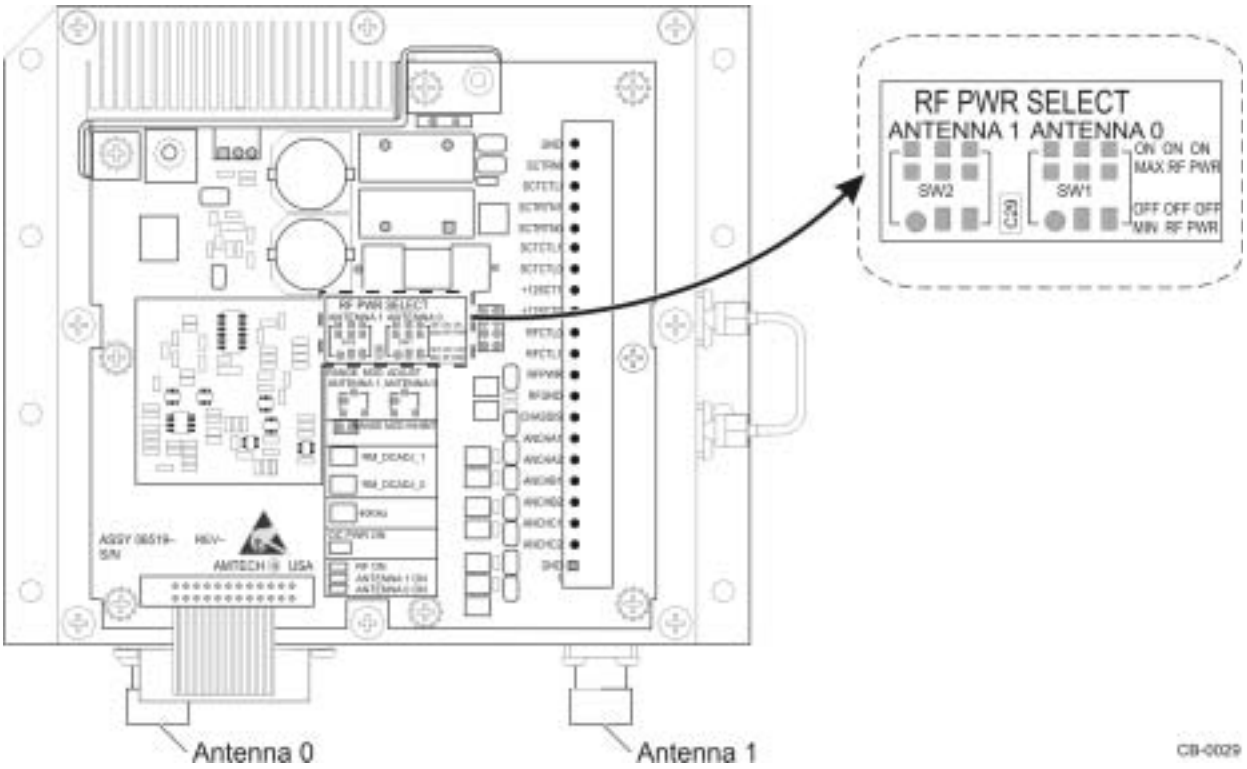

Figure 6-1 RF Power Select Dipswitch Locations

Independent RF power output level adjustments, for each antenna port, from +25.5 dBm to +32.5 dBm in 1-dB steps are specified in Table 6-1.

Table 6-1 RF Power Output Select Dipswitch Settings

RF PWR SELECT ANTENNA 1 or ANTENNA 0 DIPSWITCH SETTINGS			RF POWER OUTPUT ATTENUATION (dB)	NOMINAL RF POWER OUTPUT LEVEL (dBm)
POS 1 (LSB)	**POS 2**	**POS 3 (MSB)**		
ON	ON	ON	0 (maximum RF power output)	+32.5
OFF	ON	ON	1	+31.5
ON	OFF	ON	2	+30.5
OFF	OFF	ON	3	+29.5
ON	ON	OFF	4	+28.5
OFF	ON	OFF	5	+27.5
ON	OFF	OFF	6	+26.5
OFF	OFF	OFF	7 (minimum RF power output)	+25.5

The RF power can be further reduced (independently) for each antenna port by inserting external (fixed) attenuators between each antenna port and its associated antenna. This method of independent port power reduction reduceS receiver sensitivity (increasing attenuation reduces sensitivity). For any application requiring the addition of external (fixed) attenuators, the power rating of the attenuators should be at least twice the transmitted power.

7

Range Modulation Sensitivity Adjustment

Chapter 7

Range Modulation Sensitivity Adjustment

This chapter explains how to adjust the AR2200 RF Module's range modulation sensitivity to screen unwanted tag signals.

