2.4 GHz Wireless Data Transceivers

Installation Guide

Part Number: LIG0002AC
Revision: E
Last Updated: 08/12/2013

Safety Information

Warning! ***Do not*** remove or insert diagnostics cable while circuit is live.

Warranty

FreeWave Technologies, Inc. warrants your FreeWave® Wireless Data Transceiver against defects in materials and manufacturing for a period of two or three years, depending on model from the date of shipment, depending on model number. In the event of a Product failure due to materials or workmanship, FreeWave will, at its discretion, repair or replace the Product. For evaluation of Warranty coverage, return the Product to FreeWave upon receiving a Return Material Authorization (RMA).

In no event will FreeWave Technologies, Inc., its suppliers, or its licensors be liable for any damages arising from the use of or inability to use this Product. This includes business interruption, loss of business information, or other loss which may arise from the use of this Product. OEM customer's warranty periods can vary.

Warranty Policy will **not apply** in the following circumstances:

1. If Product repair, adjustments, or parts replacements are required due to accident, neglect, or undue physical, electrical, or electromagnetic stress.
2. If Product is used outside of FreeWave specifications as stated in the Product's data sheet.
3. If Product has been modified, repaired, or altered by Customer unless FreeWave specifically authorized such alterations in each instance in writing. This includes the addition of conformal coating.

Special Rate Replacement Option

A special rate replacement option is offered to non-warranty returns or upgrades. The option to purchase the replacement unit at this special rate is only valid for that RMA. The special replacement rate option expires if not exercised within 30 days of final disposition of RMA.

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UL Notifications

Models GX-C, GX-CE, and GX-T are suitable for use in Class 1, Division 2, Groups A, B, C, and D or non-hazardous locations only. Do not connect or disconnect any connectors while the circuit is live.

Warning! EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

Warning! DO NOT REMOVE OR INSERT THE DIAGNOSTICS CABLE WHILE THE CIRCUIT IS LIVE.

Input voltage for the models listed above is +6.0 to +30.0 VDC.

Important: Input power shall be derived from a single Class 2 power source.

FCC Notifications

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

The content of this guide covers FreeWave Technologies, Inc. models sold under FCC ID: KNY-1521131FFF (I2 series) and KNY-715712152112 (GX series).

All models sold under the FCC ID(s) listed above must be installed professionally and are only approved for use when installed in devices produced by FreeWave Technologies or third party OEMs with the express written approval of FreeWave Technologies, Inc. Changes or modifications should not be made to the device.

Warning! The I2 series and GX series transceivers have a maximum transmitted output power of 500 mW. It is recommended that the transmit antenna be kept at least 20 cm away from nearby persons to satisfy FCC exposure requirements.

The models described in this guide must be installed in a NEMA enclosure. When any FreeWave Technologies, Inc. module is placed inside an enclosure, a label must be placed on the outside of the enclosure. The label must include the text "Contains FCC ID: KNY-1521131FFF (I2 series) and KNY-715712152112 (GX series)."

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About This Installation Guide

This guide provides basic installation information for FreeWave 2.4 GHz transceivers in a non-OEM environment including the following:

- The equipment and tools required for installation.
- Best practices for choosing a location for the transceivers in the network.
- Transceiver mounting instructions.
- Approved antennas and general antenna installation information.
- Power considerations.
- Required parameter settings for quick setup.
- Waterproofing instructions.

The contents of this guide describes how to install the transceiver into the NEMA 4 enclosure, connect it to an antenna, power considerations, configuration settings for quick setup, and how to waterproof external connections.

This guide does not include instructions for installing ground rods or surge suppressors, or any item that FreeWave does not supply. Each of these components can be essential for the continued operation and protection of your system. For information about installing these components at your site, see the component manufacturer's installation documentation.

This guide covers only information required for installation. Information about how to access the transceiver's configuration menus and descriptions of each configuration setting are provided in the *User Manual and Reference Guide* for the product you are installing. FreeWave documentation is available on the *User Manual and System Tools CD* and at www.FreeWave.com.

Assumptions

The content of this guide assumes that you have knowledge of electronics, electricity, and safety when dealing with electrical components. This guide also assumes that you have knowledge of FreeWave transceivers and how to program the configuration parameters.

Notational Conventions

This document uses the following notational conventions:

- **Bold** - Indicates items that you select, parameter settings, and parameter names.
- **Warning!** - Indicates a situation that may cause damage to the transceiver, data, or network.
- - Provides time saving or informative suggestions about using the product.

Contacting FreeWave Technical Support

For up-to-date troubleshooting information, check the Support page at www.FreeWave.com.

FreeWave provides technical support Monday through Friday, 7:30 AM to 5:30 PM Mountain Time (GMT -7). Call toll-free at 1.866.923.6168, within Colorado call 303.381.9200, or contact us through email at moreinfo@freewave.com.

Documentation Feedback

Send comments or questions about this document's content to techpubs@freewave.com. Include the title of the document or the document's part number and revision letter (found in the footer) in your email.

