FREEWAVE

ZumLink™

Covers Model: Z9-P2 and Z9-PE2

Firmware v1.1.2.2

User-Reference Manual

Part Number: LUM0107AA

Revision: Oct-2019

Safety Information

The products described in this manual can fail in a variety of modes due to misuse, age, or malfunction and is not designed or intended for used in systems requiring fail-safe performance, including life safety systems. Systems with the products must be designed to prevent personal injury and property damage during product operation and in the event of product failure.

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Preface

Contact FreeWave Technical Support

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

FreeWave provides technical support Monday through Friday, 8:00 AM to 5:00 PM Mountain Time (GMT -7).

- Call toll-free at 1.866.923.6168.
- In Colorado, call 303.381.9200.
- Contact us through e-mail at support@freewave.com.

Additional Information

Note: Use the support.freewave.com website to download the latest documentation for the Z9-P2 or Z9-PE2.
Registration is required to use this website.

Document Styles

This document uses these styles:

- Products and applications appear as: **FreeWave**.
- Parameter setting text appears as: **[Page=radioSettings]**
- File names appear as: **configuration.cfg**.
- File paths appear as: **C:\Program Files (x86)\FreeWave Technologies**.
- User-entered text appears as: **xxxxxxxxx**.

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Caution: Indicates a situation that **MAY** cause damage to personnel, the radio, data, or network.

Example: Provides example information of the related text.

FREEWAVE Recommends: Identifies FreeWave recommendation information.

Important!: Provides crucial information relevant to the text or procedure.

Note: Emphasis of specific information relevant to the text or procedure.

Provides time saving or informative suggestions about using the product.

Warning! Indicates a situation that **WILL** cause damage to personnel, the radio, data, or network.

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1. Overview

Thank you for purchasing the FreeWave ZumLink Z9-P2 or Z9-PE2.

ZumLink is the latest generation of radios offered by FreeWave and consists of enclosed and board level radios.

- **Z9-P2** is a Board-level 900 MHz Ethernet radio with two Ethernet and two Serial ports.
- **Z9-PE2** is an enclosed 900 MHz Ethernet radio with with two Ethernet and two Serial ports.

The Z9-P2 or Z9-PE2 900 MHz Series:

- Operates in the unlicensed 900 MHz ISM band (902-928 MHz).
- Provides a maximum of 30dBm transmit output power.
- Is FCC compliant as both a Frequency Hopping Spread Spectrum (FHSS) and a Digital Modulating (DM) radio.
- Provides IQ, a Linux-based application environment for the deployment of applications at the edge
- Has two Ethernet ports, two serial ports, one micro USB port, and one Type A USB port.

Note: The frequency hopping capability is available at all bandwidths and the single channel (DM) operation is available for bandwidths of at least 500 kHz.

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1.1. Communication Method

The Z9-P2 or Z9-PE2 use Listen Before Talk (LBT) and Carrier Sense Multiple Access (CSMA). There are no assigned slots. The radios transmit when the channel is clear.

- The Gateway broadcasts packets to all Endpoints and Endpoint-Repeaters within range.
- Endpoint-Repeaters broadcast packets to all Endpoints and Endpoint-Repeaters within range.
- The Endpoints unicast packets back to the Gateway or downstream Endpoint-Repeaters.
- The Gateway acknowledges the Endpoint or Endpoint-Repeater packets.

FreeWave's traditional protocol has a Gateway Time Slot and an Endpoint Time Slot within a frame.

- The Gateway transmits in its slot and listens in the Endpoint slot.
- The Endpoint transmits its slot and listens in the Gateway slot.

1.2. ZumBoost Technology

ZumLink incorporates ZumBoost technology using four performance-enhancing algorithms used together or independently to improve throughput or link reliability in the most demanding RF environments.

Adaptive Spectrum Learning

- Learns which RF signals are part of the ZumLink network and which are not, reducing bad packets and retransmissions.
  - Standard on all **ZumLink** radios, the "Listen Before Talk" algorithm provides spectrum monitoring, delivering network intelligence and increasing throughputs in noisy environments.

Forward Error Correction

- The FEC Rate (on page 220) increases the reliability of the data transferred over the air at the cost of some transmission throughput.
  - Improves sensitivity by 3dB to maximize link range in noisy environments.
  - Adds redundant information to a data stream to detect packet errors and corrects them to avoid retransmission of the packet.

1.2.1. Packet Aggregation

- The Aggregate Enabled (on page 217) setting increases throughput of small packets by combining multiple packets into a single packet minimizing the number of packets required for transmission.
  - Does NOT affect medium and large packets.

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Packet Compression

- When the Compression Enabled (on page 218) setting is enabled, the outgoing packets are analyzed and, if the data packet can be compressed, sent compressed to transmit fewer bits over the air.

1.3. IQ Application Environment

ZumLink provides the IQ Application Environment that allows for the development and deployment of Linux-based applications onto the radio. The application has access to the same computing resources as the radio but is in a segregated section of the Z9-P2 or Z9-PE2.

Note: Any application using a Linux-compatible language can be housed in IQ.

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2. Included & User-supplied Equipment

2.1. Included Equipment

Included Equipment	
Qty	**Description**
1	Z9-P2 or Z9-PE2 wireless device
1	Power Cable with flying leads and 2-pin connector (FreeWave Part Number: ASC2402PT)

Note: See the Available Accessories (on page 424).

2.2. User-supplied Equipment

This list identifies the equipment the user must provide.

- DC power source
- Power cable
- USB to micro-USB cable
- CAT5e / CAT6 Ethernet cable
- FCC approved antenna **
- Computer

Note: **See Approved Antennas (on page 196) for detailed information.
Approved antennas can be purchased directly from FreeWave.

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3. Port Connections and Pinout Assignments

Port Connections

- Z9-P2 Port Connections (on page 21)
- Z9-PE2 Port Connections (on page 21)
- Serial and Ethernet Port Details (on page 22)

Pinout Assignments

- Serial Pinout Assignments (on page 23)

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3.1. Z9-P2 Port Connections

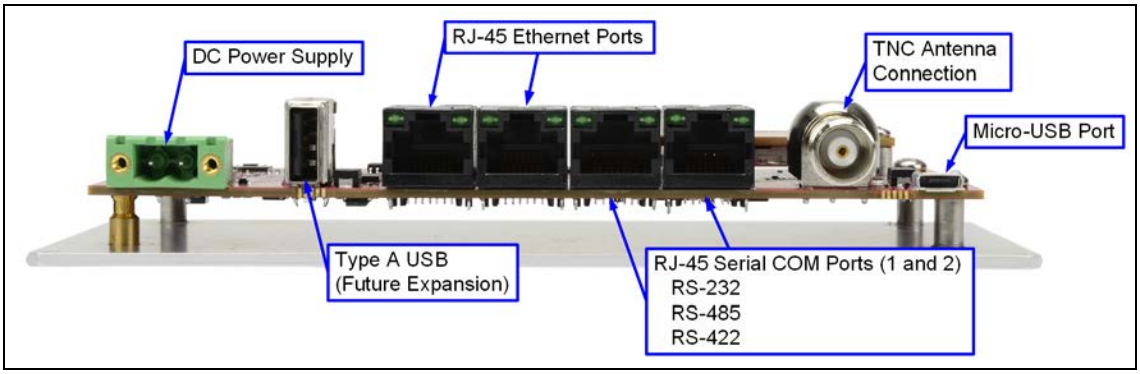

Figure 1: Z9-P2 Port Connections

3.2. Z9-PE2 Port Connections

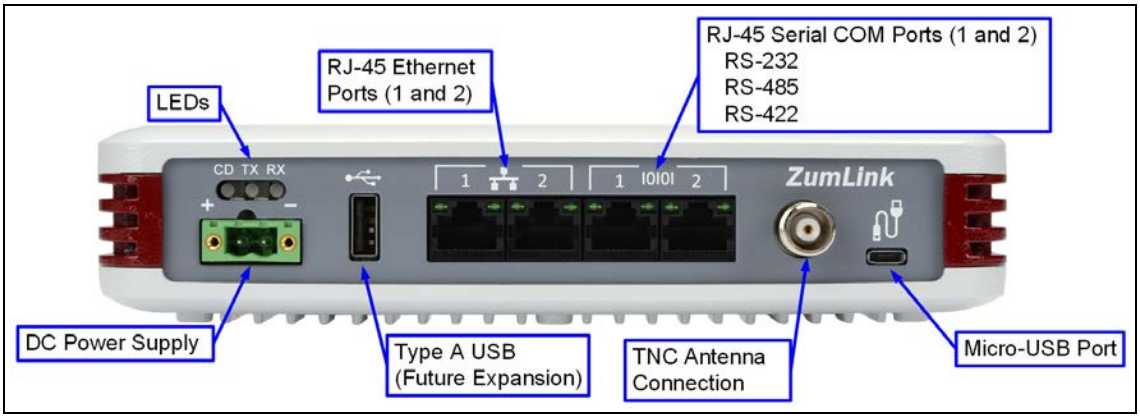

Figure 2: Z9-PE2 Port Connections

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3.3. Serial and Ethernet Port Details

Note: The RJ-45 Ethernet and the micro USB connectors are standard connectors with industry standard pinout and signals.
See the LEDs (on page 467) for additional information.

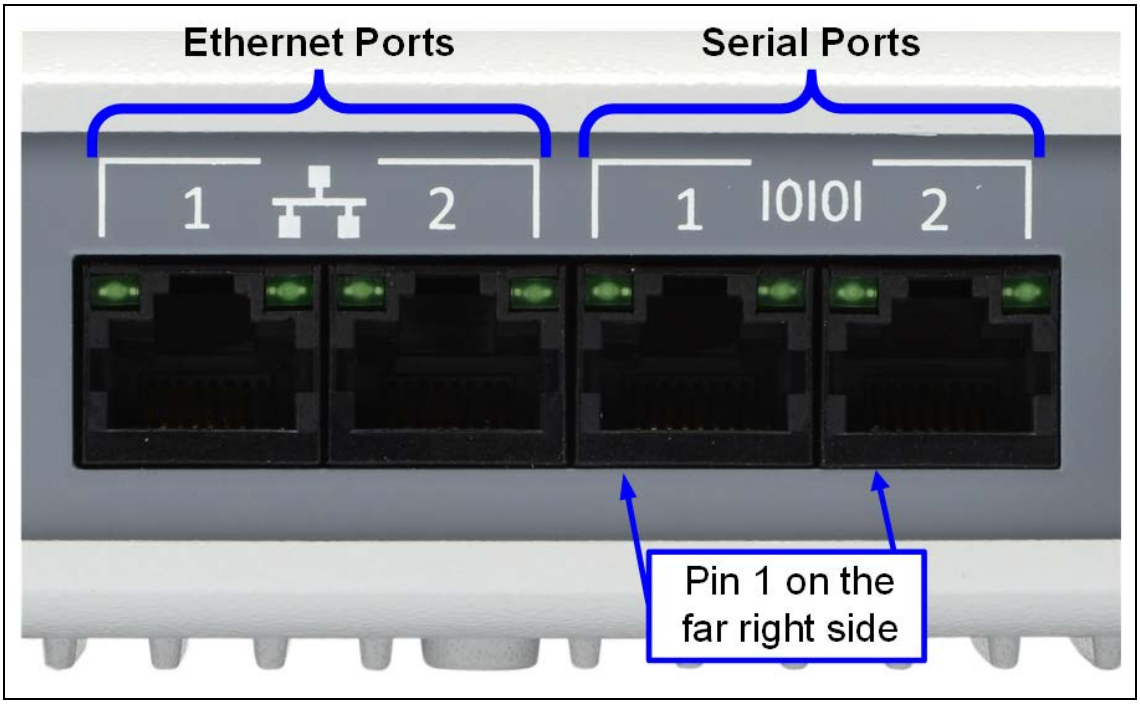

Figure 3: Serial and Ethernet Ports - Z9-P2 or Z9-PE2

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3.4. Serial Pinout Assignments

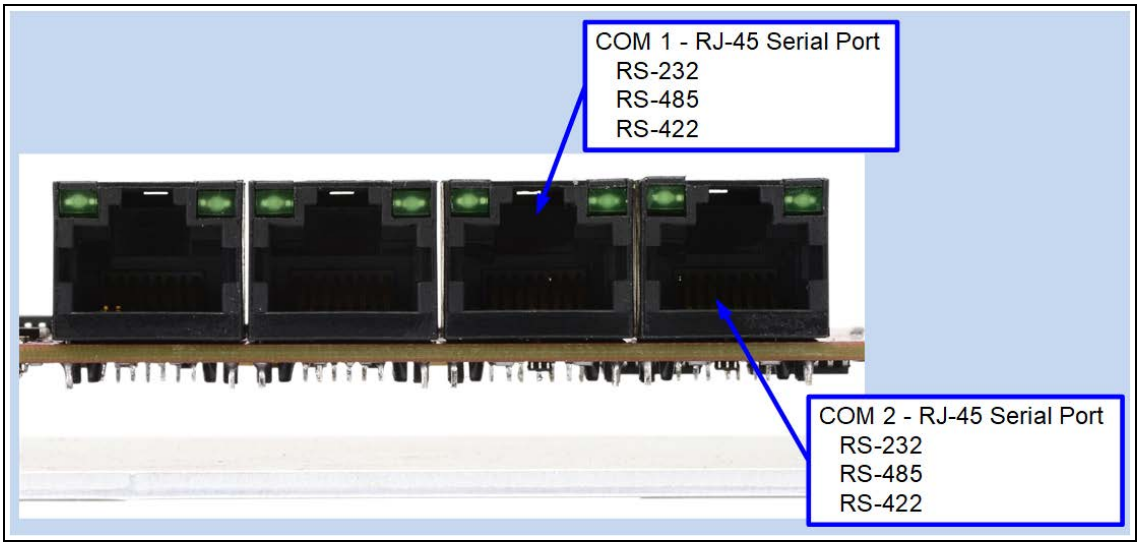

Figure 4: Serial Pinout Assignments

(I) - Input (O) - Output (B) - Bidirectional

Serial Pinout Assignments			
Pin Number	**RS232**	**RS485**	**RS422**
1	--	--	--
2	CD --- (O)	--	--
3	DTR --- (I)	--	--
4	GND	GND	GND
5	RXD --- (I)	--	TX+ (A+) --- (O)
6	TXD --- (O)	TX+/RX+ (Y+) --- (B)	RX+ (Y+) --- (I)
7	CTS --- (O)	TX-/RX- (Z-) --- (B)	RX- (Z-) --- (I)
8	RTS --- (I)	--	TX- (B-) --- (O)
***Com1.mode= Com2.mode=	RS232	RS485	RS485
***Com1.duplex= Com2.duplex=	Half or Full	Half	Full

Note: ***See the COM Parameters (on page 198) for detailed information.

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4. Installation

- The Z9-P2 or Z9-PE2 is approved to operate with an input voltage range of +6 to +30 VDC that can supply at least 0.9 Amps at 6 VDC.
- See the Technical Specifications (on page 457) for additional information.

FREEWAVE Recommends: All input power supply wires should be at least **20 AWG (0.52 mm^2)** wires.
A dedicated and stable power supply line is preferred.
The power supply used MUST provide more current than the amount of current drain listed in the specifications for the product and voltage (at least 0.49 Amps at 12V).

Warning! Use electrostatic discharge (ESD) protectors to protect the Z9-P2 or Z9-PE2 from electric shock and provide filtered conditioned power with over-voltage protection.

Note: The images in this procedure are for **Windows**® 7 and/or **Windows**® 10 and **Firefox**®.

Procedure

1. Install an FCC-approved antenna.
2. Connect the antenna feed line to the Z9-P2 or Z9-PE2.

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Warning! Only FCC approved antennas may be used. See Approved Antennas (on page 196).
The antenna must be professionally installed on a fixed, mounted, and permanent outdoor structure to satisfy RF exposure requirements.
Any antenna placed outdoors must be properly grounded.
Use extreme caution when installing antennas and follow all instructions included with the antenna.

Tip If installing a directional antenna, preset the antenna's direction appropriately.

3. Connect the Z9-P2 or Z9-PE2 to a power supply.

Important!: Torque to lock the conductors: 0.5-0.6 N-m. Torque for the mating jack: 0.3 N-m.

The LEDs (on page 467) blink to show startup.

4. Connect the USB cable to the computer and the Micro USB end to the Z9-P2 or Z9-PE2.

Important!: The USB does NOT power the Z9-P2 or Z9-PE2. It only provides a configuration interface.

The **FreeWave Drivers** and **ZumLink** windows may open.

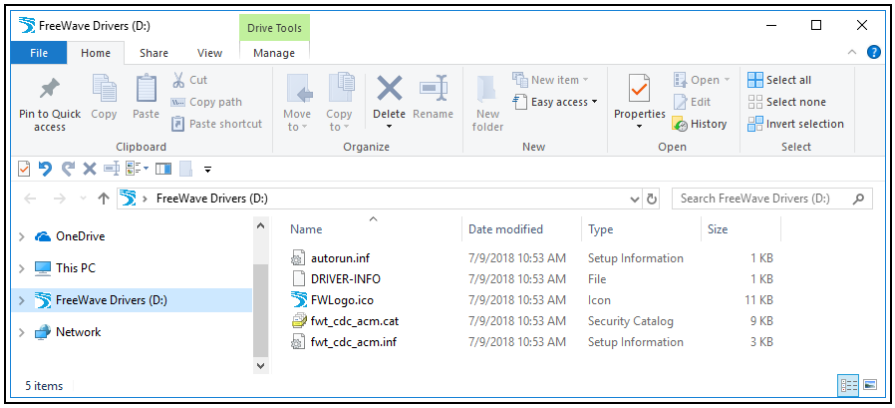

Figure 5: FreeWave Drivers window

Important!: The drivers install automatically.

