

FreeWave Technologies, Inc.

I-Series Radios User Manual Addendum Installation Manual

The FreeWave Technologies 2.4 GHz I-Series transceivers operate in substantially the same manner as the 900 MHz DGRO9 radio transceiver module. They may be operated in Point-to-Point, Multipoint, and Repeater modes.

The one difference is that ***all I-Series transceivers must be installed professionally.***

-Series transceiver installation steps

To install the I Series transceiver, follow the basic steps given below.

1. Mount the transceiver to the flat, stable surface using mounting holes in the corners of the transceiver.
2. Install the antenna and connect the antenna feedline to the transceiver. If you are installing a directional antenna, preset the antenna's direction appropriately.
3. Connect a computer to the transceiver's RS232 port (please, refer to the part D of this addendum for more information about the transceiver's pin assignment). This computer will be used to set the radio's configurations.
4. Install the power for the radio.
5. Set the radio configuration according to the system topology and data terminal equipment requirements. Default transceiver settings allow user to do a quick installation without major changes in transceiver's configuration. But there is one parameter that ***must be considered for a new installation transceivers power output settings.***

Transceiver output power level *must be* satisfy FCC maximum EIRP requirement depending on the antenna used, antenna cable loss

FreeWave I- *must be* provided by FreeWave Technologies. FreeWave I external antennas, with both bracket and magnetic mounts. The complete list of antennas available from FreeWave characteristics is given in the table below.

Gain	Manufacturer	Manufacturer Model Number	FreeWave Model Number
14 dB, directional	Mobile Mark	SCR14-2400	EAN2414CR
Adjustable gain, 17 dB max, directional	Maxrad	MSP24013MB	EAN2417CR
5 dB, omnidirectional	Maxrad	MAXC24505	EAN2405WC
0 dB, omnidirectional	MobileMark	PSTN3-2400N	EAN2400NH

Per FCC regulations maximum permissible EIRP of the communication devices in the 2.4 GHz frequency band is limited differently depending on the communication system configuration (Point-to-Point or Point-to-Multipoint). Therefore, please be advised that ***it is installer responsibility to ensure that the I-Series transceivers installed according to the guidelines listed below depending on the system configuration. It is also installer's responsibility to assure that the emission limits are not exceeded.***

WARNING: Any antennas placed outdoors must be properly grounded. Use extreme caution when installing antennas and follow all instructions included with the antennas.

The output power of the I-Series radio transceivers can be adjusted by changing "RFXmit Power" settings on the radio. Table below shows correlation between the "RFXmit Power" settings and output power of the transceiver.

RFXmit Power settings on the radio	Transceiver's output power	
	dBm	mW
9	27	500
8	26.5	450
7	25.7	375
6	24.5	280
5	22.5	180
4	20	100
3	15.6	40
2	7	5
1		0
0		0

Required "RFXmit Power" settings for each of the antennas provided by FreeWave are given in the next section of this document. To configure the Power Output Level from the transceiver follow the steps below:

- ✓ Start "Hyper Terminal" program on the computer connected to the transceiver's RS232 port (refer to the User Manual for the "Hyper Terminal" setup instructions).
- ✓ Press setup switch on the I-Series transceiver.
- ✓ Choose option number "3" from the Main Menu which appeared on the "Hyper Terminal" window.

- ✓ Choose option number “5” from the “Radio Modem Parameters” menu followed by the settings an appropriate RFXmitPower value, which was defined from the previous transceiver installation procedure.
6. Repeat the steps above for each I-Series transceiver in the network.

B. Antenna installation requirements

This section describes what settings can be used on the I-Series transceiver if one of the provided by FreeWave Technologies antennas is used.

B.1. “Maxrad” MSP24013MB antenna.

The gain of this antenna depends on the beamwidth selected during the installation. Below is the table showing the dependency between the selected beamwidth of the antenna and its gain.

Selected Beamwidth	Gain of the antenna, dB
45 deg	17
60 deg	16
90 deg	14
120 deg	13

Please refer to the antenna installation manual provided by “Maxrad” for the beamwidth selection details.

Table B.1.1 and Table B.1.2 below show how the RFXmitPower settings on the radio correspond to the EIRP of the transceiver-cable-antenna combination for the MSP24013 MB antenna for the Point-to-Point and Point-to-Multipoint system configurations.

Table B.1.1: Maximum “RFXmit Power” settings allowed for “Maxrad” MSP24013MB antenna when used in Point-to-Point system.

	Antenna gain / Beamwidth selected															
	17 dB / 45 deg				16 dB / 60 deg				14 dB / 90 deg				13 dB/120 deg			
	Cable loss, dB				Cable loss, dB				Cable loss, dB				Cable loss, dB			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Maximum “RFXmit Power” settings allowed	7	9	9	9	7	9	9	9	9	9	9	9	9	9	9	9

Table B.1.2: Maximum “RFXmit Power” settings allowed for “Maxrad” MSP24013MB antenna when used in Point-to-Multipoint system.

	Antenna gain / Beamwidth selected															
	17 dB / 45 deg				16 dB / 60 deg				14 dB / 90 deg				13 dB/120 deg			
	Cable loss, dB				Cable loss, dB				Cable loss, dB				Cable loss, dB			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Maximum “RFXmit Power” settings allowed	4	4	4	5	4	4	5	5	5	5	6	7	5	6	7	9

B.2. “Mobile Mark” SCR14-2400 antenna.