Equipment and Tools Required for Installation

The following equipment and tools are required for installation:

- Permits required for the installation site.
- FreeWave transceiver and its mounting bracket.
- Ground rod, wire, and clamp (available at electronic supply stores).
- National Electrical Manufacturers Association (NEMA) 4 industrial enclosure.
- The proper antenna for your installation. For information about approved antennas for use with FreeWave transceivers, see "Approved Antennas" на стр. 10.
- Outdoor coaxial cable for antenna installation.
- Interior cables for data and power, available for purchase from FreeWave.
- Cable ties.
- Coaxial surge suppressor.
- Waterproofing coax-sealant, foam, or mastic tape.
- Electrical tape.
- Electrical coating (if using foam or mastic tape for waterproofing).
- Laptop with Tool Suite or a terminal emulator installed to program the transceiver. The latest version of Tool Suite is available on www.FreeWave.com.
- Serial cable or serial-to-USB converter cable.
- Diagnostics cable.
- Spare wire for loop back tests.
- Screwdriver.
- Pliers.
- This installation guide.
- The user manual associated with the transceiver model you are installing. FreeWave documentation is available on the *User Manual and System Tools* CD and at www.FreeWave.com.

Transceiver Installation Overview

To successfully install a transceiver, follow the basic steps listed below.

1. Determine the best location for the transceiver.
2. Install the ground rod.
3. Install the NEMA 4 enclosure
4. Mount the transceiver and power supply into the enclosure.
5. Route data cables to the end device.
6. Connect power and configure the transceiver.
7. Install the antenna.
8. Connect a surge suppressor between the external antenna cable and interior cable connected to the transceiver's RF connector..
9. Waterproof all external connections.

Choosing a Location for the Transceiver

Placement of the FreeWave transceiver is likely to have a significant impact on its performance. The key to the overall robustness of the RF link is the height of the antenna. 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. In general, FreeWave units with a higher antenna placement will have a better communications link. In practice, the transceiver should be placed away from computers, telephones, answering machines, and other similar devices. FreeWave Technologies, Inc. offers directional and Omni directional antennas with cable lengths ranging from 3 to 200 feet.

The Show Radio Statistics page is found in option 4 in the main terminal menu or in the Diagnostic information in Tool Suite. An adjustment as little as 2 feet in antenna placement may resolve some noise issues.

Installing the NEMA Enclosure

The NEMA enclosure selected for the installation site should be a NEMA-4 rated enclosure. NEMA 4 enclosures are gasketed and the door is clamped for maximum sealing. NEMA 4 enclosures are available in sizes from small wall mounts to two-door floor mount models. The selection depends on the requirements of the particular installation and the amount of equipment to be placed inside.

Follow the installation instructions provided with the NEMA enclosure, ensuring that no holes are drilled on the top of the enclosure. Holes on the top of the enclosure can allow moisture and other elements into the enclosure. Ensure holes on the sides and bottom are waterproofed.

Mounting the Transceiver in the NEMA Enclosure

FreeWave transceivers have several mounting options including metal plates, din rail clips, and brackets. When mounting any transceiver, ensure that it is mounted to a flat, stable surface using the mounting bracket or the mounting holes in the corners of board-level transceivers.

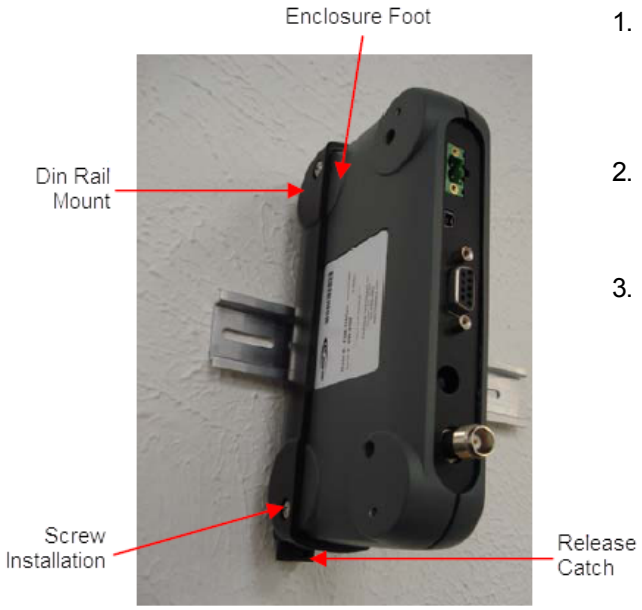
Warning! Do not use Velcro to mount the transceiver. Attaching and detaching Velcro pieces creates an electro-static discharge that may damage the transceiver's circuitry, or other electronic devices nearby. Mounting a transceiver to a metal surface may result in an electrical short across the transceiver. Removing Velcro also creates stress points on board-level transceivers with a great potential to damage the solder points.