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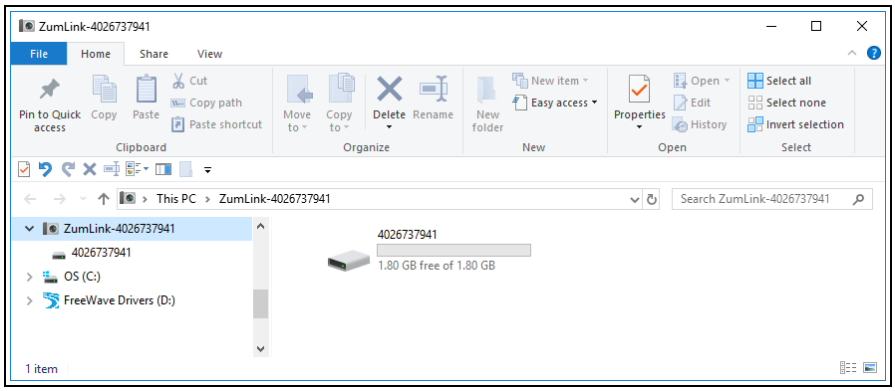

Figure 6: ZumLink window

5. Optional: Use the Ethernet port for data communications.
6. Continue with:
   - Drag and Drop Configuration (on page 28)
   - CLI Configuration (on page 34)
   - Web Interface Configuration (on page 39)

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5. Configuration

- Drag and Drop Configuration (on page 28)
- CLI Configuration (on page 34)
- Web Interface Configuration (on page 39)

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5.1. Drag and Drop Configuration

Caution: This procedure requires the **Windows® File Explorer** file extension to be visible. See the **Microsoft®** topic Windows File Name Extensions to view the extensions.

Important!: **Windows®** 7 or later is required to use the USB Drag and Drop.

Note: The images in this procedure are for **Windows®** 7 and/or **Windows®** 10 and **Firefox®**.

Procedure

1. Connect the USB cable to the computer and the Micro USB end to the Z9-P2 or Z9-PE2. The **FreeWave Drivers** and **ZumLink** windows may open. (Figure 7 and Figure 8)

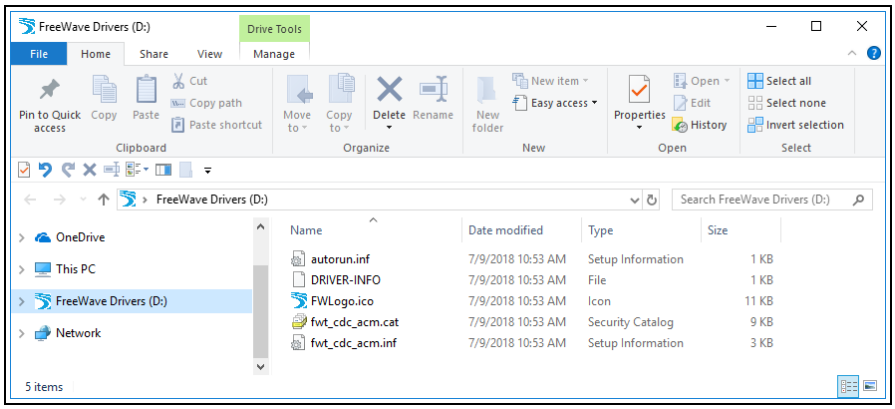

Figure 7: FreeWave Drivers window

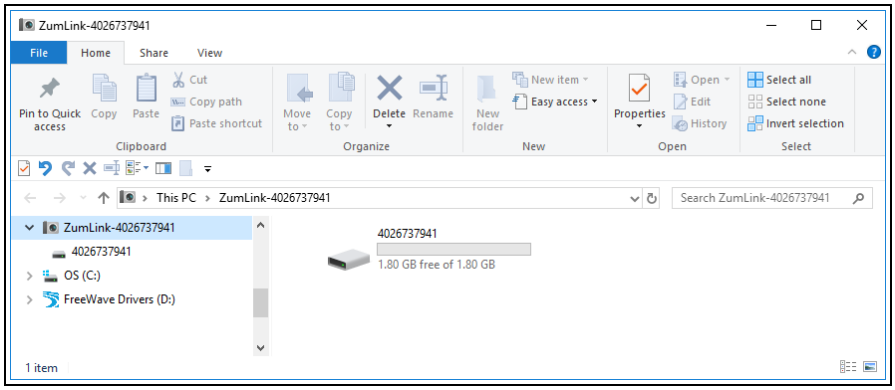

Figure 8: ZumLink window

2. In the **ZumLink** window, double-click the connected Z9-P2 or Z9-PE2. The files of the Z9-P2 or Z9-PE2 appear in the window.
3. Select the **config.txt** file and copy it to the clipboard (press <Ctrl+C>). Figure 9

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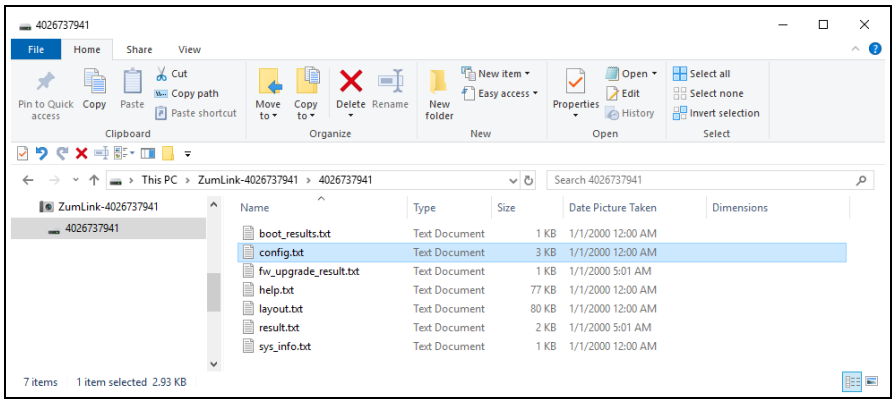

Figure 9: Opened ZumLink window Showing the Default Files

4. Leave the **ZumLink** window open - it is used later in the procedures.
5. Open a **Windows® File Explorer** window and create a designated folder for changed configuration files.

   Example: **C:\ZumLink Config File**.

6. Paste (press <Ctrl+V>) the copied **config.txt** file into the designated folder.

   Important!: The **txt** file must be copied to a separate location on the computer to edit. The file CANNOT be changed directly in the **ZumLink** folder.

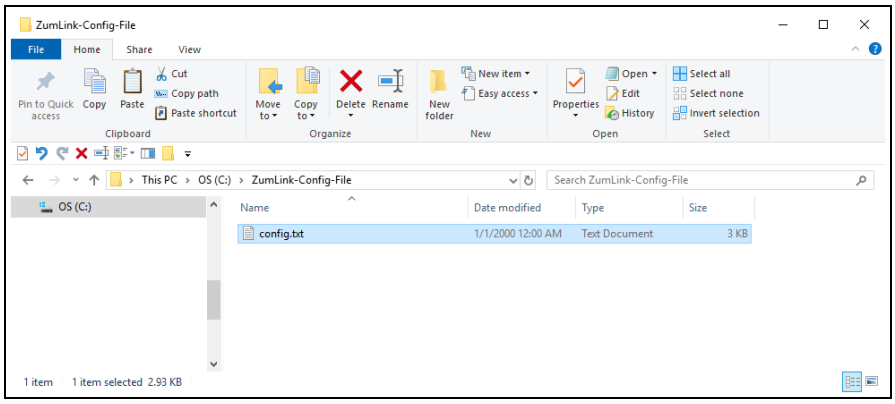

Figure 10: Copied config.txt File in the Designated Configuration Folder

7. Double-click the **config.txt** to open it in the default text editor.

   Note: This example uses **Notepad®**.

8. Click the **Notepad® File** menu and click **Save As**. Figure 11

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Figure 11: Notepad® window - File > Save As Menu

The **Save As** dialog box opens.

11. In the **File Name** text box, enter a file name with either the **.cfg** or **.cfg.txt** extension.

> **Note**: The file name used in this example is for illustration purposes only.
> Any name can be used. NO SPACES are allowed in the file name.

> **Important!**: A **.cfg** file extension is required for **Windows®** 7.
> A **.cfg.txt** file extension may be required for some versions of **Windows®** 8 and **Windows®** 10.
> Failure to save the file with the correct extension type results in the file **NOT** being able to integrate with the **ZumLink config.txt** file when copied to the **ZumLink** window.

12. Click the **Save as type** list box arrow and select **All Files**.

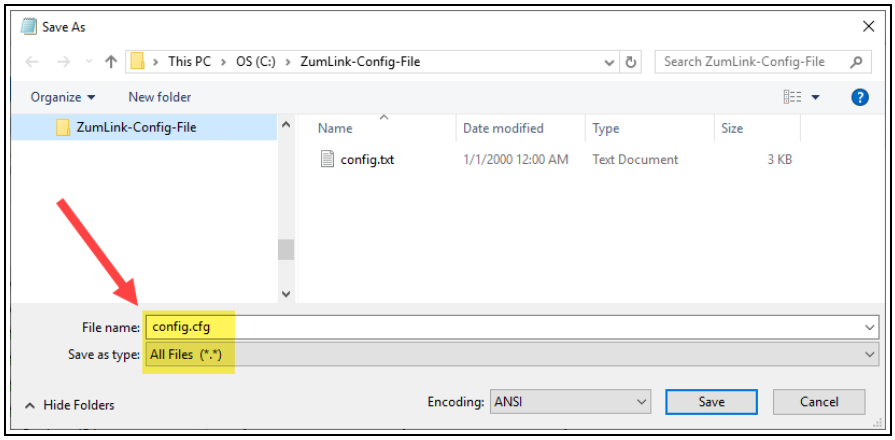

Figure 12: Save As dialog box with All Files (*.*) selected.

13. Click **Save**.
    The dialog box closes and the text editor returns with the new **.cfg** or **.cfg.txt** file open.
14. As applicable, change these general settings:
    - [Page=systemInfo]
      - **systemInfo.deviceName**
      - systemInfo.deviceId

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> **Note**: See the System Info Parameters (on page 336) for detailed information about the parameters.

- [Page=radioSettings]
  - radioSettings.txPower
  - radioSettings.rfDataRate***
  - radioSettings.radioMode
  - radioSettings.networkId***
  - radioSettings.nodeId**
  - radioSettings.radioFrequency***
  - radioSettings.radioHoppingMode***
  - radioSettings.beaconInterval

> **Note**: See Radio Settings Parameters (on page 285) for detailed information about these settings.

Each radio with the same **networkId **must have** a UNIQUE **nodeId**.
A unique nodeId is required so that only one node will unicast an acknowledgment. Otherwise, two or more nodes will unicast an acknowledgment that may collide.

***These are the **Golden Settings** and they MUST match between all radios with the same **networkId**.

> **Important!**: With **radioHoppingMode** enabled, only one radio can be designated as a Gateway or Gateway-Repeater. All other radios MUST be designated as Endpoints or Endpoint-Repeaters. For detailed information, see the Radio Settings Parameters (on page 285).

15. For illustration, the **radioSettings.radioMode** was changed from **Endpoint** to **Gateway**. Figure 13

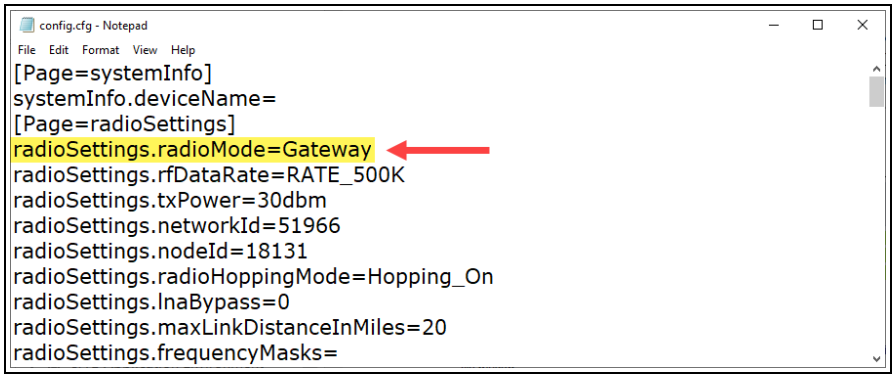

Figure 13: radioSettings.radioMode Changed from Endpoint to Gateway

16. After changes are completed, press <Ctrl+S> or, on the **File** menu, click **Save** to save the updated file.

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17. Close the text editor.
18. Locate and open the **ZumLink** window so it is side-by-side with the changed configuration file window.
19. Open the **Windows® File Explorer** designated folder for changed configuration files.
20. Select the changed .cfg or .cfg.txt file. Figure 14

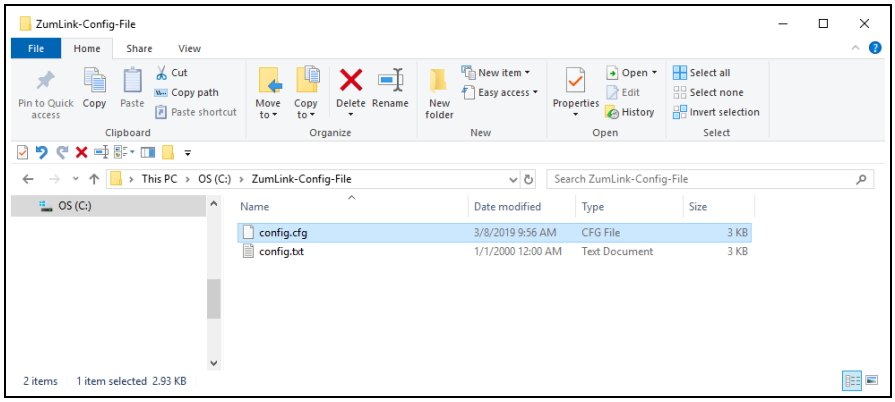

Figure 14: Select the Changed .cfg File

21. Drag and drop the .cfg or .cfg.txt file to the ZumLink window. Figure 15

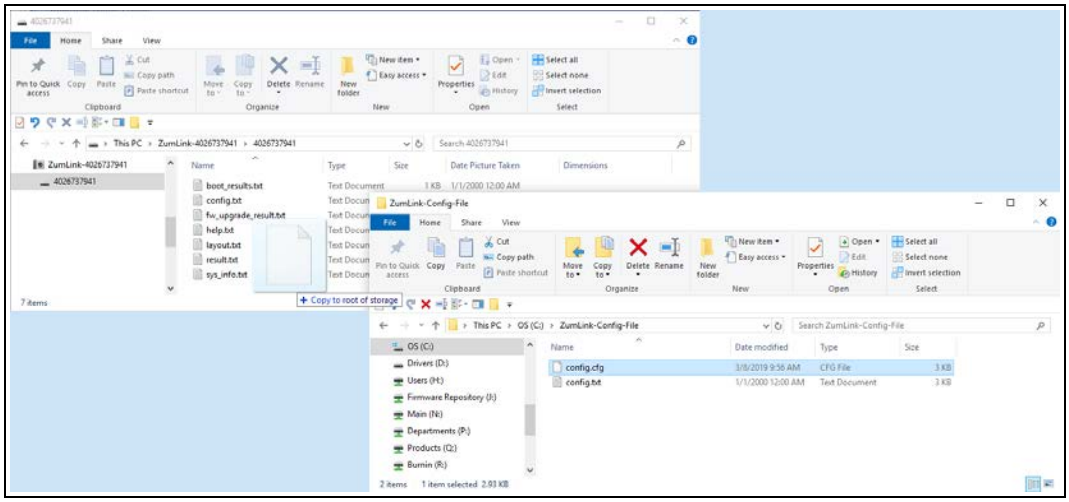

Figure 15: Drag and Drop the .cfg File to the ZumLink Window

22. Wait for the .cfg or .cfg.txt file to integrate with the ZumLink config.txt file.

> **Note**: The more changes made in the .cfg or .cfg.txt file, the longer the Z9-P2 or Z9-PE2 takes to process the file and update the config.txt file.
> If very few changes are made, the .cfg or .cfg.txt file does not appear in the window.

When the config.txt is updated, the changed .cfg or .cfg.txt file is removed from the list of files in the ZumLink window.

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23. Double-click the **result.txt** file to verify there are **No errors Detected** with the identified changes in the file. Figure 16

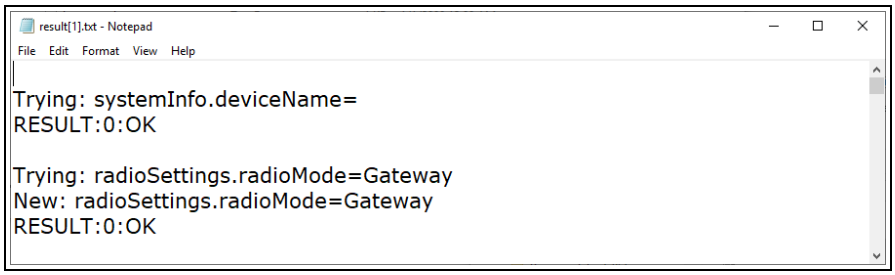

Figure 16: Opened result.txt File

> **Note**: If an error is detected, the **result.txt** file will indicate that errors are present.

