

**900 MHZ (0A-1327-1111)  
AND 2.4 GHZ (A-3446)  
ETHERNET BRIDGE RADIO  
(EBR) PAIR MANUAL**

P1327

DD1685027  
Rev 10  
23 May 2018



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# 1 Component Identification

**Ethernet:** A technology for high-speed bandwidth connectivity over local area networks (LAN).

**Client Radio:** This radio receives signal from the server radio. The client radio is connected to and receives power from the display. Signal between the client and the display is both transmitted and received.

**Server Radio:** This radio is connected to the local Ethernet network through a DC injector which provides power to the radio. It transmits and receives information to and from the client radio at the display.

**DC Injector:** This unit, shown in **Figure 5**, receives signal in from the customer's network and relays signal out to the radio. It contains a power input to power the server radio.

**Note:** The DC Injector is for indoor use only.



**Figure 1:** Ethernet Bridge Radios – Two-Wire Client Radio



**Figure 2:** Ethernet Bridge Radios – Single-Wire (10-pin Quick Connect) Client Radio

## 2 Installation

The controller has either a default IP address (172.16.192.25) for Galaxy® displays or a DHCP address for GalaxyPro® Series displays. Once the default IP address is used to connect to the display, it can be changed to a personalized address. Refer to the display manual for further information on setting an IP address. Various LAN and Internet service providers (ISP) have differing IP requirements. Consult the network administrator or ISP for more information. The DHCP address automatically adjusts to suit the local network.

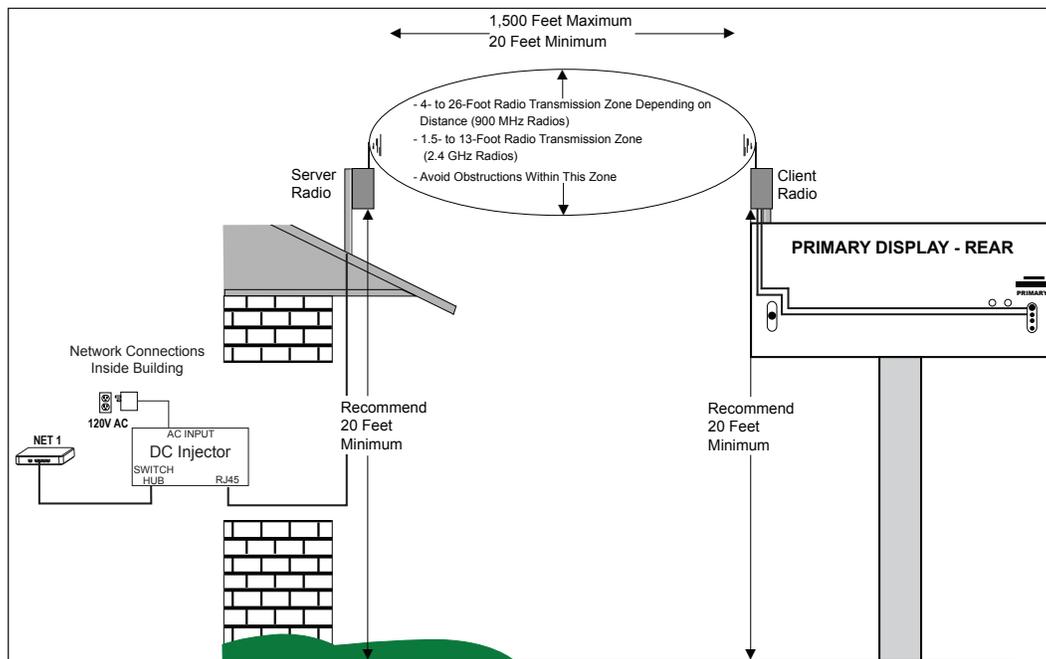
### System/Cable Requirements

In an Ethernet radio system, two radios are required. A server radio transmits/receives signal to/from a client radio, shown in **Figure 1** and **Figure 2**, at the display. The server radio connects to the Ethernet LAN through a DC injector.

Daktronics provides a yellow 20-foot CAT 5e Ethernet cable, which is required to connect the DC injector to the LAN. The customer must supply a longer cable if it is needed.

Ethernet and power cables are provided to connect the client radio to the display and the server radio to the DC injector.