Ruggedized Gannet Enclosure Din Rail Mounting Instructions (MBRK-DIN-N)

The FreeWave MBRK-DIN-N Din Rail Mounting Bracket Kit is available to mount transceivers in the dark gray ruggedized Gannet enclosure. The mounting kit ships with the following hardware:

- 1 - Din rail mount
- 2 - 6-32 x 1/4 inch truss head screws

Depending on the din rail setup, it may be helpful to note the transceiver's serial number and any other information needed from the transceiver's label. The transceiver snaps out of the mount if you require access to the label information at a later time.



1. Slide the din rail mount over the rear of the enclosure, ensuring the din rail mount is correctly oriented so the cut outs for the feet match up with the feet on the transceiver.
2. Align the holes on the din rail mount with those on the transceiver. Secure the transceiver to the din rail mount using the truss head screws provided.
3. Attach the transceiver in its din rail mount to the din rail.

   The din rail mount is designed to allow the transceiver to be fitted with the LEDs facing to the left or the right. The only difference is the location of the release catch either at the top or at the bottom.

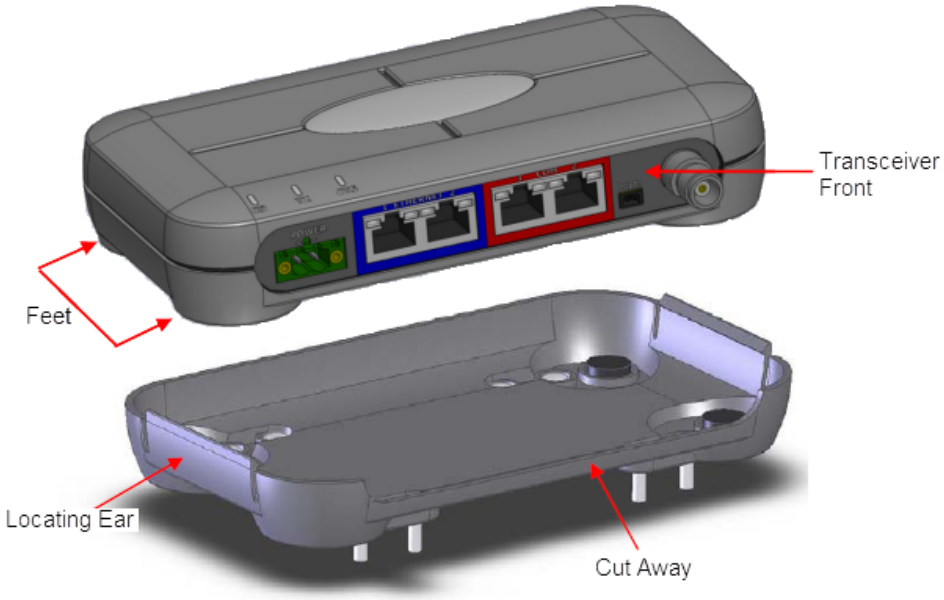
To remove the assembly from the din rail mount, insert a small screwdriver into the leverage point on the end of the release catch and push down lightly approximately 0.25 inches (12.70 mm). The clamp releases and the assembly can be lifted off.

Ruggedized Gannet Enclosure Mounting Shoe Instructions (MHS-WMS)

The FreeWave MHS-WMS Gannet Enclosure Mounting Shoe is available to mount transceivers in the dark gray ruggedized Gannet enclosure. The mounting kit ships with the following hardware:

- 1 - Mounting shoe
- 4 - #8 x 3/4 inch self tapping screws

Depending on your setup, it may be helpful to note the transceiver's serial number and any other information needed from the transceiver's label. The transceiver snaps out of the mounting shoe if you need to access the label information at a later time.



The mounting shoe is designed to securely grip the transceiver, allowing it to be mounted either horizontally or vertically.

1. Secure the mounting shoe to the desired surface following the hole patterns and using the four self-tapping screws provided.

   Ensure the mounting shoe is oriented with the cut-away so that the front of the transceiver is facing the required direction.

2. Snap the transceiver feet into place in the shoe, ensuring the front of the transceiver aligns with the cut-away.

To remove the transceiver from the mounting shoe, push one of the locating ears outward and remove the transceiver from the shoe.

Board-Level and Ruggedized Enclosure Din Rail Mounting Instructions (MBRK-DIN-K)

The FreeWave MBRK-DIN-K Din Rail Mounting Bracket Kit is available to mount a board-level transceiver or a transceiver in the light gray ruggedized or waterproof enclosure. The mounting kit ships with the following hardware:

- Rail guide
- 8 - 4 lock washers

- 8 - 4-40 x 1/4 inch screws
- 4 - standoffs

Important: Prior to mounting the bracket to an enclosed transceiver, note the transceiver's serial number and any other information you might need from the transceiver's label. After the bracket is attached to the transceiver, the label is no longer accessible without unscrewing the bracket in its entirety.

After installation, you can retrieve the serial number from the transceiver by reading the device within Tool Suite or accessing the transceiver's setup menu using a terminal emulator.