24. As appropriate, repeat the Drag and Drop procedure to correct any errors.
25. Optional: Double-click the **config.txt** file to view and verify the new Z9-P2 or Z9-PE2 configuration.
26. Optional: Change the Passwords (on page 163).

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5.2. CLI Configuration

This procedure provides a **Tera Term** terminal connection to the FreeWave CLI. Other terminal emulators (e.g., **HyperTerminal**, **PuTTY**) may be used.

The basic steps are:

A. Connect the Z9-P2 or Z9-PE2 to the Computer (on page 34)

B. Access the CLI and Change the IP Address and nodeId (on page 34)

Note: The images in this procedure are for **Windows**® 7 and/or **Windows**® 10 and **Firefox**®.

5.2.1. Connect the Z9-P2 or Z9-PE2 to the Computer

1. Connect the USB cable to the computer and the Micro USB end to the Z9-P2 or Z9-PE2. The **FreeWave Drivers** and **ZumLink** windows may open.

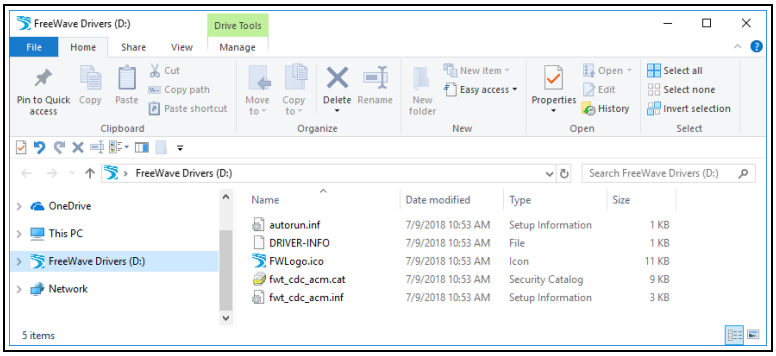

Figure 17: FreeWave Drivers window

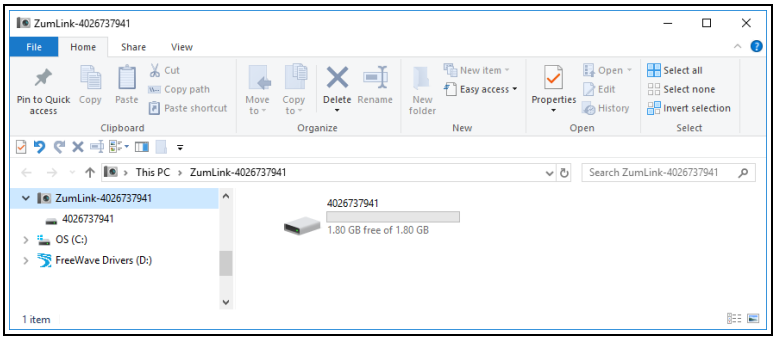

Figure 18: ZumLink window

2. Continue with Access the CLI and Change the IP Address and nodeId (on page 34).

5.2.2. Access the CLI and Change the IP Address and nodeId

Note: This procedure provides a **Tera Term** terminal connection to the FreeWave CLI. Other terminal emulators (e.g., **HyperTerminal**, **PuTTY**) may be used.
The images in this procedure are for **Windows**® 7 and/or **Windows**® 10 and **Firefox**®.

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1. On the computer connected to the Z9-P2 or Z9-PE2, open a terminal program (e.g., **Tera Term** http://ttssh2.osdn.jp/).
2. In **Tera Term**, click the **File** menu and select **New Connection**. Figure 19

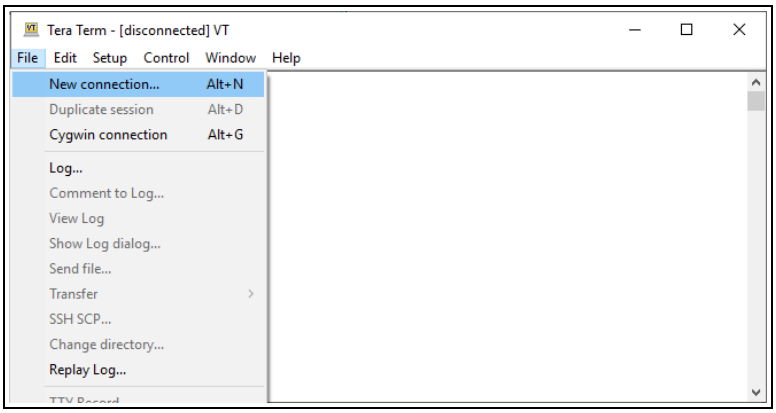

Figure 19: File menu > New Connection

The **Tera Term New Connection** dialog box opens.

3. Click the **Port** list box arrow and select the COM port the Z9-P2 or Z9-PE2 is connected to. Figure 20

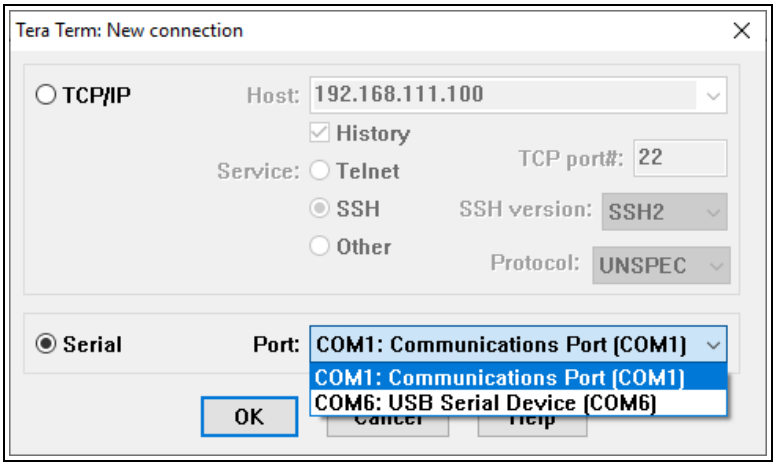

Figure 20: Select the Z9-P2 or Z9-PE2 COM Port

> **Important!**: The **Port** assignment varies from computer to computer.

4. Click **OK** to save the changes and close the dialog box.
   The **Tera Term** window shows the connected COM port and Baud rate in the title bar of the window.
5. In the **Tera Term** window, click the **Setup** menu and select **Serial Port**. Figure 21

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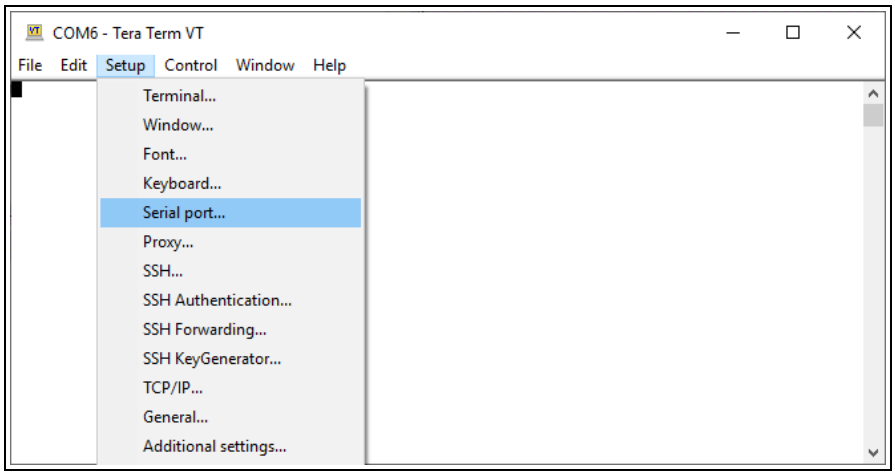

Figure 21: Setup menu > Serial Port

The **Tera Term: Serial Port Setup** dialog box opens. Figure 22

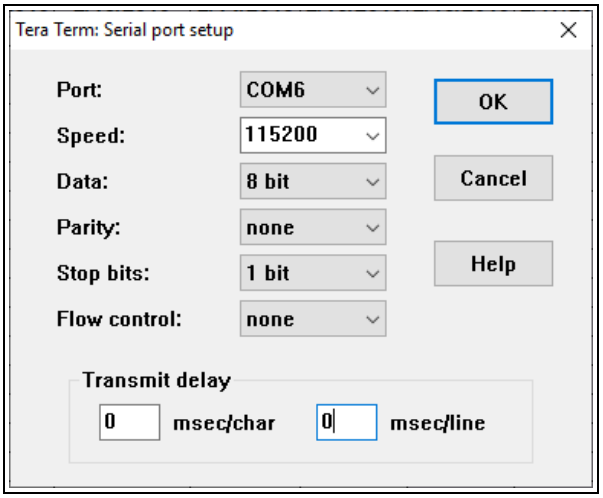

Figure 22: Tera Term: Serial Port Setup dialog box with Default Settings

6. Using Figure 22 as the example, verify the COM port settings are:
   Speed (Baud Rate): 115200
   Data (Databits): 8 bit
   Parity: none
   Stop bits: 1 bit
7. Click **OK** to save the changes and close the dialog box.
8. In the **Tera Term** window, press <Enter>.
   The FreeWave CLI Login returns.
9. Enter `admin` for the **Username** and press <Enter>.
10. Enter `admin` for the **Password** and press <Enter>.

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Note: The default username and password is **admin**.
If the **User Name** or **Password** were changed, enter the applicable information.
The password does not appear when typing - it looks blank.

The **FreeWave Shell** opens. Figure 23

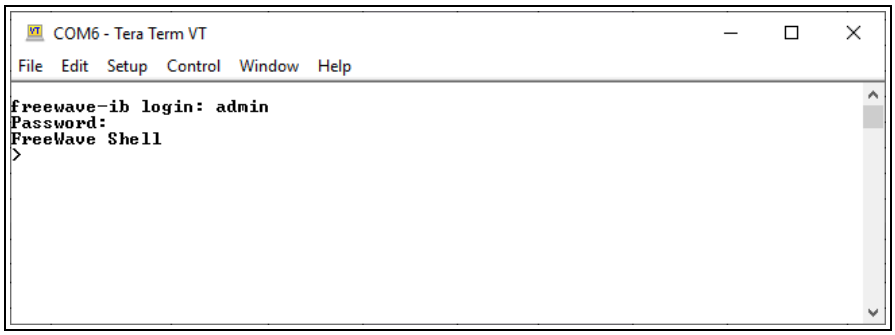

Figure 23: FreeWave Shell

11. At the > prompt, type **network** and press <Enter>.
    The Z9-P2 or Z9-PE2 **network** settings appear. Figure 24

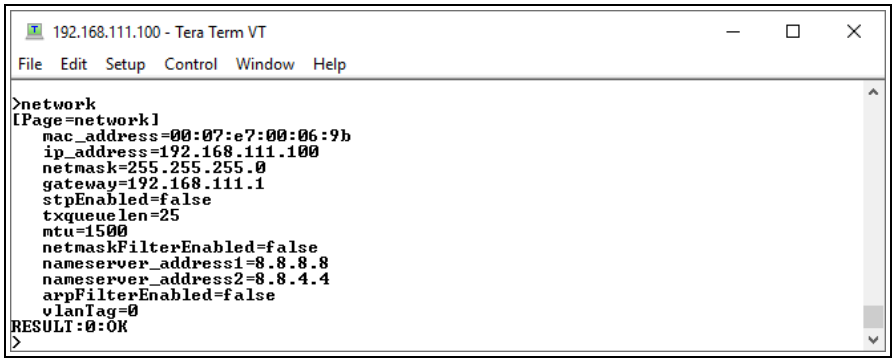

Figure 24: network Page window

Note: Steps 12 to 15 make the **IP Address** and **nodeId** unique.

12. At the > prompt, type **ip_address=nnn.nnn.nnn.nnn** and press <Enter>.

    Note: Where `nnn.nnn.nnn.nnn` is the IP Address assigned to each Z9-P2 or Z9-PE2.

13. Optional: Change the Gateway (on page 263) and the Netmask (on page 267) addresses, if required.
14. At the > prompt, type **nodeId=nnn** and press <Enter>.

    Note: Where **nnn** = a 1 to 5 digit number, unique to the connected radio.
    The **nodeId** MUST be unique on each radio within the same **networkId**.

15. At the > prompt, type **save** and press <Enter>.

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16. Continue with: Change the Passwords (on page 163).

> **Note**: Go to support.freewave.com to login and download the latest firmware for the Z9-P2 or Z9-PE2.
> Registration is required to use this website.

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5.3. Web Interface Configuration

This procedure provides a Web Interface connection to the Z9-P2 or Z9-PE2.

The basic steps are:

A. Setup the Computer IP Address Configuration (on page 40)
B. Setup the Computer IP Address Configuration (on page 40)

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5.3.1. Setup the Computer IP Address Configuration

Note: This procedure is required to access the Web Interface of the Z9-P2 or Z9-PE2.
The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

1. Connect the CAT5e / CAT6 Ethernet cable to the Z9-P2 or Z9-PE2 Ethernet port and the Ethernet port on the computer.
2. On the computer, open the **Windows**® **Control Panel**.
3. View the **Control Panel** window by **Category** and click **Network and Sharing Center**. Figure 25

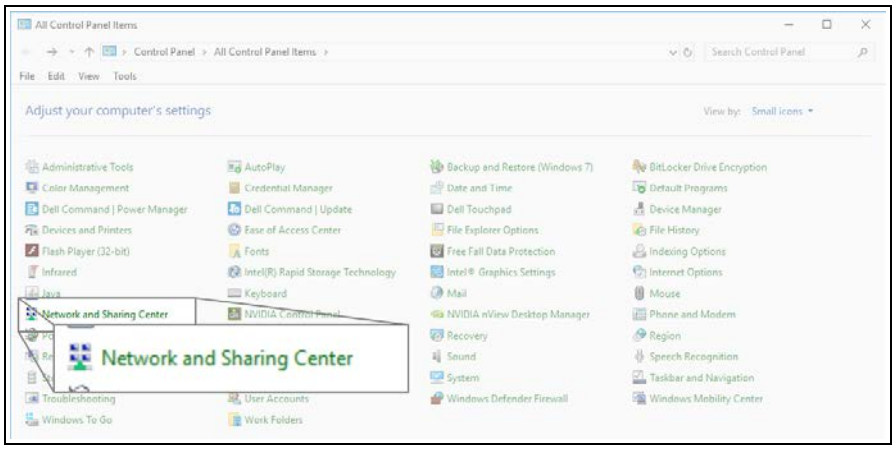

Figure 25: Control Panel > Network and Sharing Center

The **Network and Sharing Center** window opens.

4. Click the **Change Adapter Settings** link. Figure 26

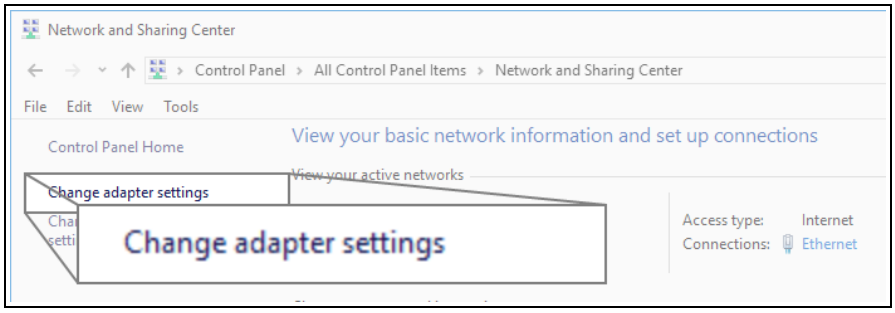

Figure 26: Change Adapter Settings Link

The **Network Connections** window opens. Figure 27

5. Double-click the **Local Area Connection** link or the connected **Network Connection**.

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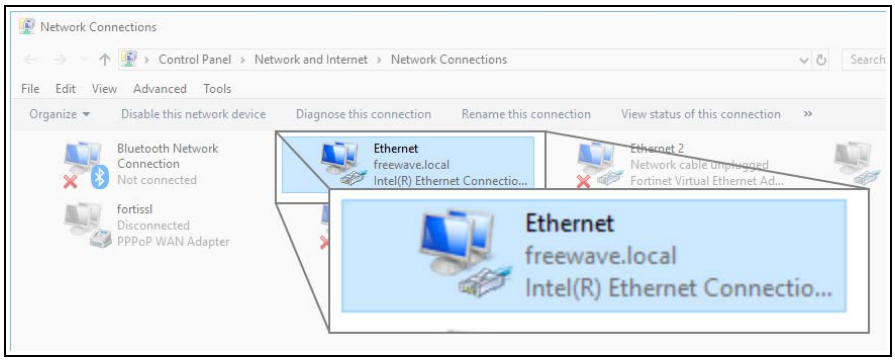

Figure 27: Network Connections window

The **Ethernet Status** dialog box opens. Figure 28

6. Click the **Properties** button.

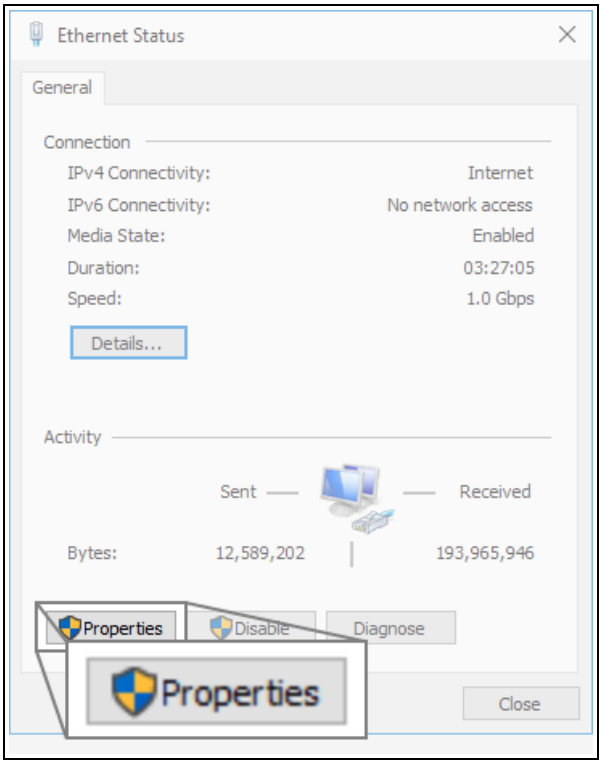

Figure 28: Ethernet Status dialog box

The **Ethernet Properties** dialog box opens.