An Ethernet radio-controlled display requires the following connections, refer to **Figure 3** for a system layout:

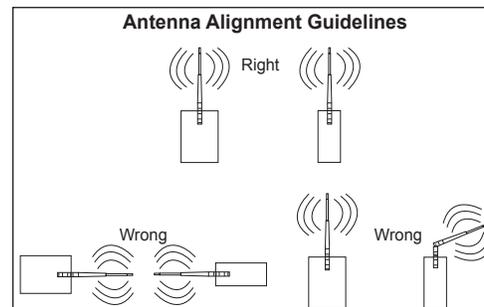


**Figure 3:** Wireless Ethernet Display Layout

1. Mount radios with antennas pointing upward. **Figure 4** illustrates correct and incorrect antenna placement.

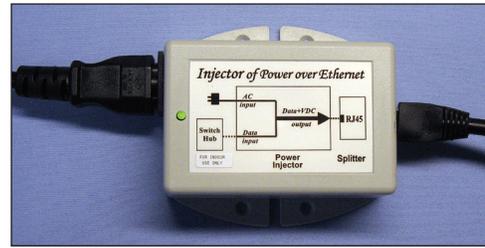
Do not mount the radios with the wire grommet pointing upward.

There are two types of client radio connectors for Galaxy products – two wire – **Figure 1** and single wire – **Figure 2**.



**Figure 4:** Antenna Alignment Examples

2. Route a CAT 5e Ethernet cable from the LAN switch/router to the DC injector.
3. Connect the Ethernet cable to the Switch Hub jack on the DC injector, as shown in **Figure 5**.
4. The DC injector is provided with an AC power adapter. Connect the AC power adapter to the AC input jack on the DC Injector and inserted into a 120 VAC wall outlet.



**Figure 5:** DC Injector

**Note:** The DC Injector is for indoor use only.

5. The server radio is provided with a 25 ft. (7.6 m) attached Ethernet cable. Connect this Ethernet cable to the RJ45 jack on the DC injector.



**Figure 6:** Extend Cat 5e Cable Using a Cat 5e Inline Coupler

The maximum distance between the network switch and server radio is 300 ft. (91.44 m).

6. Mount server and client radios outdoors for best signal quality. Indoor mounting significantly reduces signal quality and can cause communication issues to

**Note:** Install a Cat 5e inline coupler, example shown in **Figure 6**, to the end of the server radio cable and connect it to a high-quality Cat 5e cable.



**Figure 7:** Quick-Connect Cables - Two-Wire Design

the display.

7. Mount the client radio within 25 ft. (7.6 m) of the input jacks.
8. Route the signal quick-connect cables from the enclosure to the rear of the display.
9. The cable from the enclosure to the display can be routed through conduit or through the display pole, and should be secured to protect it from weather or vandalism. Provide drip loops to prevent water migration to display quick-connect interface board.



**Figure 8:** Input Jacks

10. Connect the quick-connect cables to the top two (J32 and J33) jacks. Refer to **Figure 7** and **Figure 8** for examples. Or connect the quick-connect cable to the middle jack if the display is a single-cable design, as shown in **Figure 9** and **Figure 10**.



**Figure 9:** 10-Pin Quick-Connect Cable - Single-Wire Design

- Older displays use a one-cable system, which connects to jack J32.
- Newer displays use a two-cable system, which connects to the signal cable to jack J32 and the power cable to J33.



**Figure 10:** Input Jacks

## Installation

### 3 Maintenance

#### LED Diagnostics

Use the label affixed to the radio, shown in **Figure 11** and **Figure 19**, and the 16 diagnostic LEDs on boards inside the housing of both the server and client radios to determine whether the radio is linking properly and which channel is currently being used.

The following chart also describes the diagnostic LEDs' functions:

Name	Function	Color																																																																																																
Power	Unit has power and has successfully booted.	Red																																																																																																
RF TX	Radio transmission is occurring.	Green																																																																																																
RF RX	Radio reception is occurring.	Green																																																																																																
Ethernet Link	The Ethernet Port has a valid Ethernet connection.	Green																																																																																																
CH 1 CH 2 CH 4 CH 8 CH 16 (not used with 900 MHz radios) CH 32 (not used)	<p>By adding the numbers that are lit, the user can determine the current radio channel.</p> <table border="1"> <thead> <tr> <th colspan="6">900MHz Radios</th> </tr> </thead> <tbody> <tr> <td><b>1</b></td> <td>903.12500 MHz</td> <td><b>5</b></td> <td>911.45833 MHz</td> <td><b>9</b></td> <td>919.79167 MHz</td> </tr> <tr> <td><b>2</b></td> <td>905.20833 MHz</td> <td><b>6</b></td> <td>913.54167 MHz</td> <td><b>10</b></td> <td>921.87500 MHz</td> </tr> <tr> <td><b>3</b></td> <td>907.29167 MHz</td> <td><b>7</b></td> <td>915.62500 MHz</td> <td><b>11</b></td> <td>923.95833 MHz</td> </tr> <tr> <td><b>4</b></td> <td>909.37500 MHz</td> <td><b>8</b></td> <td>917.70833 MHz</td> <td><b>12</b></td> <td>926.04167 MHz</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="6">2.4 GHz Radios</th> </tr> </thead> <tbody> <tr> <td><b>0</b></td> <td>Auto Mode</td> <td><b>10</b></td> <td>2.435417 GHz</td> <td><b>20</b></td> <td>2.456250 GHz</td> </tr> <tr> <td><b>1</b></td> <td>2.416667 GHz</td> <td><b>11</b></td> <td>2.437500 GHz</td> <td><b>21</b></td> <td>2.458333 GHz</td> </tr> <tr> <td><b>2</b></td> <td>2.418750 GHz</td> <td><b>12</b></td> <td>2.439583 GHz</td> <td><b>22</b></td> <td>2.460417 GHz</td> </tr> <tr> <td><b>3</b></td> <td>2.420833 GHz</td> <td><b>13</b></td> <td>2.441667 GHz</td> <td><b>23</b></td> <td>2.462500 GHz</td> </tr> <tr> <td><b>4</b></td> <td>2.422917 GHz</td> <td><b>14</b></td> <td>2.443750 GHz</td> <td><b>24</b></td> <td>2.464583 GHz</td> </tr> <tr> <td><b>5</b></td> <td>2.425000 GHz</td> <td><b>15</b></td> <td>2.445833 GHz</td> <td><b>25</b></td> <td>2.466667 GHz</td> </tr> <tr> <td><b>6</b></td> <td>2.427083 GHz</td> <td><b>16</b></td> <td>2.447917 GHz</td> <td><b>26</b></td> <td>2.468750 GHz</td> </tr> <tr> <td><b>7</b></td> <td>2.429167 GHz</td> <td><b>17</b></td> <td>2.450000 GHz</td> <td><b>27</b></td> <td>2.470833 GHz</td> </tr> <tr> <td><b>8</b></td> <td>2.431250 GHz</td> <td><b>18</b></td> <td>2.452083 GHz</td> <td><b>28</b></td> <td>2.472917 GHz</td> </tr> <tr> <td><b>9</b></td> <td>2.433333 GHz</td> <td><b>19</b></td> <td>2.454167 GHz</td> <td><b>29</b></td> <td>2.475000 GHz</td> </tr> </tbody> </table>	900MHz Radios						<b>1</b>	903.12500 MHz	<b>5</b>	911.45833 MHz	<b>9</b>	919.79167 MHz	<b>2</b>	905.20833 MHz	<b>6</b>	913.54167 MHz	<b>10</b>	921.87500 MHz	<b>3</b>	907.29167 MHz	<b>7</b>	915.62500 MHz	<b>11</b>	923.95833 MHz	<b>4</b>	909.37500 MHz	<b>8</b>	917.70833 MHz	<b>12</b>	926.04167 MHz	2.4 GHz Radios						<b>0</b>	Auto Mode	<b>10</b>	2.435417 GHz	<b>20</b>	2.456250 GHz	<b>1</b>	2.416667 GHz	<b>11</b>	2.437500 GHz	<b>21</b>	2.458333 GHz	<b>2</b>	2.418750 GHz	<b>12</b>	2.439583 GHz	<b>22</b>	2.460417 GHz	<b>3</b>	2.420833 GHz	<b>13</b>	2.441667 GHz	<b>23</b>	2.462500 GHz	<b>4</b>	2.422917 GHz	<b>14</b>	2.443750 GHz	<b>24</b>	2.464583 GHz	<b>5</b>	2.425000 GHz	<b>15</b>	2.445833 GHz	<b>25</b>	2.466667 GHz	<b>6</b>	2.427083 GHz	<b>16</b>	2.447917 GHz	<b>26</b>	2.468750 GHz	<b>7</b>	2.429167 GHz	<b>17</b>	2.450000 GHz	<b>27</b>	2.470833 GHz	<b>8</b>	2.431250 GHz	<b>18</b>	2.452083 GHz	<b>28</b>	2.472917 GHz	<b>9</b>	2.433333 GHz	<b>19</b>	2.454167 GHz	<b>29</b>	2.475000 GHz	Green
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Name	Function			Color
Link Quality Meter: The more LEDs that are lit, the higher the link quality	Excellent link quality	No retransmissions	Green	
	Very good link quality	Few retransmissions	Green	
	Good link quality	Occasional retransmissions	Amber	
	Fair link quality	Some retransmissions	Amber	
	Poor link quality	Many retransmissions	Red	
	No link quality	No link available	Red	

## Replacement Parts List

The following table contains some of the items that may need to be replaced over a period of time.