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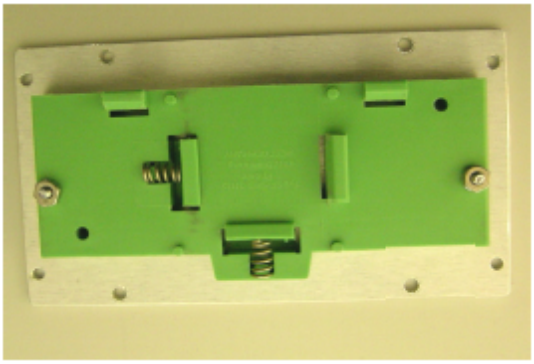
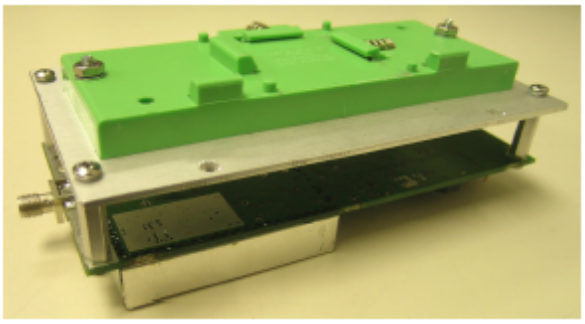
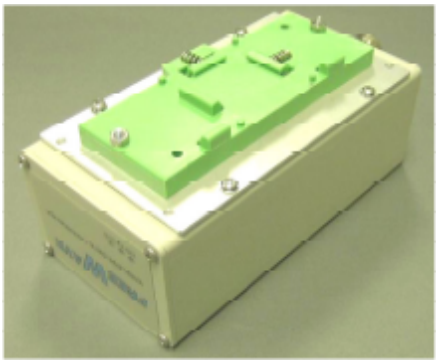
1. Mount with the rail guide slots facing out and the spring loaded guide, into which the rail is inserted, facing down:



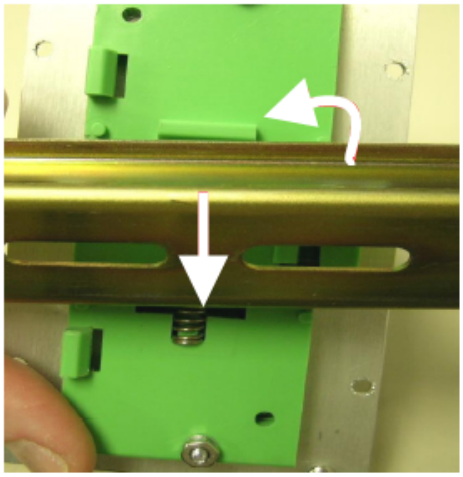
2. For board-level transceivers, place lock washers on all eight of the screws. Attach four of the standoffs to the flat side of the transceiver with four screws. Align standoffs with the panel holes and secure with the other four screws.



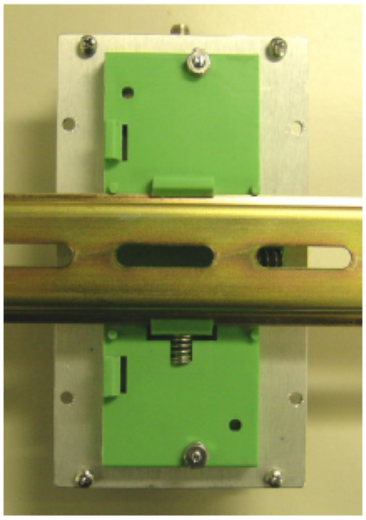
For enclosed transceivers, place lock washers on four of the screws. Align the bottom enclosure holes with the panel holes and secure with screws.



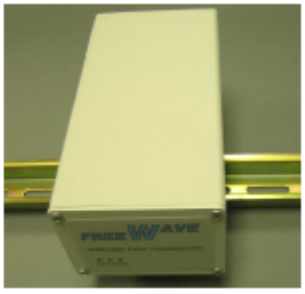
3. With the spring guide facing down and with the transceiver's RF connector facing up, attach the transceiver to the rail by pressing the spring loaded guide onto the rail edge. Push the fixed guide onto the other side of the rail.



Press down, push back



The guides on the contact foot allow the transceiver to be installed vertically or horizontally on the din rail mount.

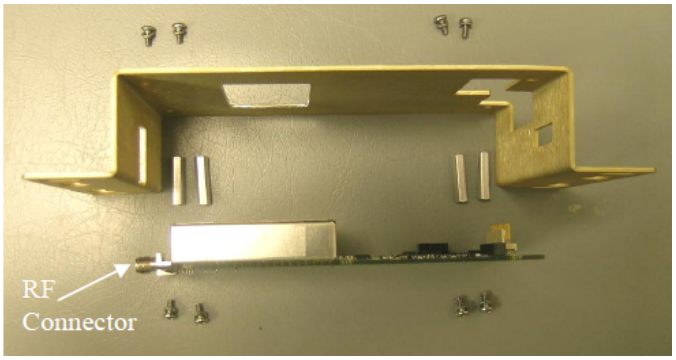


Protective Mounting Bracket Kit Instructions (PMB-ENCL)