7. Select the **Internet Protocol Version 4 (TCP/IPv4)** option. Figure 29
8. Click the **Properties** button.

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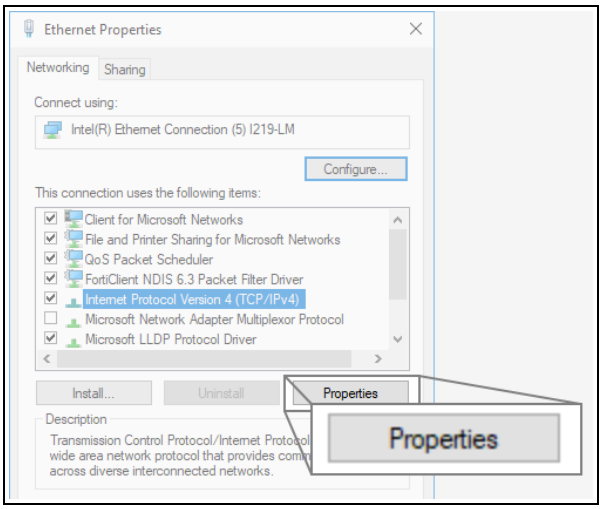

Figure 29: Ethernet Properties dialog box

The **Internet Protocol Version 4 (TCP/IPv4) Properties** dialog box opens. Figure 30

9. **IMPORTANT**: Make a note of the current settings (to reverse this procedure later).

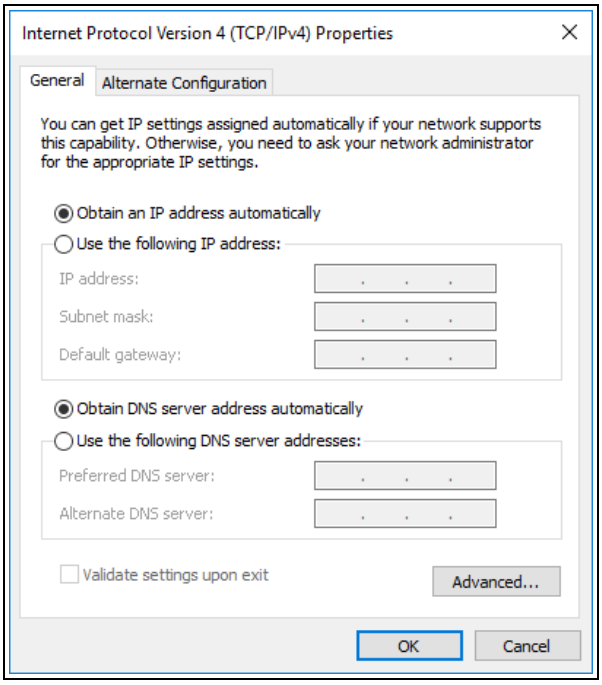

Figure 30: Default Example of Internet Protocol Version 4 (TCP/IPv4) Properties dialog box

10. Select the **Use the following IP address** option button.
11. In the **IP Address** text box, enter an IP Address that is **in the same subnet range but a DIFFERENT IP Address** than the Z9-P2 or Z9-PE2 or all other units in the network. Figure 31

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Example: Enter an **IP Address** from **192.168.111.1** to **192.168.111.254** (but NOT **192.168.111.100**) and the **Subnet Mask** to **255.255.255.0**.

Note: The default Z9-P2 or Z9-PE2 IP Address is **192.168.111.100**.
The default subnet mask is **255.255.255.0**.

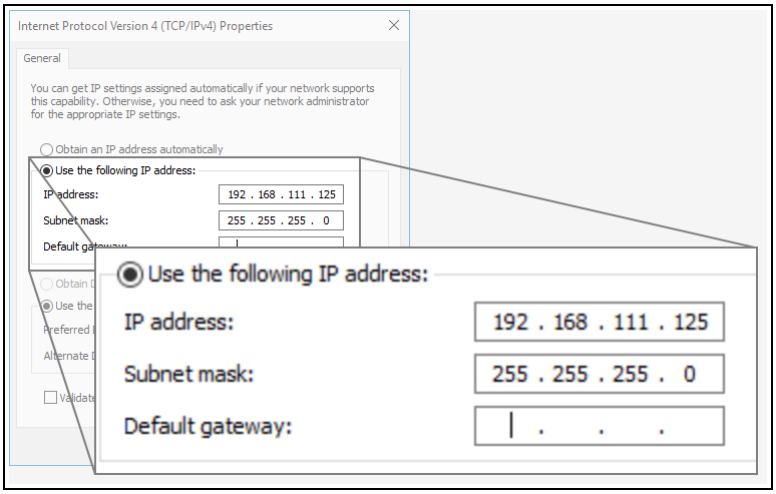

Figure 31: Changed Internet Protocol Version 4 (TCP/IPv4) Properties dialog box

Note: An IP Address is NOT required in the **Default Gateway** text box.

12. Click **OK** to save the changes and close the dialog box.
13. Click **Close** twice to close the **Local Area Connection Properties** and **Local Area Connection Status** dialog boxes.
14. Continue with Web Interface Configuration - Z9-P2 or Z9-PE2 (on page 44).

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5.3.2. Web Interface Configuration - Z9-P2 or Z9-PE2

Note: The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

1. Verify the Setup the Computer IP Address Configuration (on page 40) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 32

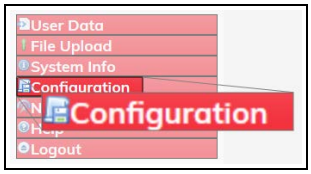

Figure 32: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. In the **Configuration** window, click the **Network** tab.
   The **Network** parameters are shown in Figure 33:

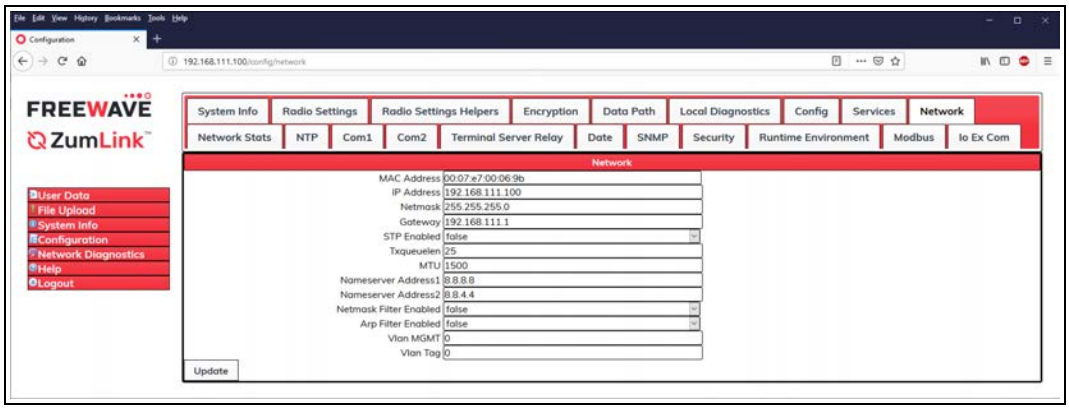

Figure 33: Network window

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> **Note**: Steps 7 to 9 make the **IP Address** and **nodeId** unique.
> Other values may be defined as long as they are unique to each Z9-P2 or Z9-PE2.

7. In the **IP Address** text box, enter the new IP Address for the Z9-P2 or Z9-PE2.

> **Note**: Where `nnn.nnn.nnn.nnn` is the IP Address assigned to each Z9-P2 or Z9-PE2.

8. Optional: Change the Gateway (on page 263) and the Netmask (on page 267) addresses, if required.
9. Click the **Update** button to save the changed information.

Warning! At this point, for Ethernet connections, the connection to the Z9-P2 or Z9-PE2 is disabled.

---

10. Re-connect to the Z9-P2 or Z9-PE2 using the new IP Address entered in Step 7.
11. In the **Configuration** window, click the **Radio Settings** tab.
The **Radio Settings** parameters are shown in Figure 34:

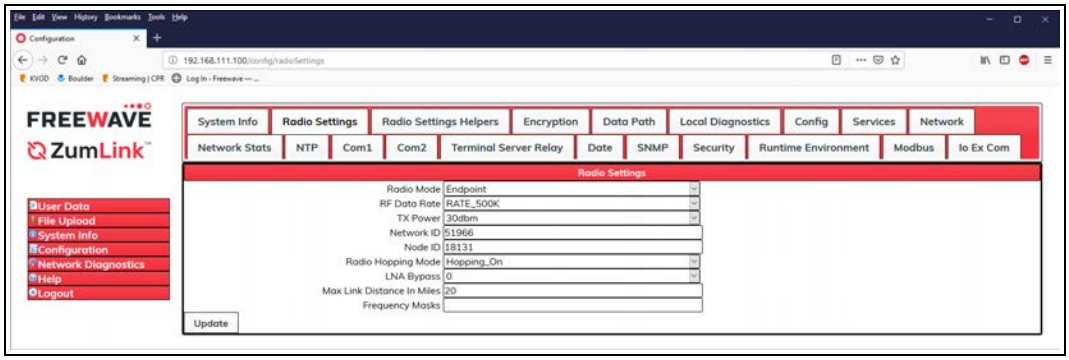

Figure 34: Radio Settings window

> **Important!**: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

12. In the **Node ID** text box, enter the same unique 3-digit number **used in the last octet** of the IP Address entered in Step 7.
13. Click the **Update** button to save the changed information.
14. Continue with: Change the Passwords (on page 163).

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6. Creating a Basic ZumLink Gateway and Endpoint Network

Note: The basic network described in this procedure is created by using either the Drag and Drop Configuration (on page 28), the CLI Configuration (on page 34), or the Web Interface Configuration (on page 39) procedure.

Figure 35 shows a basic network setup for the **ZumLink** device.

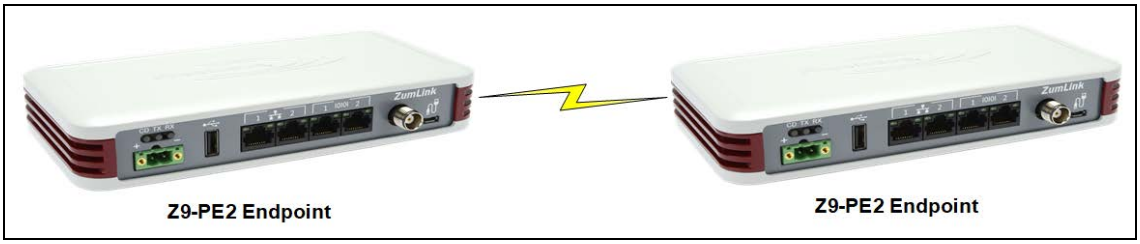

Figure 35: A Basic ZumLink Network

Procedure

Note: This example procedure is specific for CLI configuration.

1. Connect and apply power to the **ZumLink** devices in the network.
2. Complete the CLI Configuration (on page 34) procedure.
3. Select one radio and, at the > prompt, type `radioSettings.radioMode=Gateway` and press <Enter>.
4. At the > prompt, type a setting between `10 and 30` for the **radioSettings.txPower** and press <Enter>.

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Example: `txPower=30` or `radioSettings.txPower=30`.

Entering **txpower=0** or **radiosettings.txpower=0** changes the output power to the minimum or 10 dB.

Note: See the Radio Settings Parameters (on page 285) for detailed information.

5. For the other radio in the network, at the > prompt, type `radioSettings.radioMode=Endpoint` and press <Enter>.
6. Verify the `radioSettings.networkId=` setting is the same on ALL radios in the network.

Note: For Endpoints, the **radioSettings.nodeID** is set automatically.

Important!: The Gateway **radioSettings.nodeId** defaults to 1 and CANNOT be changed.

7. At the > prompt, type `save` and press <Enter>.
   A Solid Green CD LED indicates that the radios are linked.

Note: See LEDs (on page 467) for additional information.

8. Type `logout` and press <Enter> to exit the FreeWave Shell.

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7. IQ Application Environment

The Z9-P2 or Z9-PE2 employs the **IQ Application Environment** to provide application deployment.

Download and Install

a. Download the IQ Application Environment (on page 49)
b. Drag and Drop Installation of the IQ Application Environment (on page 52)
c. Web Interface - Installation of IQ Application Environment (on page 56)

Activation and Usage

a. CLI Activation of the IQ Application Environment (on page 60)
b. Web Interface Activation of the IQ Application Environment (on page 69)
c. Access the IQ Linux Environment (on page 83)

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7.1. Download the IQ Application Environment

Complete this procedure if installing the **IQ Application Environment**.

Notes

- **Zum** products shipped from FreeWave with version v1.1.2.2 firmware have the **IQ Application Environment** pre-installed but it is not licensed or activated.
- If currently using an **IQ Application Environment**, an update to **3_Optional_IQ_Developer_Edition_v1_1_2_2.pkg** is NOT required.
- The images in this procedure are for **Windows®** 7 and/or **Windows®** 10 and **Firefox®**.

Procedure

1. On the support.freewave.com web page, open the **Firmware** window for the Z9-P2 or Z9-PE2.

   Important!: If continuing from the Download the Update Files-v1122 procedure for the **Firmware_v1_1_2_2.zip** file, return to the **Firmware** window. Figure 36

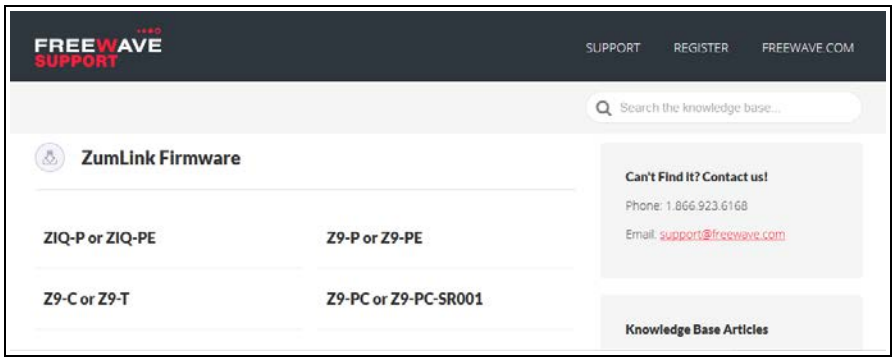

Figure 36: Firmware window

2. Click the **ZIQ-P or ZIQ-PE** link.
   The released Firmware v1.1.2.2 files appear in the window. Figure 37

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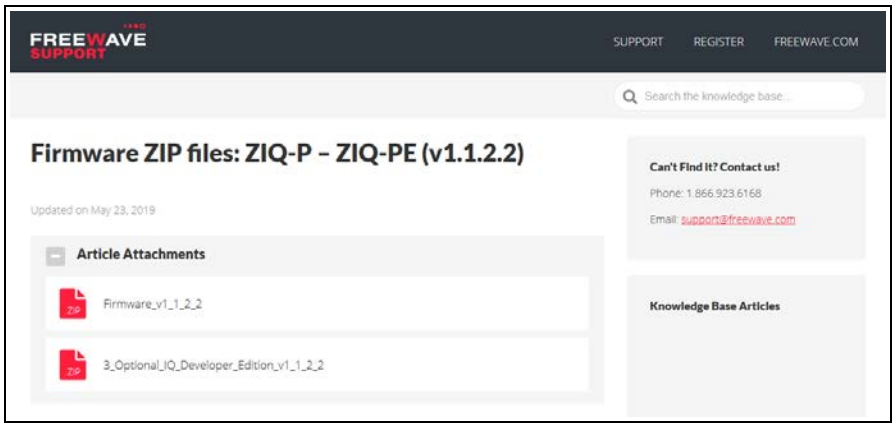