If a component is not listed in the replacement parts list, use the label to order a replacement. Most components within this display carry a label that lists the part number of the unit. A typical label is shown in **Figure 12** with the part number in bold.

900 xTR Radios (900 MHz)	
Part Description	Part Number
DC Injector with Internal Transformer and Power Cable	A-2551
Patch Cable, Ethernet RJ45 2ft.	W-1537
900 MHz Ethernet Bridge Radio Kit With 6-Pin Quick Connect (2 Wire Client)	0A-1327-1111
902-928 MHz Antenna	A-2545

2400 xTR Radios (2.4 GHz)	
Part Description	Part Number
DC Injector with Internal Transformer and Power Cable	A-2551
Patch Cable, Ethernet RJ45 2ft.	W-1537
2.4 GHz Ethernet Bridge Radio Kit With 6-Pin Quick Connect (2-Wire Client)	A-3446
2.4 GHz Antenna	A-3457

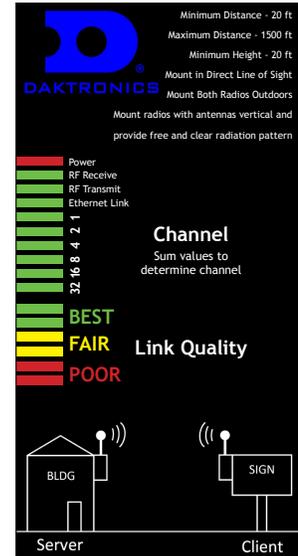


Figure 11: Radio Label

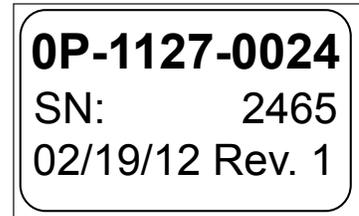


Figure 12: Typical Parts Label

## 4 Troubleshooting and Radio Diagnostics

The Daktronics Ethernet Bridge Radio Diagnostics utility helps determine if radios are linked and communicating effectively.

**Note:** The utility can only be used on Ethernet Bridge Radios with Radio Firmware version v81 or greater and Web Page Firmware version v1.58.4250 or greater.

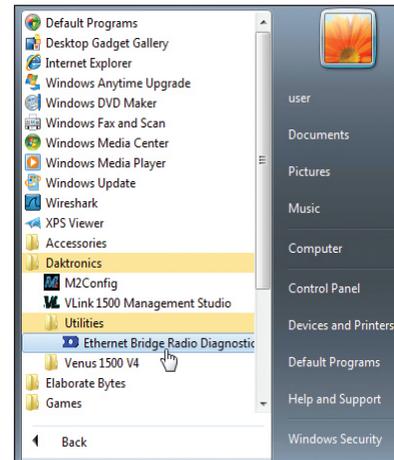
### Download the Utility

Go to <http://dakfiles.daktronics.com/downloads/venus1500/utis/EBRDiagnosics>.

Click **EBRDiagSetup.exe** and **Save**. Save the file on your computer's hard drive. Run the installer from that location to complete the installation process.

### Open the Utility

Access the utility by clicking the **Windows Start** button located at the bottom-left of your computer screen. Click **All Programs > Daktronics > Utilities > Ethernet Bridge Radio Diagnostics**, refer to **Figure 13**.

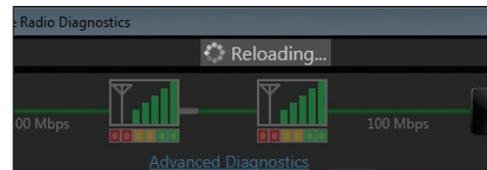


**Figure 13:** Open the Ethernet Bridge Radio Diagnostics Utility

### Network Map

The Network Map opens when you start the utility. It provides basic connection and signal strength information.