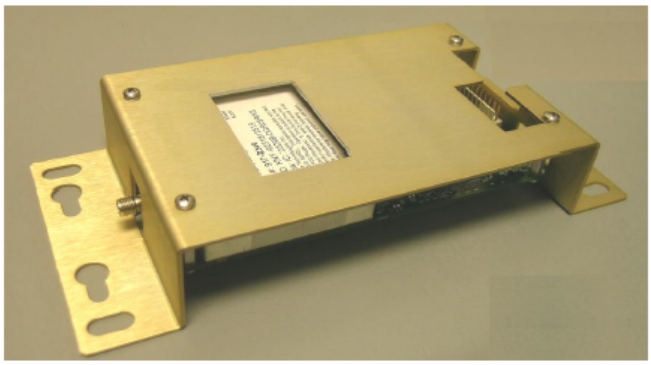
The FreeWave PMB-ENCL Protective Mounting Bracket Kit is available to mount a board-level transceiver other than in a din rail system.The mounting kit ships with the following hardware:

- 8 - lock washers
- 8 - 4-40 x 1/4 inch screws
- 4 - standoffs

Depending on the setup, it may be helpful to note the transceiver's serial number and any other information needed from the transceiver's label.



1. Place lock washers on all eight of the screws.
2. Attach the standoffs to the front side (non-flat side) of the transceiver with four screws.
3. Align standoffs with the bracket holes and secure with the other four screws.



Powering the Transceiver

To provide power to the transceiver, connect it to a power supply that meets the specifications outlined in the product's data sheet and the product's user manual.

For any application where the transceiver is used in a UL-controlled environment, the power supply must be a Class 2 power source. Use a dedicated power supply line.

> **Important:** GX-C, GX-CE, and GX-T transceivers are UL approved for use between +6.0 to +30.0 VDC. However, for guaranteed performance, FreeWave recommends using between +7.5 to +30.0 VDC to power the transceiver.

If the power supply line runs outside the enclosure, use electrostatic discharge (ESD) protectors to protect the transceiver from electric shock, and transient voltage suppressors (TVS) to protect from an over-voltage

situation. Using both helps enhances reliable operation and can be purchased at most electronic supply stores.

Warning! If the power supply is above +18.0 VDC, use a 1 ohm resistor inline with power input to the transceiver. For more information, see application note #5467: *Power Wiring Precaution for FGR-Series at High Supply*. The cautions outlined in the application note also apply to the GX series transceivers.

Configuring the Transceiver

A standard network requires that the following parameters are set the same on all transceivers in the network:

- **Frequency Key**
- **Hop Table Version**
- **Hop Frequency Offset**
- **Min Packet Size**
- **Max Packet Size**
- **Network ID**
- **RF Data Rate**

Transceivers that contain the same settings in all the parameters above can communicate with each other. If you choose to use the Call Book instead of the **Network ID**, or the network is a Point-to-Point network, the Call Book must include the appropriate serial numbers for each transceiver. If the network contains parallel Repeaters, the **Frequency Key** setting may differ.

In addition, set the **Transmit Power** parameter to the appropriate setting based on the cable loss in your installation. For more information, see "Cable Loss and Transmit Power Settings" на стр.12.

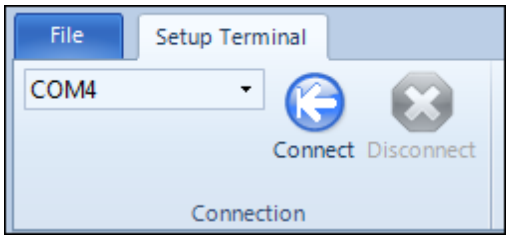
Use a terminal emulator of your choice to access the Setup menu. For any terminal emulator application, plug the serial cable into a COM port on the transceiver, open a session, and ensure that the port settings are set to the following for a proper connection to the transceiver:

Port Setting	Select
Bits per second	19200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

The following instructions describe how to access the transceiver's Setup menu using the Setup Terminal application within Tool Suite. Setup Terminal contains the port settings above, by default. For more information about using Tool Suite, see the *Tool Suite User Manual* available on the *User Manual and System Tools* CD or by selecting **File > Help** in the Tool Suite software.

1. Plug a serial cable into the COM 1 port on the transceiver, connect the cable to a COM port on the computer running Tool Suite, and connect the transceiver to a power source.

2. Open Tool Suite and select Setup Terminal in the Applications pane.
3. From the drop-down list at the top left of the window, select the COM port on the computer to which the transceiver is connected.



4. Click **Connect**.

For information about the settings available, see the *User Manual and Reference Guide* for the transceiver you are programming.

Approved Antennas

FreeWave offers directional (Yagi) and omni-directional (Omni) antennas with both bracket and magnetic mounts. Any antenna used with FreeWave transceivers must have the following characteristics to remain in compliance with FCC requirements and regulations.