Figure 37: Z9-P2 or Z9-PE2 Firmware Upgrade window

3. Select and click the **3_Optional_IQ_Developer_Edition_v1_1_2_2.zip** attachment.
   The **Opening** dialog box opens. Figure 38

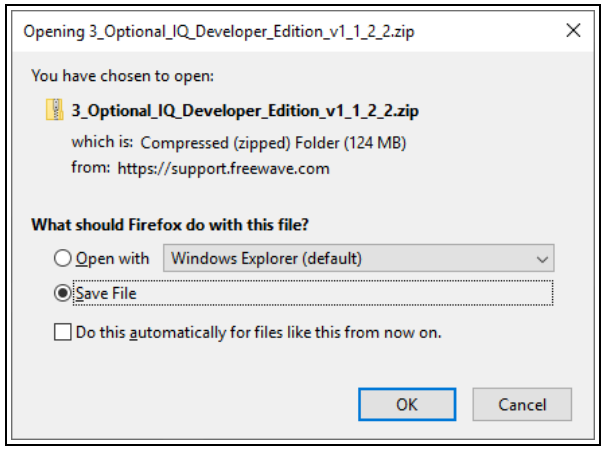

Figure 38: Opening 3_Optional_IQ_Developer_Edition_v1_1_2_2.zip dialog box

4. Click **OK**.
   The **Enter name of file to save to** dialog box opens. Figure 39

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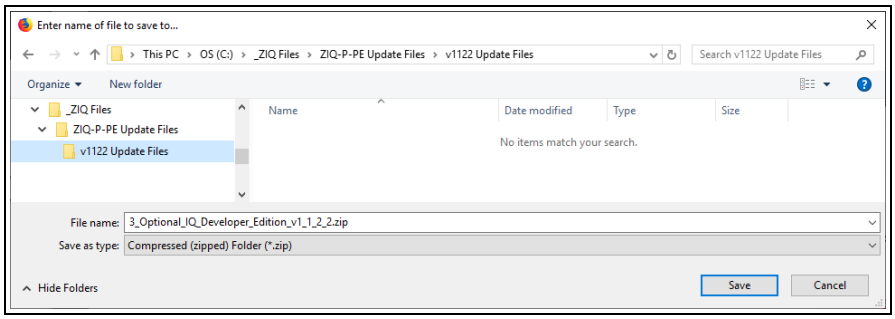

Figure 39: Enter name of file to save to dialog box

5. Search for and select a location to save the **.zip** file to and click **Save**.
   The **Enter name of file to save to** dialog box closes.
6. Open a Windows® Explorer window and find the location where the **.zip** file was saved.
7. Double-click the **.zip** file.
8. Extract the files from the **.zip** file into the parent location.

   Note: The file includes the **.pkg** file used for the **IQ Application Environment** installation.

9. Continue with:
   - Drag and Drop Installation of the IQ Application Environment (on page 52)
   - Web Interface - Installation of IQ Application Environment (on page 56)

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7.2. Drag and Drop Installation of the IQ Application Environment

FREEWAVE Recommends: If currently using an **IQ Application Environment**, an update is not required. All existing IQ environments will work with v1.1.2.2 device firmware.

1. Verify the Download the IQ Application Environment (on page 49) procedure is completed.
2. **IMPORTANT**: Install the **1_Device_Firmware_v1_1_2_2.pkg** file first.
   See v1122-Firmware Update - Drag and Drop.
3. Locate and select the downloaded **3_Optional_IQ_Developer_Edition_v1_1_2_2.pkg** upgrade file. Figure 40

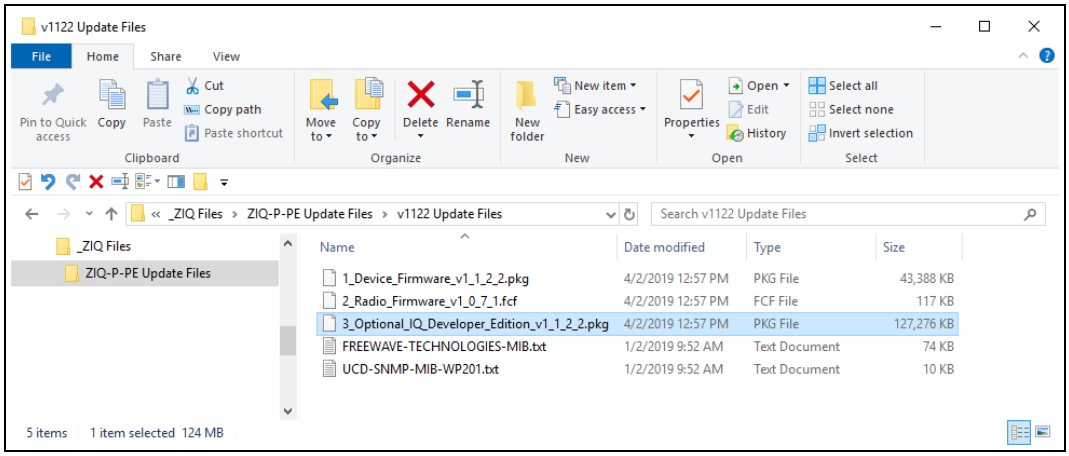

Figure 40: Selected 3_Optional_IQ_Developer_Edition_v1_1_2_2.pkg File

4. Drag and drop the **.pkg** file on to the **ZumLink** window. Figure 41
   The **.pkg** file will disappear after a few minutes.

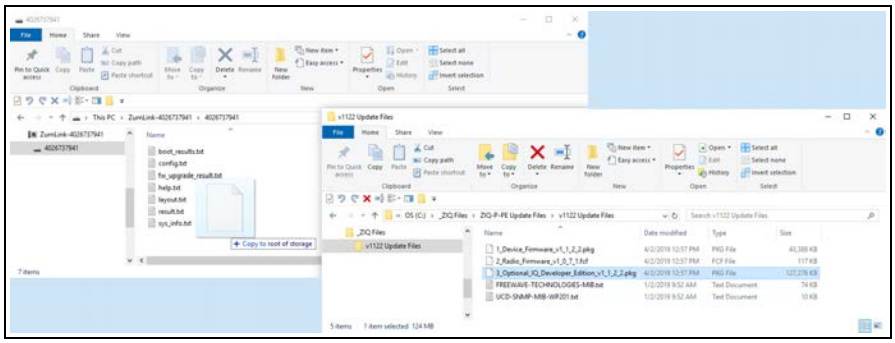

Figure 41: Drag and Drop the 3_Optional_IQ_Developer_Edition_v1_1_2_2.pkg File to the ZumLink window

Important!: If the **.pkg** file is NOT accepted, a **Windows®** error message appears immediately. Figure 42

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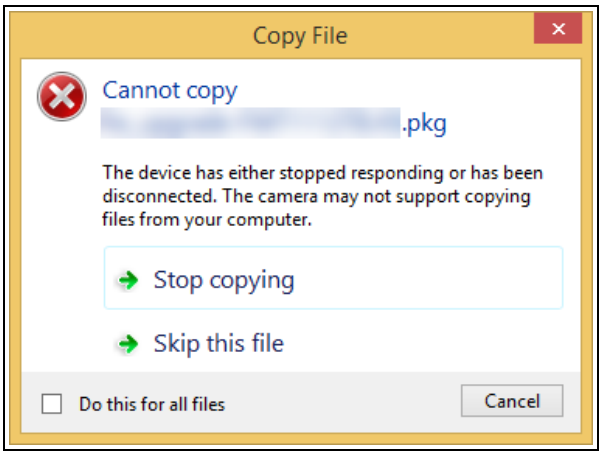

Figure 42: Failed PKG Message dialog box

Important!: A **.pkg** or **.fcf** file extension is required for **Windows®** 7.
A **.pkg.txt** or **.fcf.txt** file extension **may be required** for some versions of **Windows®** 8, 8.1, and 10.

a. If the **.pkg** file was rejected, change the extension of the **.pkg** file to **.pkg.txt** and select that file.
b. Drag and drop the **.pkg.txt** file to the **ZumLink** window.
The **.pkg.txt** file will disappear after a few minutes.

The **Copying** message appears. Figure 43

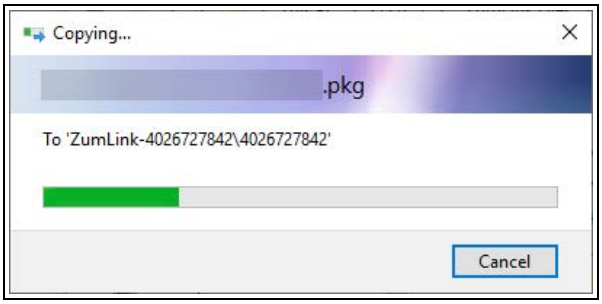

Figure 43: Copying .pkg message

Caution: DO NOT click the **Cancel** button to stop the drag-n-drop process.
If the drag-n-drop process is canceled during the file copy process, the Z9-P2 or Z9-PE2 cannot be accessed in **Windows® File Explorer**.
If this happens, reboot the Z9-P2 or Z9-PE2 and re-start the drag-n-drop process.

When the file is copied, the Z9-P2 or Z9-PE2 window is similar to Figure 44:

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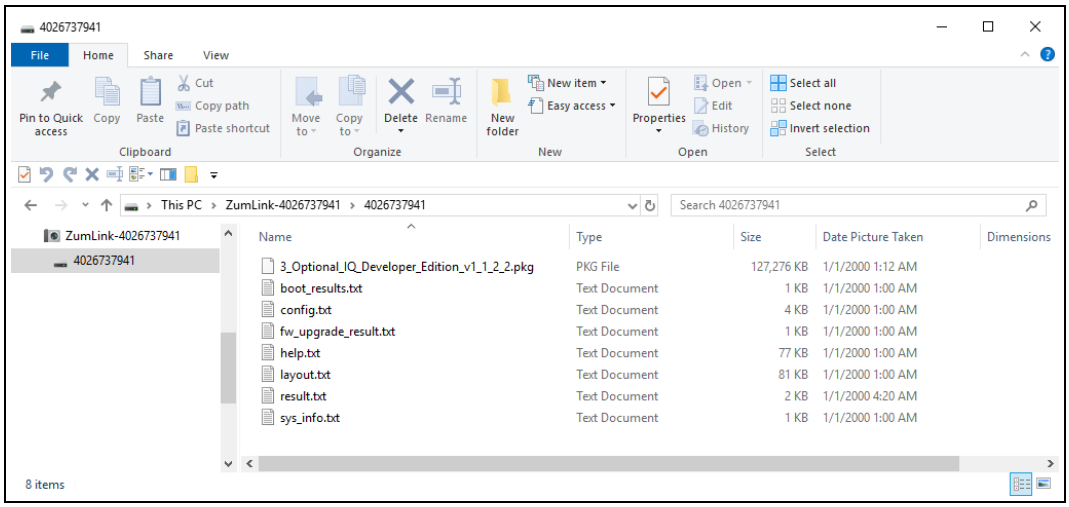

Figure 44: 3_Optional_IQ_Developer_Edition_v1_1_2_2.pkg File Dropped in the ZumLink window

Note: If, after 6-10 minutes, the .pkg file has NOT disappeared, refresh the ZumLink window.

Warning! DO NOT remove power from the Z9-P2 or Z9-PE2 during or immediately after the firmware update process!
Wait until the Home window (on page 378) Web Interface is accessible before removing power from the Z9-P2 or Z9-PE2 device.

If power is removed prematurely during the update process, the Web Interface pages may not be accessible.
To recover from a failed Web Interface update, use the v1122-Firmware Update - Drag and Drop procedure to reinstall the .pkg file and **WAIT for the file update process to complete**.

DO NOT start another update or configuration change while an update is in progress.

5. Optional: View the updated Rte Template Version (on page 315) in the **sys.info.txt** file to verify the update information. Figure 45

Important!: The image provides example information only.
Each Z9-P2 or Z9-PE2 provides its own unique information.

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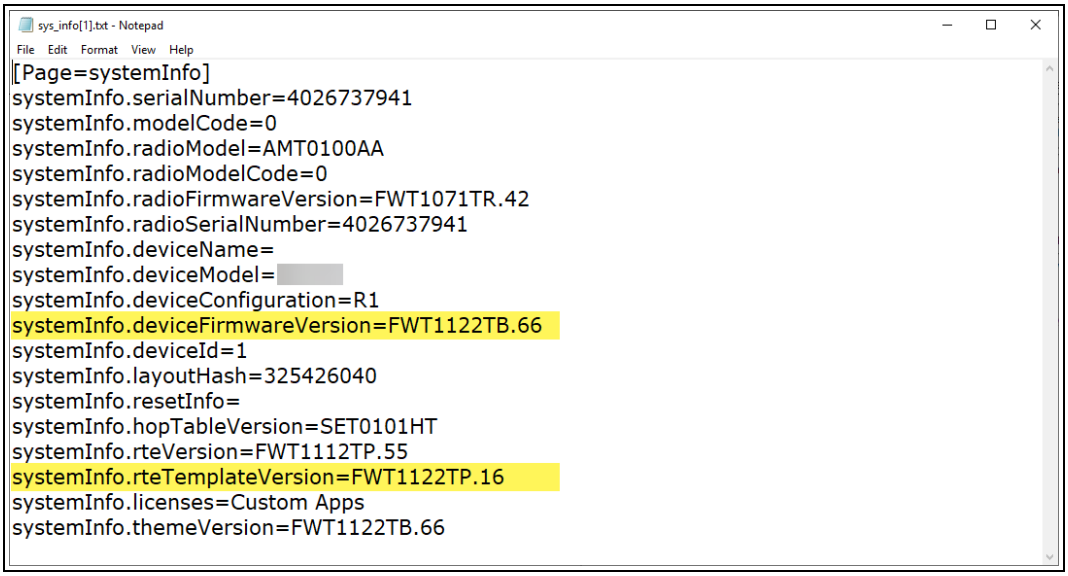

Figure 45: sys.info.txt file with Updated Firmware

Important!: For the v1.1.2.2 update, these settings should have this information:
systemInfo.deviceFirmwareVersion=FWT1122TB.66
Web Interface - Device Firmware Version is FWT1122TB.66
systemInfo.rteTemplateVersion=FWT1122TP.16
Web Interface - Rte Template Version is FWT1122TP.16
If neither of these are listed in their respective settings, repeat the upgrade procedure.

6. Contact FreeWave Technical Support (on page 14) for the license key file.
7. Continue with:
   - CLI Activation of the IQ Application Environment (on page 60)
   - Web Interface Activation of the IQ Application Environment (on page 69)

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7.3. Web Interface - Installation of IQ Application Environment

FREEWAVE Recommends: If currently using an **IQ Application Environment**, an update is not required. All existing IQ environments will work with v1.1.2.2 device firmware.

1. Verify the Download the IQ Application Environment (on page 49) procedure is completed.
2. **IMPORTANT**: Install the **1_Device_Firmware_v1_1_2_2.pkg** file first.
   See v1122-Firmware Update - Drag and Drop.

   Important!: If continuing from the Firmware Update - Web Interface-v1122--ZIQ procedure for the **Firmware_v1_1_1_2.zip** file, go to Step 6.
3. Using a CAT5e / CAT6 Ethernet cable, connect the Z9-P2 or Z9-PE2 Ethernet port to the computer's Ethernet port.
4. Open a web browser.
5. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.

   The Home window (on page 378) opens.
6. On the **Menu** list, click the **File Upload** link. Figure 46

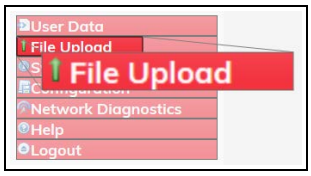

Figure 46: File Upload link

   The **Authentication Required** (Login) dialog box opens.
7. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and theFile Upload window opens. Figure 47

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

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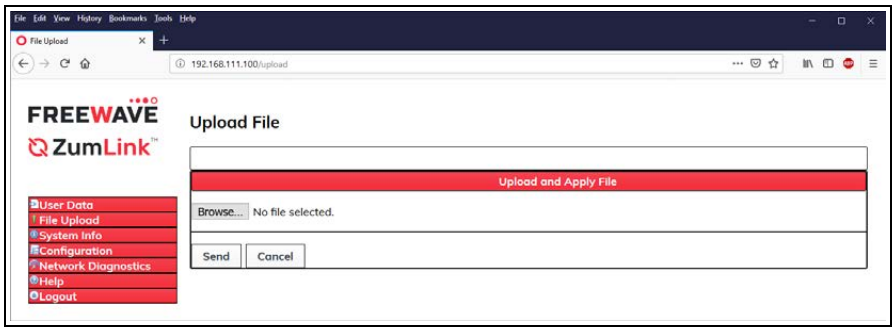

Figure 47: File Upload window

8. Click the **Browse** button.
   The **File Upload** dialog box opens.
9. Locate and select the downloaded **3_Optional_IQ_Developer_Edition_v1_1_2_2.pkg** upgrade file. Figure 48

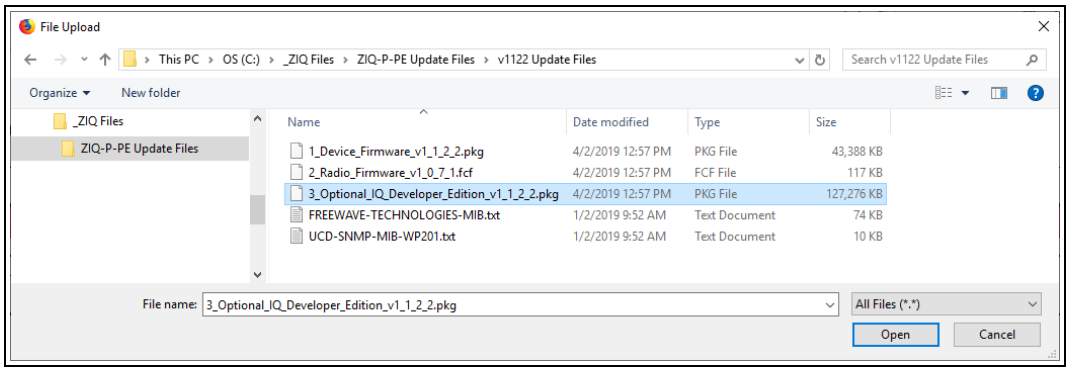

Figure 48: File Upload dialog box with Selected 3_Optional_IQ_Developer_Edition_v1_1_2_2.pkg File

10. Click **Open**.
    The dialog box closes and the **File Upload** window returns showing the selected file. Figure 49

Figure 49: File Upload window with Selected .pkg File

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11. Click **Send**.
    The **File Upload** window changes to show the upload percentage to the Z9-P2 or Z9-PE2.