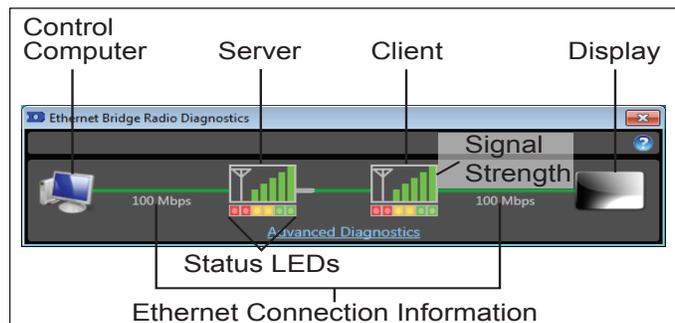
Information shown in the Network Map reloads every 6 seconds by default. Each time data updates, **Reloading...** appears on the map, as shown in **Figure 14**.



**Figure 14:** Data Update

A green line with connection information, for example 100 Mbps, shown below it reflects a successful Ethernet Connection between the Control Computer, Server and Client Radios, and Display. A green line will also link the server and client radios, as shown in **Figure 15**.

When a red line with either **Disconnected** or **Unknown** below it appears in the Network Map, you will know the Ethernet Connection is not successful.



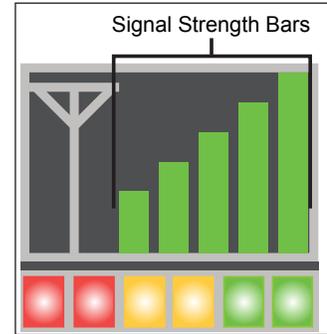
**Figure 15:** Daktronics Ethernet Bridge Radio Diagnostics Network Map

If a disconnect state is noted on the Network Map, check how the radios are installed.

- Are they installed correctly with both antennas pointing upward and are the radios mounted high enough to eliminate obstructions like semi-trailer traffic?
- Or are there obstructions like trees between radio installations?
- Are the radios installed at an appropriate distance to one another?

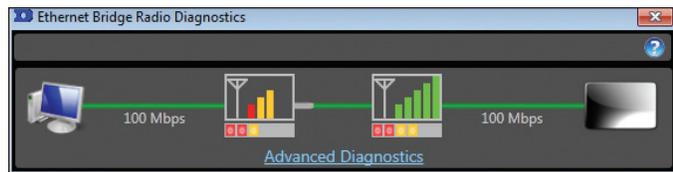
All of these can disrupt signal strength. If the radios are installed correctly, but transmission problems still exist, call the Daktronics Help Desk at 866-343-3122 for further instruction.

Observe the diagrams that represent the Server and Client radios.



**Figure 16:** Server and Client Radio Signal Strength Bars

The bars reflect Signal Strength and are directly affected by the Block Error Rate in Advanced Diagnostics. Signal Strength is strongest when all five bars are green, as shown in **Figure 16**.

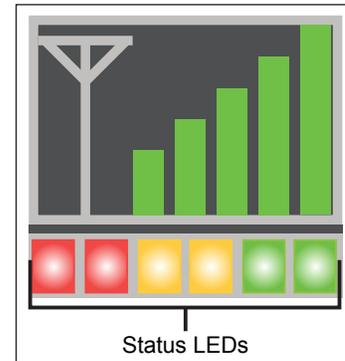


**Figure 17:** Weak Signal Strength

When signal strength is weak, as shown in **Figure 17**, bar 1 is red, and bars 2 and 3 are amber.

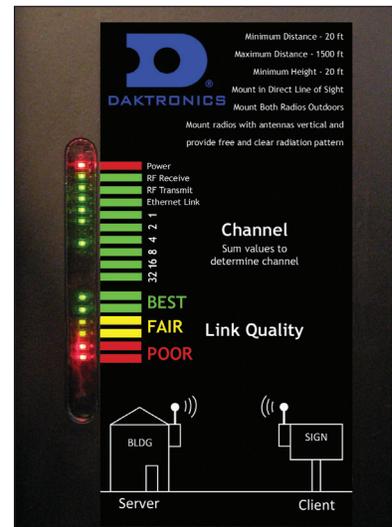
The colored boxes below each Signal Strength diagram, shown in **Figure 18**, correspond to the Link Quality LEDs, shown in **Figure 19**, found on the board in each radio. When both green boxes at the right side of each diagram are lit, you know that communication between radios is good.

If neither green box is lit, check how the radios are installed. Are they installed correctly with both antennas pointing upward and are the radios mounted high enough to eliminate obstructions like semi-trailer traffic? Or are there obstructions like trees between radio installations? Are the radios installed at an appropriate distance to one another?