- Antenna gain does not exceed 14.0 dBi.
- Overall system Equivalent Isotropically Radiated Power (EIRP) does not exceed 36 dBm.

The complete list of antennas available from FreeWave including antenna gains is shown below:

2.4 GHz Yagi Antennas			
Gain dBi	**Manufacturer**	**FreeWave Part Number for Ordering**	**Manufacturer Model Number**
14.0 dBi	Mobile Mark	EAN2414CR	SCR14-2400
5.0 dBi	WaveLink Antenna	EAN2400YC	PRO2400-4-40F02N4

2.4 GHz Omni-Directional Antennas			
Gain dBi	**Manufacturer**	**FreeWave Part Number for Ordering**	**Manufacturer Model Number**
5.0 dBi	Maxrad	EAN2405WC	MAXC24505

2.4 GHz Whip Stub Antennas			
Gain dBi	**Manufacturer**	**FreeWave Part Number for Ordering**	**Manufacturer Model Number**
1.0 dBi	Larsen	EAN2400SR	SPDA24RP2400

Installing the Antenna

Antennas must be professionally installed on a fixed, mounted, and permanent outdoor structure to satisfy RF exposure requirements.

Warning! Any antenna placed outdoors must be properly grounded. Use extreme caution when installing antennas and follow ***all*** instructions included with the antenna.

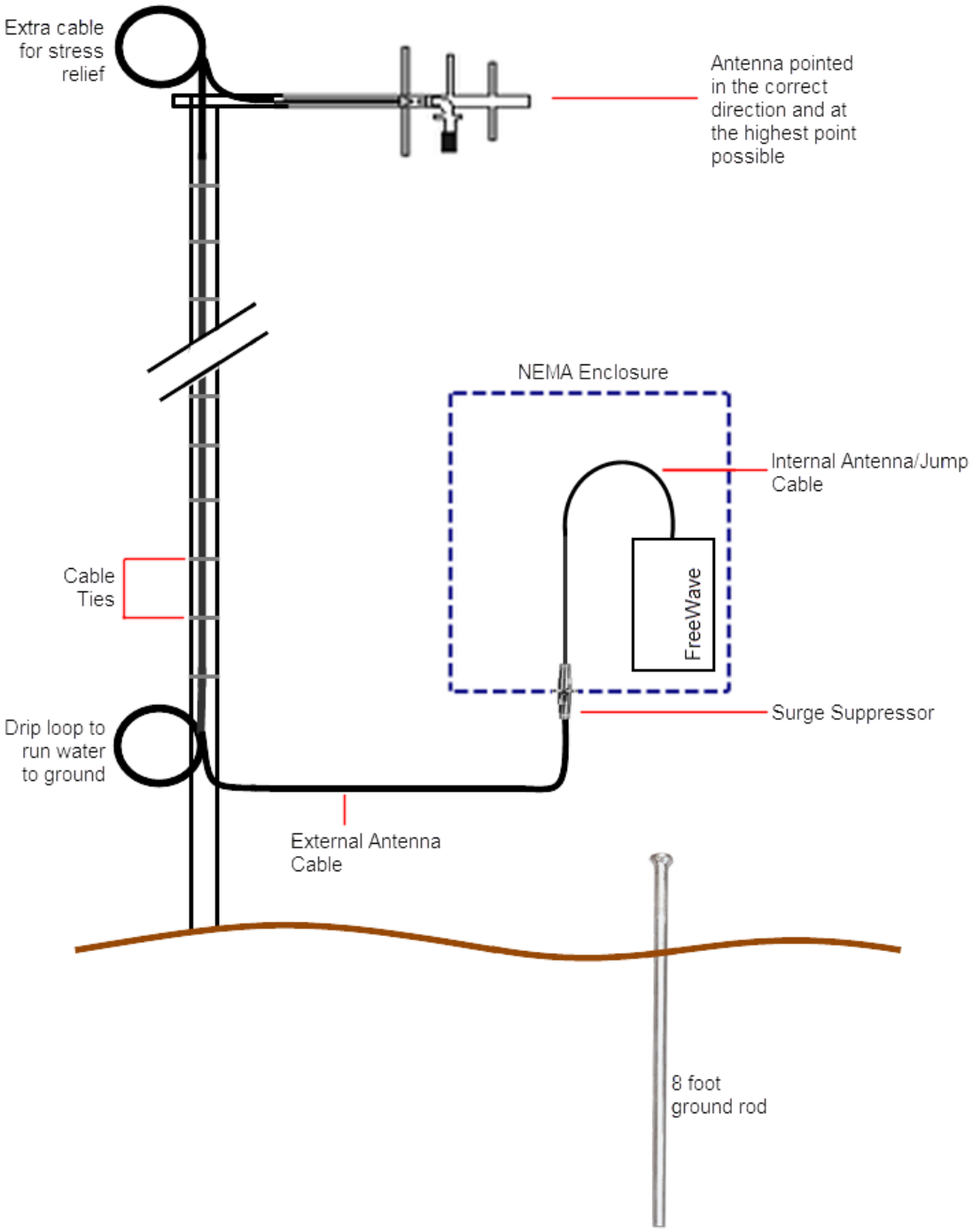
Per FCC regulations, any antenna used with FreeWave transceivers must be an approved antenna that has comparable performance parameters. For more information about approved antennas, see "Approved Antennas" на стр.10.

