

## **FreeWave Technologies, Inc.**

### **900 MHz Wireless Modem Installation Guide**

This installation guide covers all models of the FreeWave Technologies 900 MHz spread spectrum transceiver sold under FCC ID KNY-6231812519.

**All transceiver models sold under FCC ID KNY-6231812519 must be installed professionally. This transceiver is only approved for use when installed in devices produced by FreeWave Technologies or third party OEMs approved by FreeWave Technologies. The antenna(s) to be used must be installed to provide a separation distance of at least 23cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. This transceiver must be installed in a NEMA enclosure.**

## FCC Notification

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

This device must be operated as supplied by FreeWave Technologies, Inc. Any changes or modifications made to the device without the express written approval of FreeWave Technologies may void the user's authority to operate the device.

**CAUTION:** This device has a maximum transmitted output power of 955mW. It is required that the transmit antenna be kept at least 23 cm away from nearby persons to satisfy FCC RF exposure requirements.

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ◆ Reorient or relocate the receiving antenna.
- ◆ Increase the separation between the equipment and receiver.
- ◆ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- ◆ Consult the dealer or an experienced radio/TV technician for help.

**Note:** Whenever any FreeWave Technologies module is placed inside an enclosure a label **must** be placed on the outside of that enclosure which includes the module's FCC ID.

## UL Notification

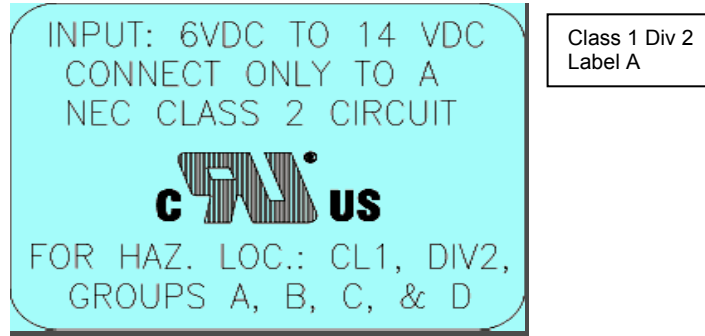
**Model# FGRO9CSU is suitable for use in Class 1, Division 2, Groups A, B, C, and D or non-hazardous locations only. Input voltage for Model# FGRO9CSU is 6 to 30 volts DC.**

**Model# DGRO9RFS is suitable for use in Class 1, Division 2, Groups A, B, C, and D or non-hazardous locations only.**

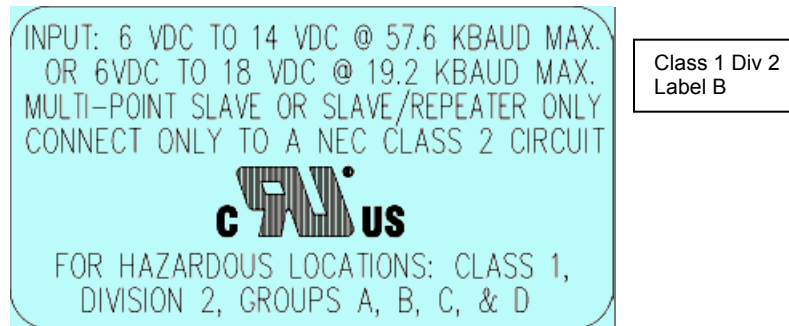
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Input voltages for Model# DGRO9RFS are determined by the label on the bottom of the board. If the board has Label A shown below the input voltage is 6 to 14 volts DC.



If the board has Label B shown below the input voltage is 6 to 14 volts DC at a maximum baud rate of 57.6 Kbaud or 6 to 18 volts DC at a maximum baud rate of 19.2 Kbaud, operation mode of multipoint slave or multipoint slave/repeater only.



## A. Transceiver installation steps

To install the DGR and FGR series transceivers, follow the basic steps given below.

1. Mount the transceiver to the flat, stable surface using mounting holes in the corners of the transceiver. Transceiver models sold under FCC ID KNY-6231812519 are to be installed professionally in NEMA enclosures.
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. The antenna must be professionally installed on fixed-mounted permanent outdoor structures for satisfying RF exposure requirements.
3. Connect a computer to the transceiver's RS232 port (please refer to the part C 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 – transceiver's power output settings.***

Transceiver output power level *must be* set according to the tables given below to satisfy FCC maximum EIRP requirement. Per FCC regulations, any antenna used with FreeWave transceivers must either be one of the approved antennas shown below or an antenna with comparable performance parameters. FreeWave Technologies offers a variety of omnidirectional and directional external antennas, with both bracket and magnetic mounts. The complete list of antennas available from FreeWave Technologies including antenna gains, antenna manufacturer's information and antenna's characteristics is shown below:

The following antennas are approved for use with FreeWave transceivers:

### 900MHz Directional Antennas

| Gain | Manufacturer | Manufacturer Model Number | FreeWave Model Number |
|------|--------------|---------------------------|-----------------------|
| 10dB | Mobile Mark  | YAG10-915N                | EAN0900YB             |
| 10dB | Larsen       | YA0006                    | EAN0900YA             |
| 6dB  | Mobile Mark  | YAG6-915N                 | EAN0906YB             |
| 6dB  | Larsen       | YA6-900                   | EAN0906YA             |