    Note: When using the Web Interface on a computer with **Windows®** 8 or **Windows®** 10, clicking **Cancel** does **not** halt the upload process.

    The **File Upload** window refreshes and shows the uploaded file.

    Warning! DO NOT remove power from the Z9-P2 or Z9-PE2 during or immediately after the firmware update process!
    Wait until the Home window (on page 378) Web Interface is accessible before removing power from the Z9-P2 or Z9-PE2 device.

    If power is removed prematurely during the update process, the Web Interface pages may not be accessible.
    To recover from a failed Web Interface update, use the v1122-Firmware Update - Drag and Drop procedure to reinstall the **.pkg** file and **WAIT for the file update process to complete**.

    DO NOT start another update or configuration change while an update is in progress.

12. Refresh the browser window (press <F5>).
13. On the **Menu** list, click the **System Info** link. Figure 50

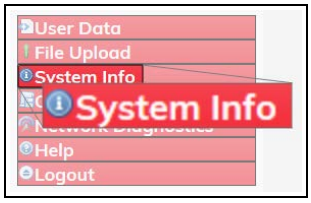

Figure 50: System Info link

The System Info window opens showing the updated firmware on the Z9-P2 or Z9-PE2. Figure 51

Important!: The image provides example information only.
Each Z9-P2 or Z9-PE2 provides its own unique information.

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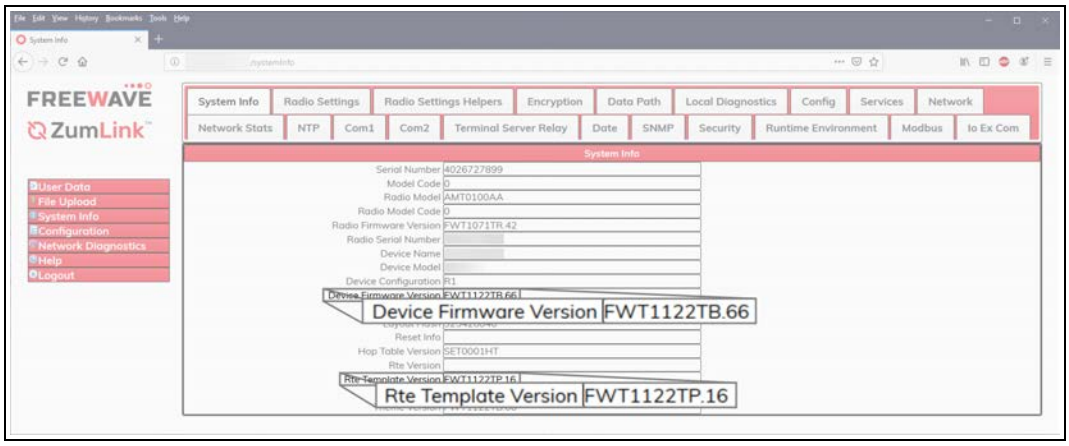

Figure 51: System Info window

Important!: For the v1.1.2.2 update, these settings should have this information:
systemInfo.deviceFirmwareVersion=FWT1122TB.66
Web Interface - Device Firmware Version is FWT1122TB.66
systemInfo.rteTemplateVersion=FWT1122TP.16
Web Interface - Rte Template Version is FWT1122TP.16
If neither of these are listed in their respective settings, repeat the upgrade procedure.

14. Contact FreeWave Technical Support (on page 14) for the license key file.
15. Continue with:
    - CLI Activation of the IQ Application Environment (on page 60)
    - Web Interface Activation of the IQ Application Environment (on page 69)

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7.4. CLI Activation of the IQ Application Environment

This procedure uses the CLI to activate the **IQ Application Environment** for all **ZumLink** and **ZIQ** products.

Note: See the Web Interface Activation of the IQ Application Environment (on page 69) to use the Web Interface to activate the **IQ Application Environment**

Warning! The process of activating IQ Application Environment activates a fresh copy of the IQ environment.

If IQ has already been activated, this procedure will erase any user-generated content and settings in the existing Linux development environment.

These are the basic steps to license and activate the **IQ Application Environment**:

A. Get the License File from FreeWave (on page 60)
B. Drag and Drop the License File onto the Z9-P2 or Z9-PE2 (on page 61)
C. Activate the IQ Application Environment (on page 64)
D. Verify Successful Licensing and Activation (on page 67)

7.4.1. Get the License File from FreeWave

The Z9-P2 or Z9-PE2 must be licensed to activate the **IQ Application Environment**. Licensing can be added in the factory or after purchase.

1. Locate the Serial number on the Z9-P2 or Z9-PE2 product label.
2. Contact FreeWave Technical Support (on page 14) for the license key file.
3. Tech Support will ask for the Serial number and an email address to send the license information to.
4. An email is sent to the provided address with a **License_nnnnnnnnnn.LIC** file attached.

   Note: Where **nnnnnnnnnn** is the 10-digit Serial number of the Z9-P2 or Z9-PE2.

5. Search for and select a location to save the **.LIC** file to.
6. Continue with Drag and Drop the License File onto the Z9-P2 or Z9-PE2 (on page 61).

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7.4.2. Drag and Drop the License File onto the Z9-P2 or Z9-PE2

Note: The images in this procedure are for **Windows**® 7 and/or **Windows**® 10 and **Firefox**®.

1. Connect the USB cable to the computer and the Micro USB end to the Z9-P2 or Z9-PE2. The **FreeWave Drivers** and Z9-P2 or Z9-PE2 windows open. Figure 52 and Figure 53

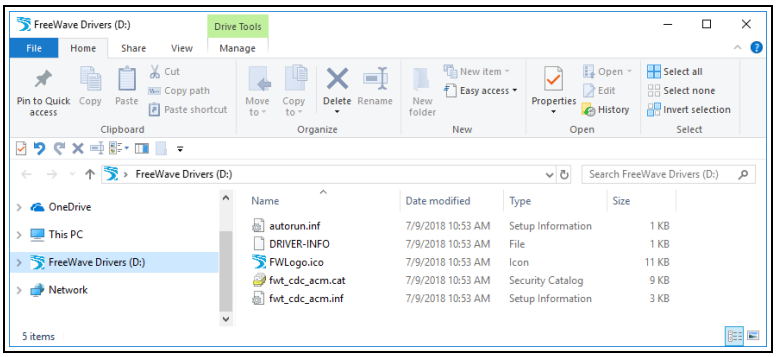

Figure 52: FreeWave Drivers window

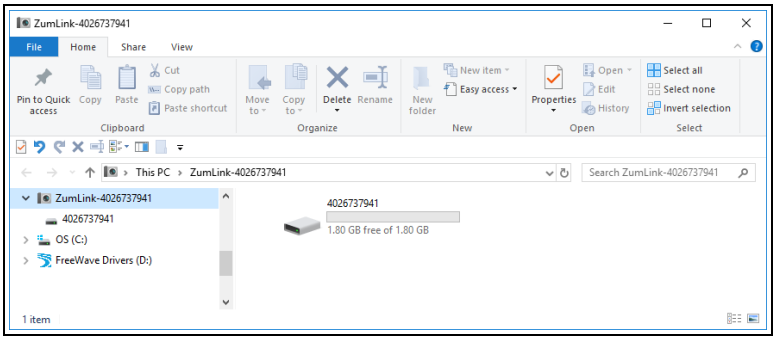

Figure 53: ZumLink window

2. In the Z9-P2 or Z9-PE2 window, double-click the connected device. The files of the Z9-P2 or Z9-PE2 appear in the window. Figure 54

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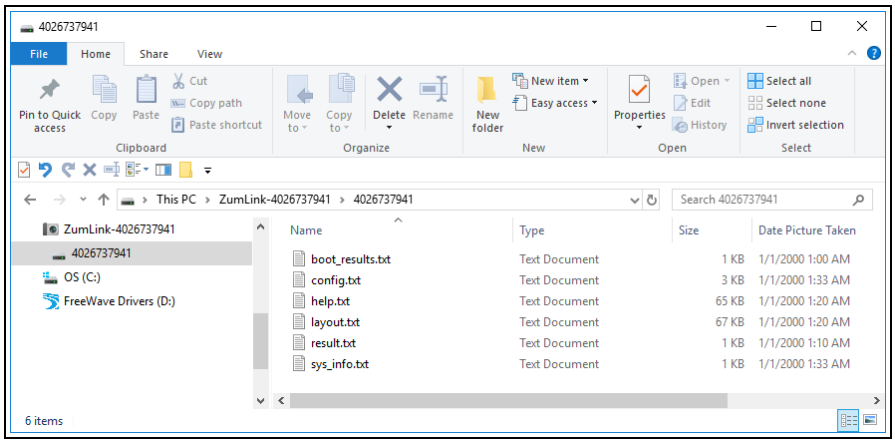

Figure 54: Opened ZumLink window showing the Default Files

3. Locate and select the saved License_nnnnnnnnnn.LIC file. Figure 55

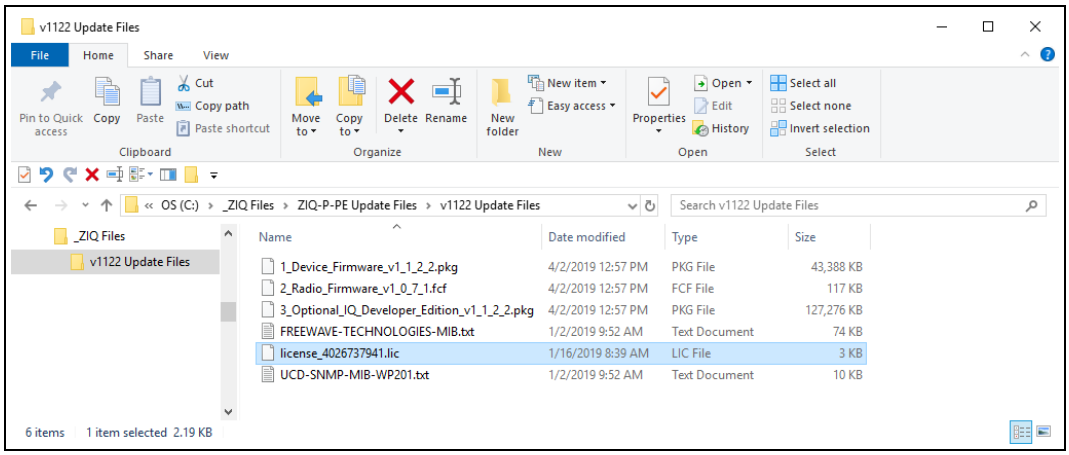

Figure 55: Selected License_nnnnnnnnnn.LIC File

4. Drag and drop the License_nnnnnnnnnn.LIC file on to the ZumLink window. Figure 56

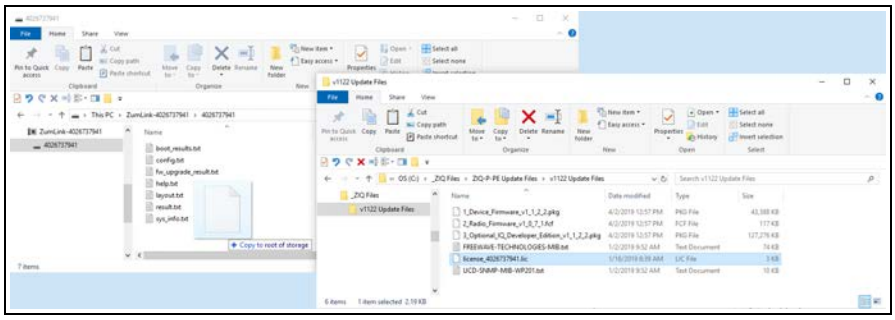

Figure 56: Drag and Drop the License_nnnnnnnnnn.LIC file on to the ZumLink window

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Important!: If the **License_nnnnnnnnnn.LIC** file is NOT accepted, a **Windows®** error message appears immediately. Figure 57

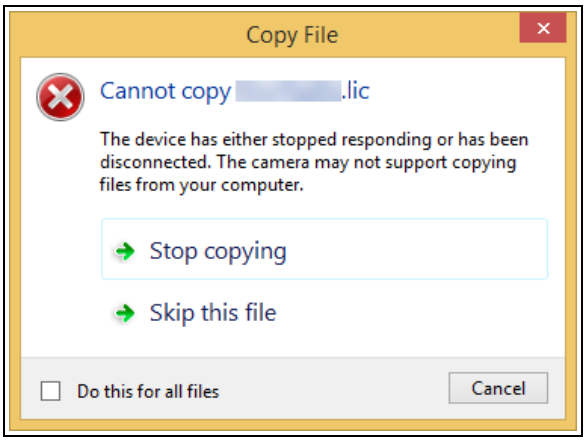
5. 

Figure 57: Failed .LIC Message dialog box

Important!: A **.LIC** file extension is required for **Windows®** 7.
A **.LIC.txt** file extension **may be required** for some versions of **Windows®** 8, 8.1, and 10.

a. If the **.LIC** file was rejected, change the extension of the **.LIC** file to **.LIC.txt** and select that file.
b. Drag and drop the **.LIC.txt** file to the **ZumLink** window.

Note: The Z9-P2 or Z9-PE2 loads the **License_nnnnnnnnnn.LIC** file immediately.

Caution: Do NOT unplug the Z9-P2 or Z9-PE2 to reboot.
The **`rteReset=Hard`** and **`reset=now`** commands are **required** to reboot of the Z9-P2 or Z9-PE2.

6. Continue with Activate the IQ Application Environment (on page 64).

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7.4.3. Activate the IQ Application Environment

Note: This procedure provides a **Tera Term** terminal connection to the FreeWave CLI. Other terminal emulators (e.g., **HyperTerminal**, **PuTTY**) may be used.

1. Open a terminal emulator application (e.g., **Tera Term** http://ttssh2.osdn.jp/).
2. Select the **Serial** option buttion.
3. Click the **Port** list box arrow and select the COM port the Z9-P2 or Z9-PE2 is connected to. Figure 58

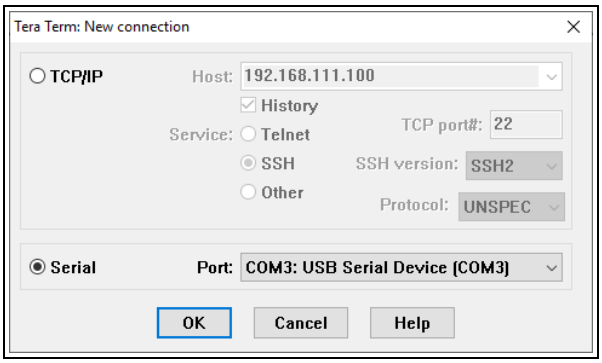

Figure 58: Tera Term: New Connection window

4. Click **OK**.
   The **Tera Term New Connection** dialog box closes.
   The **Tera Term** window opens.
5. In the **Tera Term** window, press <Enter>.
   The FreeWave CLI Login returns.
6. Enter **admin** for the **Username** and press <Enter>.
7. Enter **admin** for the **Password** and press <Enter>.

   Note: If the **User Name** or **Password** were changed, enter the applicable information. The password does not appear when typing - it looks blank.