When installing an antenna on a pole or tower, ensure the installation complies with the following requirements:

- If there are multiple antennas installed on the same pole or tower, ensure there is at least 10 feet (3.048 meters) vertical separation between antennas on the structure. Installing antennas too close to one another, even if they are of different frequencies, maycause the energy from one to interfere with the other.
- If the antenna is mounted parallel to the pole or tower, ensure there is at least 18 inches (46 cm) standoff between the structure and the antenna itself. Installing the antenna too close to the structure to which it is mounted may cause the energy being transmitted from the antenna to interfere with the antenna itself.
- If you are installing a directional antenna, set the antenna's direction appropriately.If the antenna has a moisture weep hole, ensure the antenna is mounted so the weep hole faces down to drain water.
- Run extra cable at the top of the installation for stress relief (see the illustration below).
- Include a drip loop of cable at the bottom of the installation that is lower than the NEMA enclosure (see the illustration below). This loop allows moisture to run off the cable to the ground.

In addition, ensure your installation has the following components and that they are installed according to the manufacturer's installation instructions:

- 8 foot ground rod.
- Bulkhead mount surge suppressor.



Cable Loss and Transmit Power Settings

The **Transmit Power** parameter is the output power of the transceiver. The transceiver output power level must be set to satisfy maximum Equivalent Isotropically Radiated Power (EIRP) requirements in the country in which the installation exists.

When setting up the network, consider the power gain that an antenna may add, and the power loss through cabling. Adjust the **Transmit Power** on the transceiver to ensure that you do not exceed the maximum EIRP for the regulating body where the installation exists. Use the tables below to determine the correct **Transmit Power** parameter setting for each transceiver in the network.

> **Important:** The information in this section discusses FCC and ETSI maximum EIRP regulations. Ensure your installation meets the maximum EIRP requirements for the country in which you are installing transceivers. It remains the installer's responsibility to ensure that an installation is within EIRP emission limits.

The FCC permits 27 dBm (0.5 Watt) output power at the transceiver and 36 dBm (4 Watts) at the antenna. ETSI permits a total of 20 dBm (100 mW) total, which includes the output power at the transceiver and the antenna gain.When calculating the power gain, use the following equation to determine the total output power at the antenna. Loss calculations should include cable, connectors, surge protectors, and so on.

Transceiver Output – Losses + Antenna Gain = Output Antenna Power

For example, 30 dBm – 2 dB + 6 dB = 34 dBm (or 2.5 Watts). 34 dBm is within the FCC limits. However, 30 dBm – 2 dB + 10 dB = 38 dBm (or 6.3 Watts) ***exceeds*** the FCC limits. Neither is permitted under ETSI regulations.

The following table shows the RF loss at various cable lengths:

	Cable Type	
Length in Feet	**LMR240**	**LMR400**
10	1.3 dB	0.7 dB
20	2.6 dB	1.4 dB
25	3.2 dB	1.7 dB
30	3.9 dB	2.1 dB
50	6.5 dB	3.4 dB
100	12.9 dB	6.8 dB

In GX series transceivers, the **Transmit Power** parameter settings range from 0 dBm to 27 dBM (1 mW to 500 mW). The maximum transmit power is capped at 20 dBm at the factory to comply with ETSI regulations for countries that require it, or capped at other values to comply with country-specific requirements.

The output power can vary slightly between transceivers; however, the output power never exceeds 27 dBm (500 mW).

The following table provides the maximum **Transmit Power** parameter setting for FreeWave transceivers at a given antenna gain and cable loss combination. 14 dBi and 5 dBi antennas are used in this example.

	Cable Loss			
Antenna Gain	**1 dB**	**2 dB**	**3 dB**	**4 dB**
14 dBi Point-to-Point	25	26	26	26
14 dBi Point-to-MultiPoint	23	24	25	26
5 dBi Point-to-Point	27	27	27	27
5 dBi Point-to-MultiPoint	27	27	27	27

The following table demonstrates how the **Transmit Power** parameter setting on the transceiver corresponds to the EIRP in dBm with the transceiver-cable-antenna combination for a 14.0 dBi Yagi antenna at different cable losses in a Point-to-MultiPoint or Point-to-Point network.

The shaded areas indicate combinations where EIRP limitations exceed FCC regulations and the **Transmit Power** setting must be decreased.

Note: ETSI regulations allow only 20 dBm. A 14.0 dBi antenna may not be appropriate for your installation.