The range modulation sensitivity adjustment feature of the RF module is used to screen unwanted tag signals without decreasing RF power. This feature reduces the system's reading range and the difference between peak and continuous read sensitivity.

Using the range modulation feature you can independently reduce the receiver sensitivity levels for Antenna Port 1 or Antenna Port 0 via two 14-turn continuously adjustable potentiometers (one for each antenna port). You can enable the range modulation by removing programming jumper J3 (Figure 7-1). Entailing J3 inhibits the range modulation.

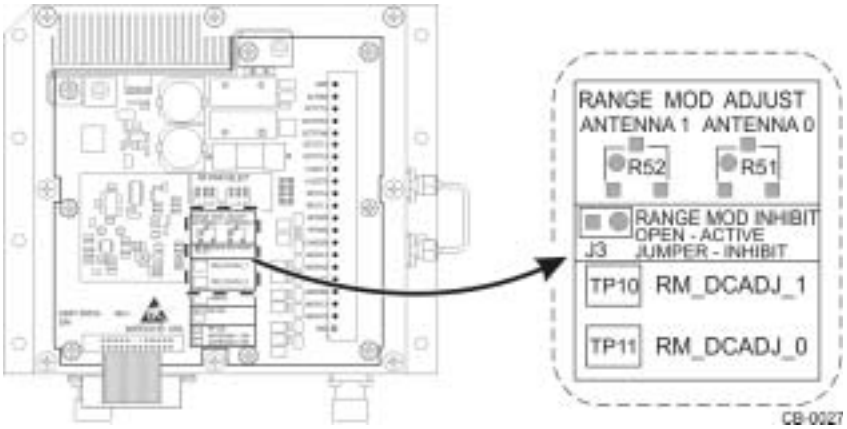

Figure 7-1 Range Modulation Sensitivity Potentiometers

You can enable or disable the range modulation using the two-position programming jumper, J3 (Figure 7-1). Installing the jumper disables the range modulation. Removing the jumper enables range modulation.

You can make continuos and independent adjustment for each antenna port via two 14-turn continuously adjustable potentiometers (one for each port) that are located on the I/O Interface (Figure 7-1). The potentiometers specifics are as follows:

- Antenna Port 1 range modulation sensitivity adjustment: R52 (ANTENNA1)
- Antenna Port 0 range modulation sensitivity adjustment: R51 (ANTENNA0)

To adjust read sensitivity, insert a small flat-blade screwdriver into the potentiometer slot for the appropriate antenna and rotate the potentiometer fully counter-clockwise for maximum receiver sensitivity/read range or fully clockwise for minimum receiver sensitivity/read range.

The sensitivity range parameters are as follows:

- RM_DCADJ_1, RM_DCADJ_0 = 5.0V DC, maximum sensitivity/read range
- RM_DCADJ_1, RM_DCADJ_0 = 4.0V DC, minimum sensitivity/read range

The resulting reduction in receiver sensitivity is as follows:

- 0 dB to 20 dB (minimum)
- 0 dB to 30 dB (nominal)

The range sensitivity adjustment does not cover the system's entire tag reading capability, or dynamic range. For some installations, you may need to reduce RF power in conjunction with range sensitivity adjustment to achieve the desired results. Experiment with both RF power attenuation and range sensitivity adjustment to achieve the optimal read range.

A

AR2200 Technical Specifications

Appendix A
Technical Specifications

This appendix provides reference information for the AR2200 RF Module.

Component Specifications

This appendix describes the engineering specifications for the AR2200 RF Module.

Electrical Specifications

Table A-1 shows the electrical requirements for the AR2200 RF Module.

Table A-1 AR2200 RF Module Electrical Requirements

Characteristic	Specification
Input power	12 VDC
Power consumption	40 W maximum
Power connection	3-pin connector

Environmental Specifications

The AR2200 RF Module can withstand the environmental conditions shown in Table A-2.

Table A-2 AR2200 RF Module Environmental Specifications

Environment	Specification
Shock	5 G ½-sine pulse, 10 ms duration, 3 axes
Vibration	1.0 G_{rms} 10 to 500 Hz
Operating temperature	-40° to +167°F (-40° to +75°C)
Humidity	95% noncondensing

Physical Specifications

Table A-3 lists the physical specifications of the AR2200 RF Module.

Table A-3 AR2200 RF Module Physical Specifications

Specification	Value
Size	13.5 x 13.0 x 6.36 in (34.3 x 33.0 x 16.2 cm)
Weight	22 lb (10 kg)