   The **FreeWave Shell** returns. Figure 59

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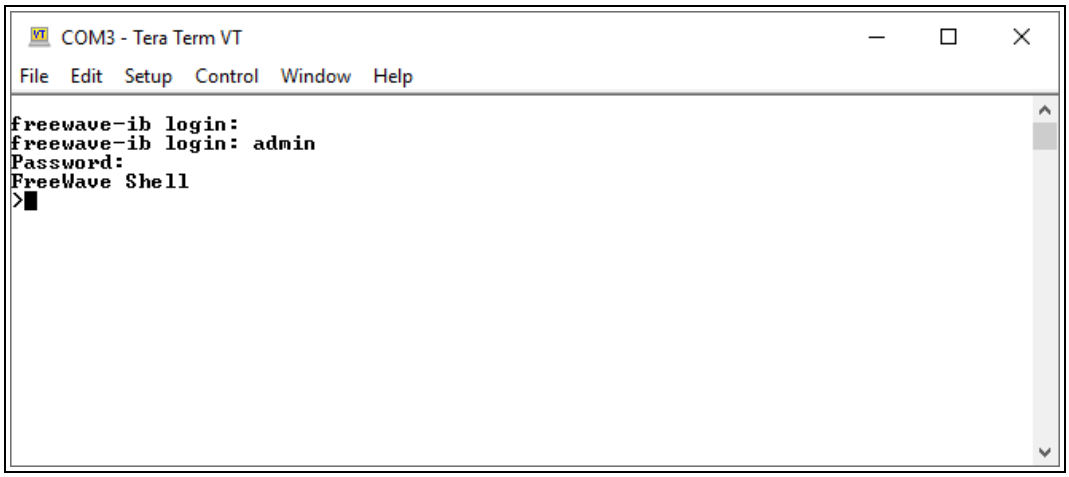

Figure 59: FreeWave Shell window

8. At the > prompt, type, **systemInfo** and press <Enter>.
9. Verify the Licenses (on page 340) parameter is **licenses=Custom Apps**. Figure 60

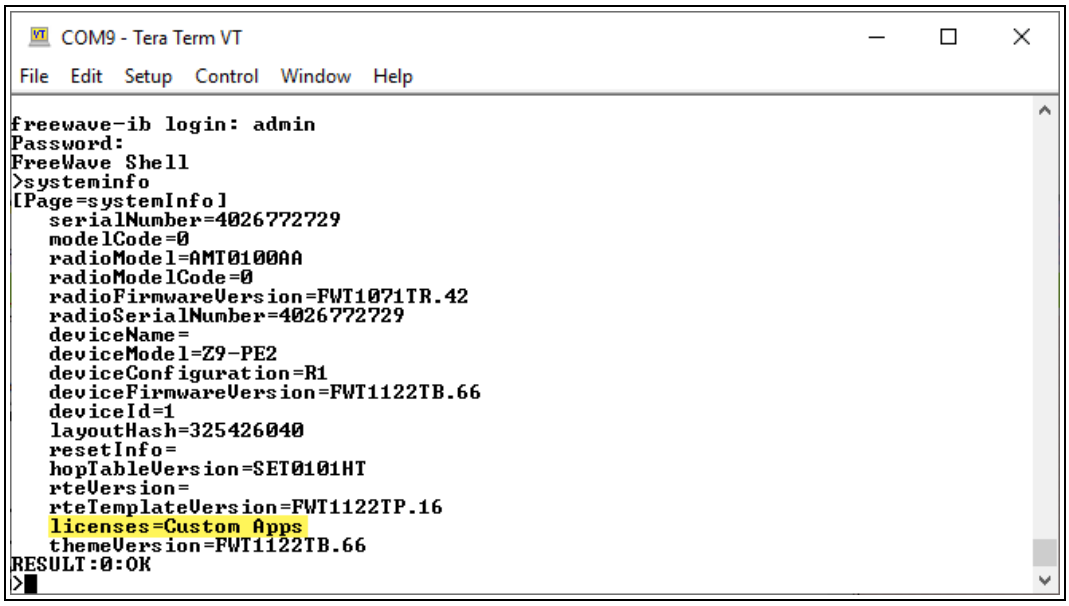

Figure 60: licenses=Custom Apps

10. Type **rteReset=Hard** and press <Enter>. Figure 61

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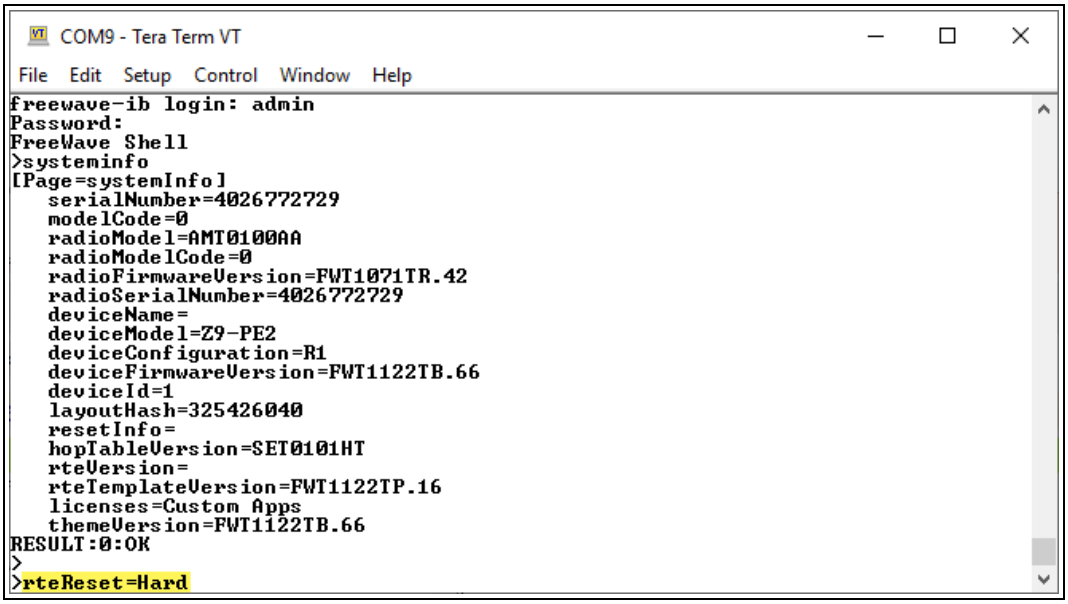

Figure 61: rteReset=Hard window

11. Type **reset=now** and press <Enter>. Figure 62
The Z9-P2 or Z9-PE2 reboots.

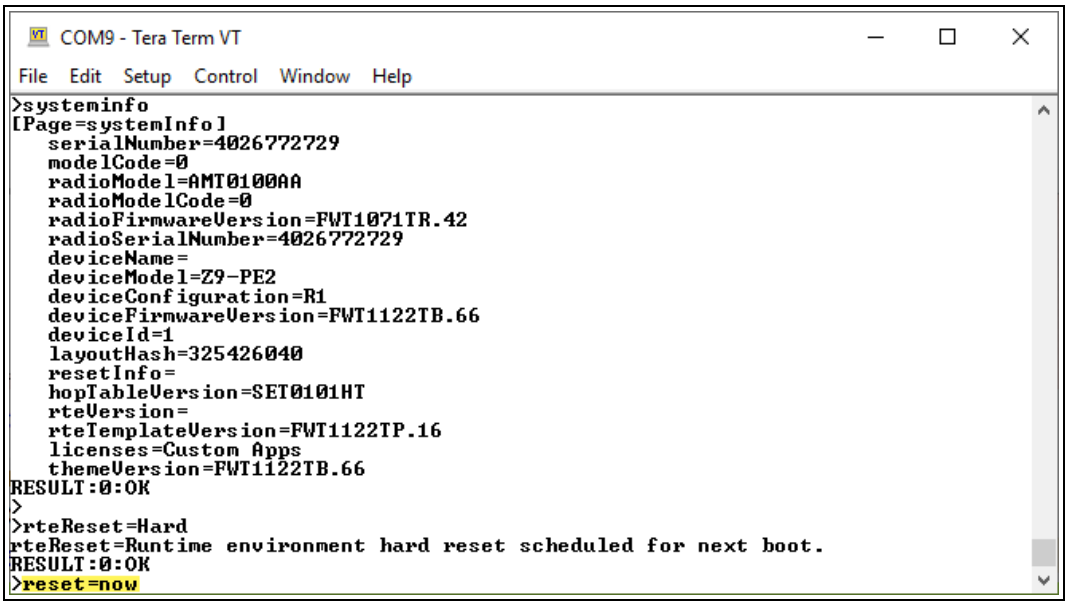

Figure 62: reset=Now window

The **FreeWave Drivers** and Z9-P2 or Z9-PE2 windows open.

12. Continue with Verify Successful Licensing and Activation (on page 67).

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7.4.4. Verify Successful Licensing and Activation

1. Re-open the terminal emulator application.

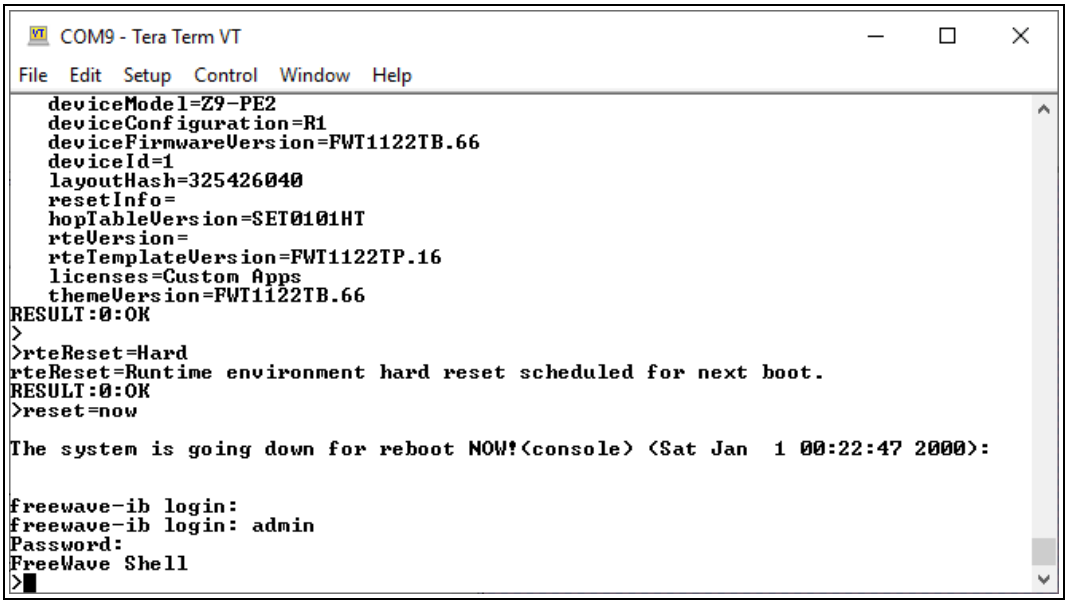

Figure 63: FreeWave Shell window

2. At the > prompt, type **systeminfo** and press <Enter>. Figure 64

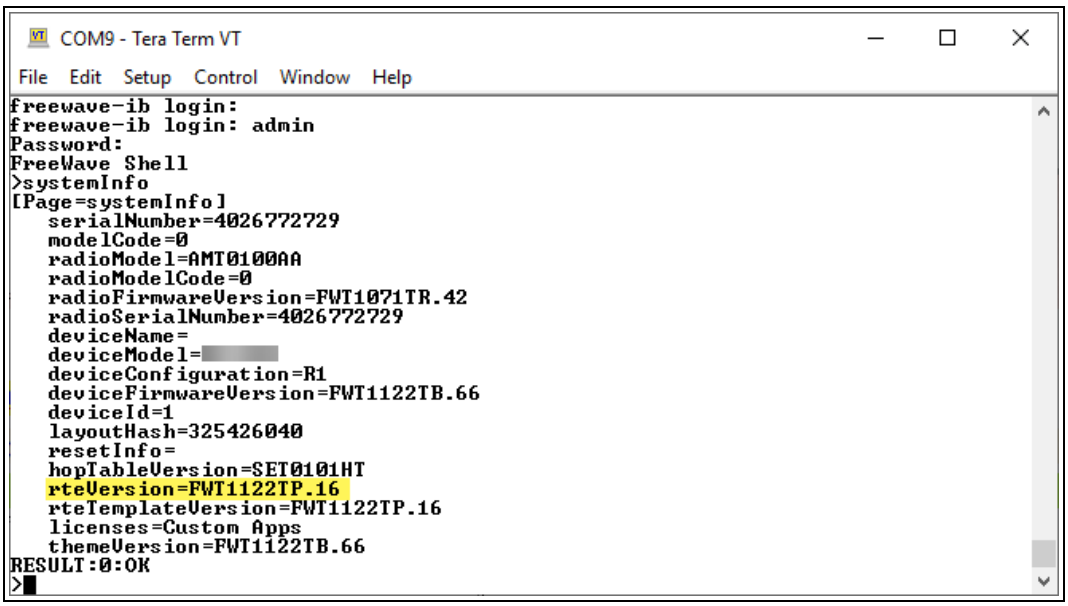

Figure 64: The rteVersion is FWT1122TP.16

> **Important!**: The image provides example information only.
> Each Z9-P2 or Z9-PE2 provides its own unique information.

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3. Verify these parameters have these values:

Verification Settings	
Parameter	**Value**
Radio Firmware Version (on page 341)	FWT1071TR.42
Device Firmware Version (on page 337)	FWT1122TB.66
Rte Version (on page 344)	FWT1122TP.16
Rte Template Version (on page 344)	FWT1122TP.16
Licenses (on page 340)	Custom Apps

4. Continue with Access the IQ Linux Environment (on page 83).

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7.5. Web Interface Activation of the IQ Application Environment

This procedure uses the Web Interface and the CLI to activate the **IQ Application Environment**.

> **Note**: See the CLI Activation of the IQ Application Environment (on page 60) to use the CLI to activate the **IQ Application Environment**.

Warning! The process of activating IQ Application Environment activates a fresh copy of the IQ environment.

If IQ has already been activated, this procedure will erase any user-generated content and settings in the existing Linux development environment.

These are the basic steps to license and activate the **IQ Application Environment**:

A. Get the License File from FreeWave (on page 69)
B. Setup the Computer IP Address Configuration (on page 70)
C. Download the License File (on page 74)
D. Activate the IQ Application Environment (on page 77)
E. Verify Successful Licensing and Activation (on page 81)

7.5.1. Get the License File from FreeWave

The Z9-P2 or Z9-PE2 must be licensed to activate the **IQ Application Environment**. Licensing can be added in the factory or after purchase.

1. Locate the Serial number on the Z9-P2 or Z9-PE2 product label.
2. Contact FreeWave Technical Support (on page 14) for the license key file.
3. Tech Support will ask for the Serial number and an email address to send the license information to.
4. An email is sent to the provided address with a **License_nnnnnnnnnn.LIC** file attached.

   > **Note**: Where **nnnnnnnnnn** is the 10-digit Serial number of the Z9-P2 or Z9-PE2.

5. Search for and select a location to save the **.LIC** file to.
6. Continue with Setup the Computer IP Address Configuration (on page 70).

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7.5.2. Setup the Computer IP Address Configuration

Note: This procedure is required to access the Web Interface of the Z9-P2 or Z9-PE2.
The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

1. Connect the CAT5e / CAT6 Ethernet cable to the Z9-P2 or Z9-PE2 Ethernet port and the Ethernet port on the computer.
2. On the computer, open the **Windows**® **Control Panel**.
3. View the **Control Panel** window by **Category** and click **Network and Sharing Center**. Figure 65

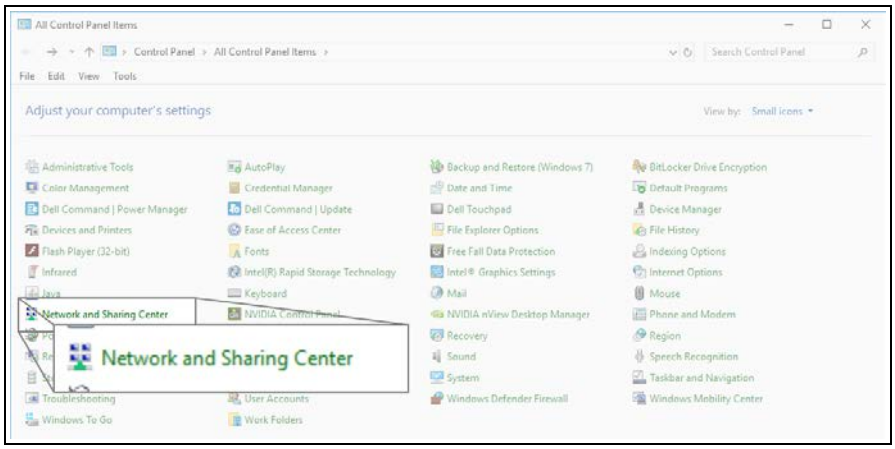

Figure 65: Control Panel > Network and Sharing Center

The **Network and Sharing Center** window opens.