Table B.2.1 below shows how the RFXmitPower settings on the radio correspond to the EIRP of the transceiver-cable-antenna combination for the SCR14-2400 antenna at different cable loss values if the communication system is Point-to-Multipoint.

Table B.2.1: EIRP for SCR14-2400 Antenna, Cable loss vs “RFXmit Power” Setting for Point-to-Multipoint systems.

		Cable Loss				
		1dB	2dB	3dB	4dB	5 dB
RF Xmit Power	9	40.00	39.00	38.00	37.00	36.00
	8	39.50	38.50	37.50	36.50	35.50
	7	38.75	37.75	36.75	35.75	34.75
	6	37.50	36.50	35.50	34.50	33.50
	5	35.50	34.50	33.50	32.50	31.50

Table B.2.2 below shows how the RFXmitPower settings on the radio correspond to the EIRP of the transceiver-cable-antenna combination for the SCR14-2400 antenna at different cable loss values if the communication system is Point-to-Point.

Table B.2.2: EIRP for SCR14-2400 Antenna, Cable loss vs “RFXmit Power” Setting for Point-to-Point systems.

		Cable Loss			
		1dB	2dB	3dB	4dB
RF Xmit Power	9	40.00	39.00	38.00	37.00
	8	39.50	38.50	37.50	36.50
	7	38.75	37.75	36.75	35.75
	6	37.50	36.50	35.50	34.50
	5	35.50	34.50	33.50	32.50

Shaded area indicates combinations where EIRP limitations exceed FCC regulations and RF Xmit Power must be reduced.

B.3. “Maxrad” MAXC24505 antenna.

Table B.3.1 below is similar to the Tables B.2.1 and B.2.2, but for the MAXC24505 antenna to be used in either Point-to-Point or Point-to-Multipoint systems.

Table B.3.1: EIRP for MAXC24505 Antenna, Cable loss vs RF Xmit Power Setting for Point-to-Point and Point-to-Multipoint systems.

		Cable Loss			
		1dB	2dB	3dB	4dB
RF Xmit Power	9	31.00	30.00	29.00	28.00
	8	30.50	29.50	28.50	27.50
	7	29.75	28.75	27.75	26.75
	6	28.50	27.50	26.50	25.50
	5	26.50	25.50	24.50	23.50

B.4. “Mobile Mark” PSTN3-2400N antenna.

Table B.4.1 below shows the EIRP if the PSTN3-2400N antenna is used in either Point-to-Point or Point-to-Multipoint systems.

Table B.4.1: EIRP for PSTN3-2400N Antenna, Cable loss vs RF Xmit Power Setting for Point-to-Point and Point-to-Multipoint systems.

		Cable Loss			
		1dB	2dB	3dB	4dB
RF Xmit Power	9	26.00	25.00	24.00	23.00
	8	25.50	24.50	23.50	22.50
	7	24.75	23.75	22.75	21.75
	6	23.50	22.50	21.50	20.50
	5	21.50	20.50	19.50	18.50

C. Transceiver Location

Placement of your I-Series FreeWave unit is likely to have a significant impact on its performance. In general the rule of thumb with FreeWave is that the higher the placement of the antenna the better the communication link - height is everything! In practice you should also place the transceiver away from computers, telephones, answering machines, and other similar equipment. To improve the data link, FreeWave Technologies offers directional and omnidirectional antennas with cable lengths ranging from 3 to 200 feet.

When using an external antenna, placement of that antenna is critical to a solid data link. Other antennas in close proximity are a potential source of interference; use the Radio Statistics to help identify potential problems. It is also possible that slight adjustments in antenna placement (as little as 2 feet) will solve noise problems. In extreme cases, such as when the transceiver is located close to Pager or Cellular Telephone transmission towers, FreeWave offers a band pass filter to reduce the out of band noise.

The I-Series does not provide protection against water or environmental hazards, and will fade when placed in direct sunlight. For outdoor applications I-Series may not be used. Please, contact FreeWave Technologies for more information in this respect.

D. Pin Assignments

The I-Series transceiver uses standard RS232 polarity and voltage levels for all of the RS232 signal lines (DTR, Transmit Data, Receive Data, Carrier Detect, RTS, and Clear to Send).

Table D.1: I-800 Series
Pinout

Pin	Assignment
1	Carrier Detect (CD)
2	Transmit Data
3	Receive Data
4	Data Terminal Ready (DTR)
5	Ground
6	Data Set Ready (DSR)
7	Ready To Send (RTS)
8	Clear To Send (CTS)
9	Ground

Table D.2: I-900 Series
Pinout

Pin	Assignment
1	Carrier Detect (CD)
2	Transmit Data
3	Receive Data
4	Data Terminal Ready (DTR)
5	Ground
6	Data Set Ready (DSR)
7	Ready To Send (RTS)
8	Clear To Send (CTS)
9	Power Ground
10	B+
11	Shield Ground

E. Power Connection

The I-Series transceiver can be operated from any well-filtered 9.5-30 VDC power source. The power source should be capable of providing at least 0.6 amperes of continuous current.

Transceiver is designed to operate in negative ground systems only