**Figure 18:** Server and Client Radio Status LEDs

All of these can disrupt signal strength. If the radios are installed correctly, but transmission problems still exist, call the Daktronics Help Desk at 866-343-3122 for further instruction.



**Figure 19:** Link Quality LEDs and Label Found on Radios

## 5 Technical Specifications

### 900xTR (900 MHz) Technical Specifications

Characteristic	Specification/Description
RF Transmission Rate	1.536 Mb/s
Ethernet Throughput	935 Kb/s
Output Power	21 dBm (4 Watts EIRP used with 15 dBi antenna)
Receiver Sensitivity	-97 dBm at 10 <sup>-4</sup> BER
Range	40 miles line of sight with 15 dBi antenna
Radio Channels/Bandwidth	12 non-overlapping channels with 2.0833 MHz spacing and 1.75 MHz occupied bandwidth
Frequency Selection	Automatic or manually selectable via web browser interface
Connector Types	RF: RPTNC Female/10/100 baseT Ethernet RJ45
Data Encryption	128-bit AES, FIPS197, keys set through password-protected browser interface
Error Correction Technique	Sub-block error-detection and retransmission
Adjacent Band Rejection	SAW receiver filter attenuates cellular and pager interference
Power Regulation	Built-in switching regulator
Browser Management Tools	QoS Statistics, Network Settings, Spectrum Analyzer, and Firmware Upgrade
Power Consumption	Transmit: 1.7 Watts Receive: 0.8 Watts
Voltage	9 to 48 VDC via unused pins in RJ45 jack – pins 4,5 positive, pins 7,8 ground
Transmit Current Draw	<ul style="list-style-type: none"> <li>• 175 mA at 9 VDC</li> <li>• 140 mA at 12 VDC</li> <li>• 35 mA at 48 VDC</li> </ul>
Temperature Range	-40° C to 70° C
Physical Package	Heavy die-cast aluminum, black powder-coated finish. Meets IP66 Standard for water and dust protection. Sealing gland for Ethernet cable entry.
Size	200 x 80 x 50 mm not including connectors; .0570 Kg
Compatibility	May be mixed in combination with AW900iTR and AW900xTP radios, not compatible with older AW900xT, AW900i, and AW900iT radios.

## 2400xTR (2.4 GHz) Technical Specifications

Characteristic	Specification/Description
RF transmission rate	1.536 Mb/s
Ethernet data rate	935 Kb/s
RF Output Power	+21 dBm (4 Watts EIRP with 15 dBi antenna)
Receiver Sensitivity	-97 dBm at 10 <sup>-4</sup> Bit Error Rate
Range	Up to 40 miles line of sight with 15 dBi antenna
RF Channels/Bandwidth	29 non-overlapping channels with 2.048 MHz spacing and 1.75 MHz occupied bandwidth 5.728125 GHz to 5.846909 GHz
Connector types	RF: RPTNC Female / 10/100 base T Ethernet: RJ-45
Data Encryption	128-bit AES, FIPS197, keys set through password-protected browser interface
Error correction technique	Sub-block error detection and retransmission
Adjacent band rejection	SAW receiver filter attenuates cellular and pager interference
Power regulation	Built-in switching regulator
Browser management tools	QoS Statistics, Network Settings, Spectrum Analyzer, Firmware Upgrade
Power consumption	Transmit: 1.7 Watts Receive: 0.8 Watts
Voltage	9 to 48 VDC via unused pins in RJ-45 jack - pins 4,5 positive, 7,8 ground
Power regulation	Switching regulator
Transmit current draw	140 ma at 12 VDC
Operating Temperature Range	-40 °C to +75 °C
Enclosure	Die cast aluminum, powder-coated, gasket-sealed connectors and cover. Meets IP66 for water and dust resistance.
Size	6 by 8 by 20 cm, 0.8 Kg, connectors included Mounting holes on bottom flange, 52 by 190 mm, 4 mm dia

## FCC Compliance

### Compliance Statement (Part 15.19)

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.

## **Warning (Part 15.21)**

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## **RF Exposure (OET Bulletin 65)**

To comply with FCC RF exposure requirements for mobile transmitting devices, this transmitter should only be used or installed at locations where there is at least 20 cm separation distance between the antenna and all persons.

## **Information to the User - Part 15.105 (b)**

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.

This product should be installed ONLY by experienced, professional installers who are familiar with local building and safety codes, and wherever applicable, are licensed by the appropriate authorities. Failure to do so may void the warranty and may expose the user or the service provider to legal and financial liabilities.