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**900MHz Omnidirectional Antennas**

| Gain | Manufacturer       | Manufacturer Model Number | FreeWave Model Number |
|------|--------------------|---------------------------|-----------------------|
| 5dB  | Antennex<br>Maxrad | EB8965C<br>BMEFC8985HD    | EAN0905WC             |
| 3dB  | Maxrad             | MAX-9053                  | EAN0900WC             |
| 0dB  | JEMA               | JA900SS                   | EAN0900WR             |
| 0dB  | Mobile Mark        | PSTG0-915FW               | EAN0900RQ             |
| 0dB  | Mobile Mark        | PSTN3-915S                | EAN0900SH             |
| 0dB  | Mobile Mark        | PSTG0-915SE               | EAN0900SQ             |
| 0dB  | Mobile Mark        | PSTN3-915N                | EAN0900NH             |

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

Table 1 below provides the maximum output power settings for FreeWave transceivers at given antenna gain (10 dB and 6 dB Yagi antennas are given as an example) and cable loss combinations. Please note that *it is the installer's responsibility to ensure that the emission limits are not exceeded.*

**Table 1:** Output Power Settings at given Antenna Gain & Cable Loss combination.

|              |      | Cable Loss |     |     |     |
|--------------|------|------------|-----|-----|-----|
| Antenna Gain |      | 1dB        | 2dB | 3dB | 4dB |
|              | 10dB | 5          | 6   | 7   | 9   |
|              | 6dB  | 9          | 9   | 9   | 9   |

Table 2 below shows how the RFXmitPower settings on the radio correspond to the EIRP of the transceiver-cable-antenna combination for the 10 dB Yagi antenna at different cable loss values.

**Table 2:** EIRP for 10dB Yagi Antenna, Cable loss vs RF Xmit Power Setting.

|               |   | Cable Loss |       |       |       |
|---------------|---|------------|-------|-------|-------|
|               |   | 1dB        | 2dB   | 3dB   | 4dB   |
| RF Xmit Power | 9 | 39.00      | 38.00 | 37.00 | 36.00 |
|               | 8 | 38.50      | 37.50 | 36.50 | 35.50 |
|               | 7 | 37.75      | 36.75 | 35.75 | 34.75 |
|               | 6 | 36.40      | 35.40 | 34.40 | 33.40 |
|               | 5 | 34.44      | 33.44 | 32.44 | 31.44 |

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

Table 3 below is similar to the Table 2, but shows the information for the 6 dB Yagi antenna.

**Table 3:** EIRP for 6dB Yagi Antenna, Cable loss vs RF Xmit Power Setting.

|               |   | Cable Loss |       |       |       |
|---------------|---|------------|-------|-------|-------|
|               |   | 1dB        | 2dB   | 3dB   | 4dB   |
| RF Xmit Power | 9 | 35.00      | 34.00 | 33.00 | 32.00 |
|               | 8 | 34.50      | 33.50 | 32.50 | 31.50 |
|               | 7 | 33.75      | 32.75 | 31.75 | 30.75 |
|               | 6 | 32.40      | 31.40 | 30.40 | 29.40 |
|               | 5 | 31.44      | 29.44 | 28.44 | 27.44 |

Follow the steps below to configure the Power Output Level:

- ✓ Start HyperTerminal or any other terminal emulation program on the computer connected to the transceiver's RS232 port (refer to the User Manual for the HyperTerminal setup instructions).
- ✓ Invoke the setup menu on the 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 transceiver in the network.

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## B. Transceiver Location

Placement of the FreeWave transceiver 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 or Diagnostics software 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.

## C. Board Level Pin Assignments

The board level 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).

Pin 1: B+ Power input.

Pin 2: Interrupt (INT) – Input – A 0 volt level on this pin will switch the radio into setup mode.

|                                                   |
|---------------------------------------------------|
| <b>Table 4:</b> Board Level<br>Transceiver Pinout |
|---------------------------------------------------|

| Pin | Signal | Assignment                        |
|-----|--------|-----------------------------------|
| 1   | Input  | B+ input                          |
| 2   | Input  | Interrupt (Ground to invoke menu) |
| 3   | Input  | DTR                               |
| 4   |        | Ground                            |
| 5   | Output | Transmit Data                     |
| 6   |        | Ground                            |
| 7   | Input  | Receive Data                      |
| 8   | Output | Carrier Detect                    |
| 9   | Input  | RTS                               |
| 10  | Output | Clear to Send                     |

**Note:** Pin 1 on the DGRO9 board level transceiver is the pin farthest from the three LEDs and pin 10 is closest to the LEDs.

## D. Power Connection

The DGR and FGR series transceivers can be operated from any well-filtered DC power source, input voltages vary by model. The power source should be capable of providing at least 0.8 amperes of continuous current. The pin #1 of the 10-pin connector on the transceiver is the positive lead; pin #4 or pin #6 of this connector should be as a negative lead.

***Transceiver is designed to operate in negative ground systems only.***