Networks with 14.0 dbi Yagi Antenna

	Cable Loss			
Transmit Power	**1 dB**	**2 dB**	**3 dB**	**4 dB**
27	40	39	38	37
26	39	38	37	36
25	38	37	36	35
24	37	36	35	34
23	36	35	34	33
22	35	34	33	32
21	34	33	32	31
20	33	32	31	30

Note: Networks using 2.4 GHz transceivers exclusively for fixed, Point-to-Point operation may employ transmitting antennas with directional gain greater than 6 dBi, provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 2 dB that the directional gain of the antenna exceeds 6 dBi.

This excludes the use of a Point-to-MultiPoint system, omni-directional applications, or multiple co-located intentional radiators transmitting the same information.

Waterproofing External Connections

After you have installed all the components at the site, waterproof ***all*** exterior connections with a moldable plastic coax sealant or using mastic tape and an electrical coating. Ensure that each connection in the installations is thoroughly sealed.

Moldable coax sealant and other electronic waterproofing supplies are available at most electronic supply stores. Follow the installation instructions provided with the product to ensure a proper waterproofed seal.

Board-Level and DB9 Pinouts

The information in the following sections provides the pinout connection information for the connectors on the 2.4 GHz transceivers.

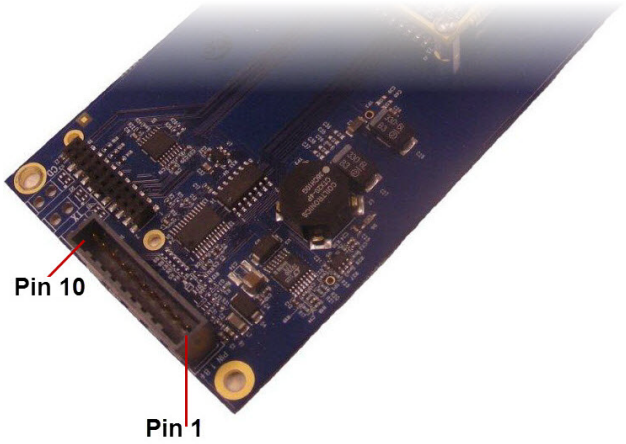
RF Board Level Pinout

The board-level transceivers are available in both TTL and RS232 versions. The TTL version uses reverse polarity from standard RS232 at 0 to 5 Volt levels. All pin descriptions and pin numbering are the same as the RS232 version. The RS232 version 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) and TTL standard polarity and voltage level for the Interrupt pin.

Pin 1: B+ Power input.

Pin 2: Interrupt (INT) – Input – A 0 Volt level on this pin switches the transceiver into Setup mode.

Pin 1 on the board-level transceiver is the pin farthest from the three LEDs and pin 10 is closest to the LEDs.



Pin	Assignment	Signal	Color on ACS3610xx cable
1	B+ input	Power	Red
2	Interrupt (temporarily ground to invoke menu)	Input	Brown
3	Data Terminal Ready (DTR)	Input	Orange
4	Ground		Black
5	Transmit Data (TXD)	Output	Yellow
6	Ground		Black
7	Receive Data (RXD)	Input	Green
8	Carrier Detect (DCD)	Output	Blue
9	Request to Send (RTS)	Input	Violet (purple)
10	Clear to Send (CTS)	Output	Gray

RS232 Pin Assignments (DB-9)

Pin		Assignment	Signal	Definition
1	CD	Carrier Detect	Output	Used to show an RF connection between transceivers.
2	TX	Transmit Data	Output	Used to transmit data bits serially from the transceivers to the system device.
3	RX	Receive Data	Input	Used to receive data bits serially from the system device connected to the transceivers.
4	DTR	Data Terminal Ready	Input	Used only in transceivers in Point-to-Point Slave/Master switchable mode or for DTR Connect.
5	GND	Ground		Signal return for all signal lines shared with Pin 9.
6	DSR	Data Set Ready	Output	Always high when the transceiver is powered from the 2.5 mm power connector. Indicates power is on to the transceiver. Also, this pin can be used for +12.0 Volts when powering the transceivers directly through the RS232 port. **Note:** This is not used on the OEM module.
7	RTS	Request to Send	Input	The transceiver does not recognize RTS for flow control. RTS is used as a control line in RTS/CTS mode.
8	CTS	Clear to Send	Output	This signal is used to tell the system device connected to the transceiver that the transceiver is ready to receive data. When asserted, the transceiver accepts data, when de-asserted the transceiver does not accept data. This should always be used for data rates above 38.4 KB or a risk of lost data may occur if an RF link is not very robust.
9	GND	Ground		Signal return for all signal lines shared with Pin 5.

RS422 and RS485 Full Duplex Pinouts

Function	Bare Board Pin Number	DB-9 Pin Number
RX+	7	3
RX-	9	7
TX+	5	2
TX-	10	8
Signal Ground	4 or 6	5

RS485 Half Duplex Pin-Outs

Function	Bare Board Pin Number	DB-9 Pin Number
Wire to both pins for Bus +	Short 5 and 7	Short 2 and 3
Wire to both pins for Bus -	Short 9 and 10	Short 7 and 8
Signal Ground	4 or 6	5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