4. Click the **Change Adapter Settings** link. Figure 66

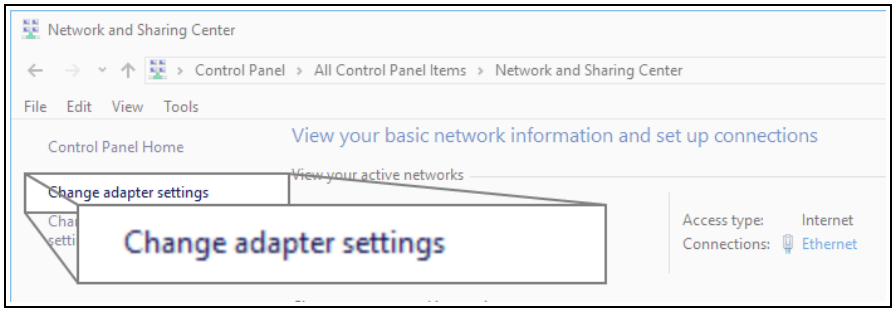

Figure 66: Change Adapter Settings Link

The **Network Connections** window opens. Figure 67

5. Double-click the **Local Area Connection** link or the connected **Network Connection**.

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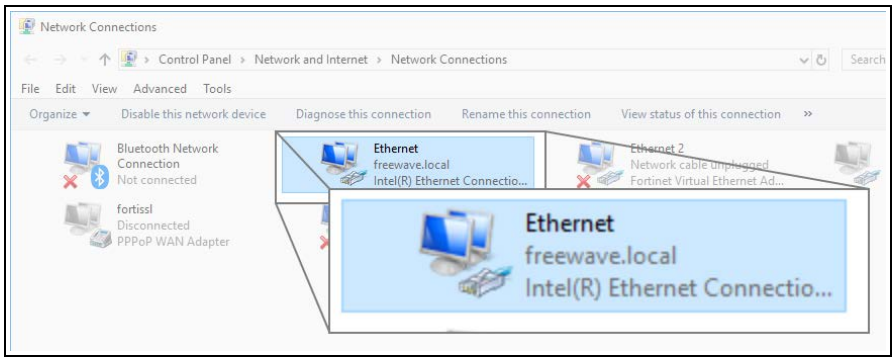

Figure 67: Network Connections window

The **Ethernet Status** dialog box opens. Figure 68

6. Click the **Properties** button.

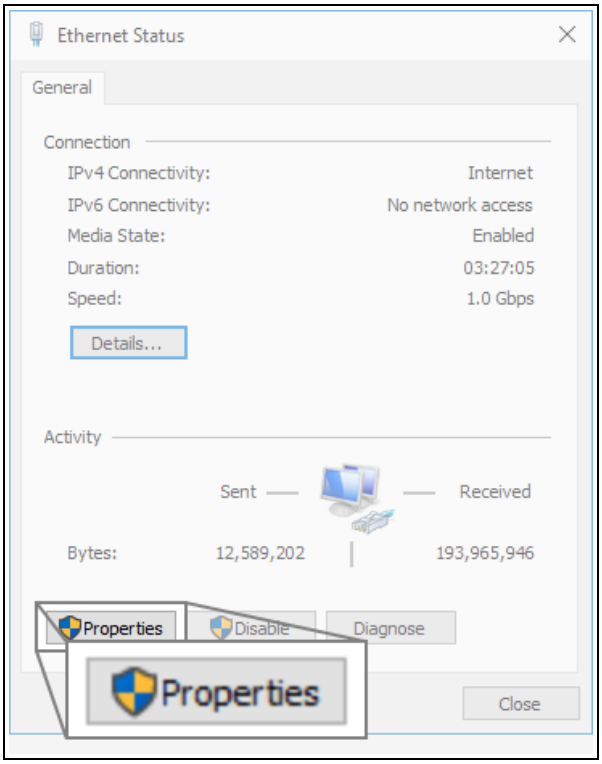

Figure 68: Ethernet Status dialog box

The **Ethernet Properties** dialog box opens.

7. Select the **Internet Protocol Version 4 (TCP/IPv4)** option. Figure 69
8. Click the **Properties** button.

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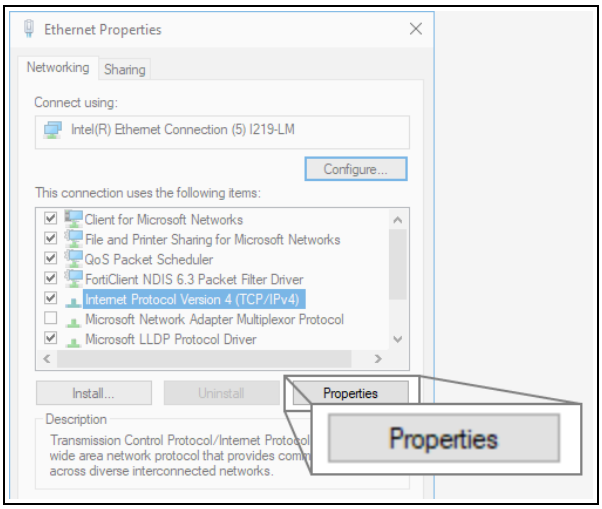

Figure 69: Ethernet Properties dialog box

The **Internet Protocol Version 4 (TCP/IPv4) Properties** dialog box opens. Figure 70

9. **IMPORTANT**: Make a note of the current settings (to reverse this procedure later).

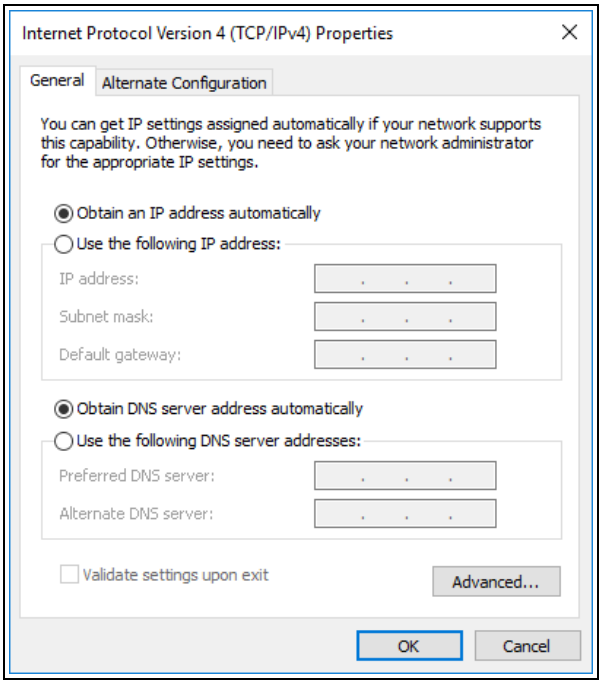

Figure 70: Default Example of Internet Protocol Version 4 (TCP/IPv4) Properties dialog box

10. Select the **Use the following IP address** option button.
11. In the **IP Address** text box, enter an IP Address that is **in the same subnet range but a DIFFERENT IP Address** than the Z9-P2 or Z9-PE2 or all other units in the network. Figure 71

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Example: Enter an **IP Address** from **192.168.111.1** to **192.168.111.254** (but NOT **192.168.111.100**) and the **Subnet Mask** to **255.255.255.0**.

Note: The default Z9-P2 or Z9-PE2 IP Address is **192.168.111.100**.
The default subnet mask is **255.255.255.0**.

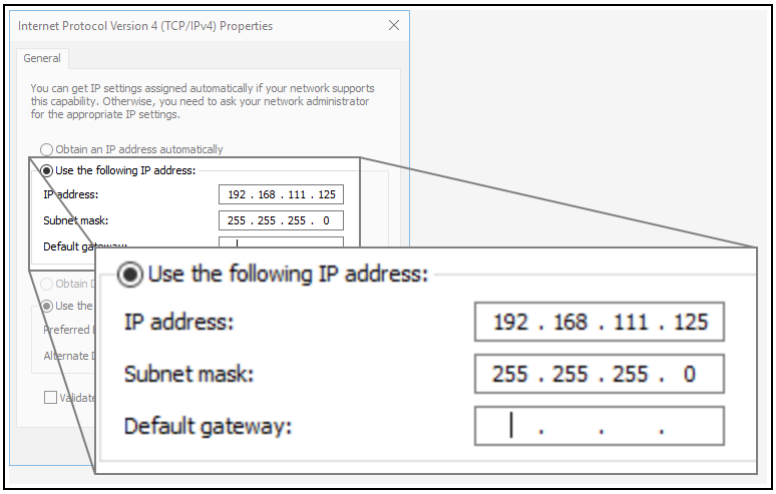

Figure 71: Changed Internet Protocol Version 4 (TCP/IPv4) Properties dialog box

Note: An IP Address is NOT required in the **Default Gateway** text box.

12. Click **OK** to save the changes and close the dialog box.
13. Click **Close** twice to close the **Local Area Connection Properties** and **Local Area Connection Status** dialog boxes.
14. Continue with Download the License File (on page 74).

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7.5.3. Download the License File

Note: The images in this procedure are for **Windows**® 7 and/or **Windows**® 10 and **Firefox**®.

1. Verify these procedures are completed:
   a. Get the License File from FreeWave (on page 69)
   b. Setup the Computer IP Address Configuration (on page 70)
2. Using a CAT5e / CAT6 Ethernet cable, connect the Z9-P2 or Z9-PE2 Ethernet port to the computer's Ethernet port.
3. Open a web browser.
4. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.

4. On the **Menu** list, click the **File Upload** link. Figure 72

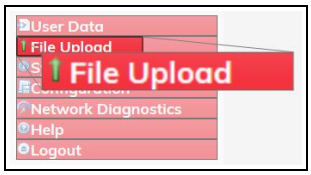

Figure 72: File Upload link

The **Authentication Required** (Login) dialog box opens.

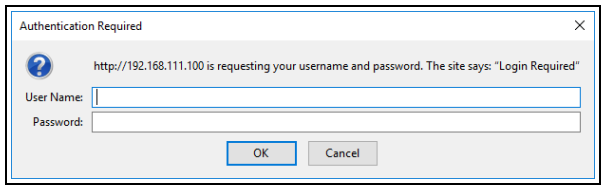

Figure 73: Authentication Required (Login) dialog box

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The File Upload window opens. Figure 74

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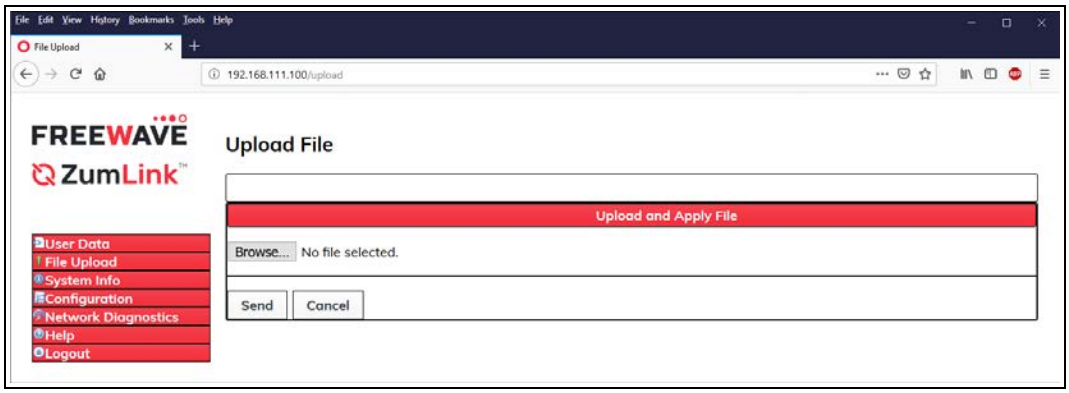

Figure 74: File Upload window

6. Click the **Browse** button.
   The **File Upload** dialog box opens.
7. Locate and select the saved **License_nnnnnnnnnn.LIC** file. Figure 75

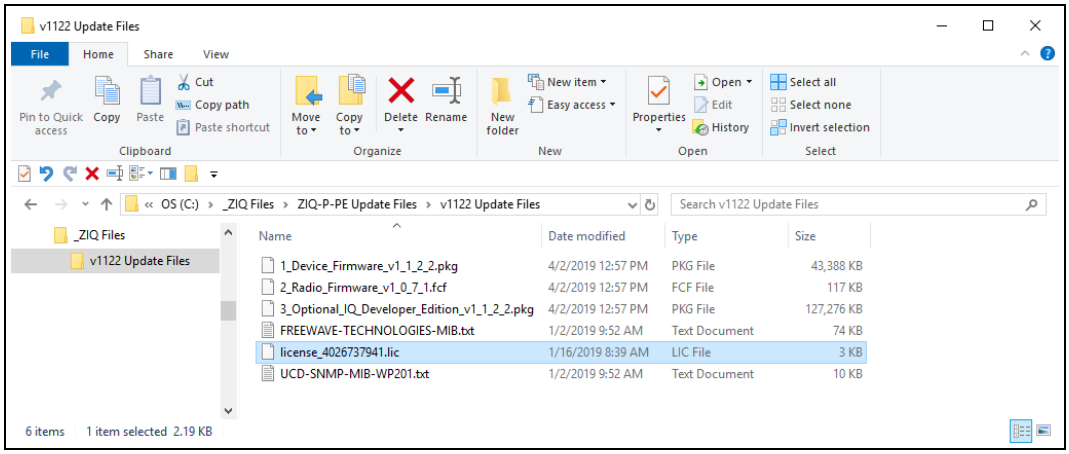

Figure 75: Selected License_nnnnnnnnnn.LIC File

8. Click **Open**.
   The dialog box closes and the **File Upload** window returns showing the selected file. Figure 76

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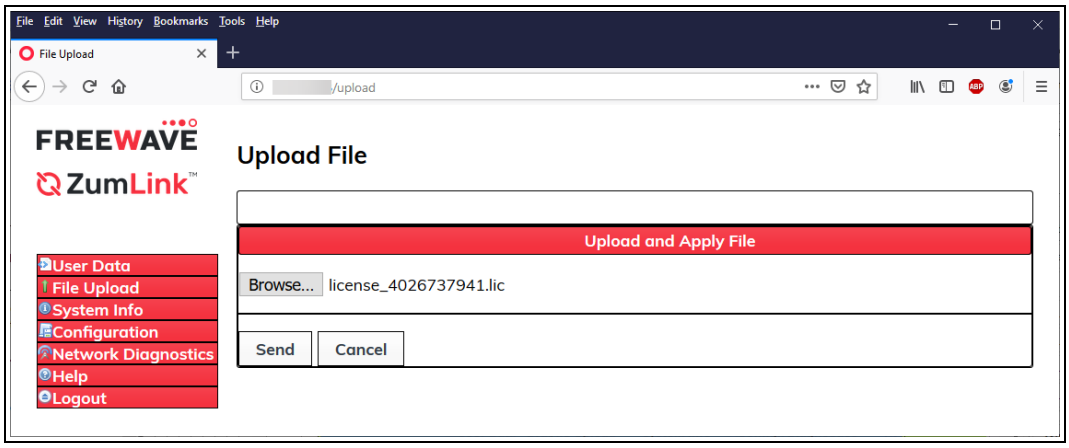

Figure 76: File Upload window with Selected License_nnnnnnnnnn.LIC File

9. Click **Send**.
   The **File Upload** window refreshes and shows the uploaded file.
10. Continue with Activate the IQ Application Environment (on page 77).

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7.5.4. Activate the IQ Application Environment

Note: This procedure provides a **Tera Term** terminal connection to the FreeWave CLI. Other terminal emulators (e.g., **HyperTerminal**, **PuTTY**) may be used.

1. Open a terminal emulator application (e.g., **Tera Term** http://ttssh2.osdn.jp/).
   The **Security Warning** dialog box opens. Figure 77

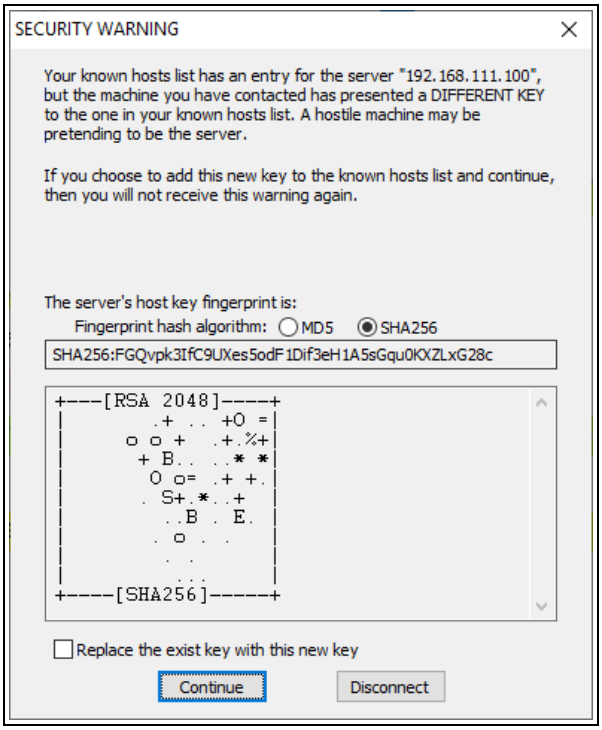

Figure 77: Security Warning dialog box

2. Click **Continue**.
   The **Tera Term: New Connection** window opens. Figure 78

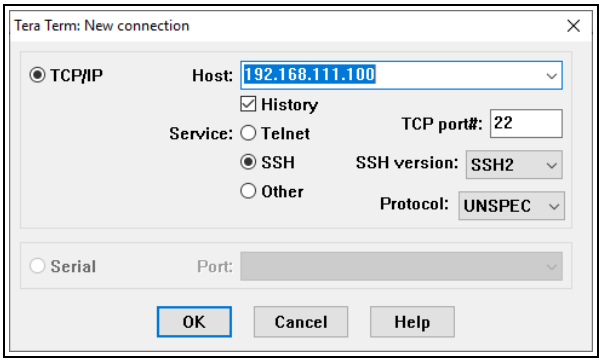

Figure 78: Tera Term: New Connection window

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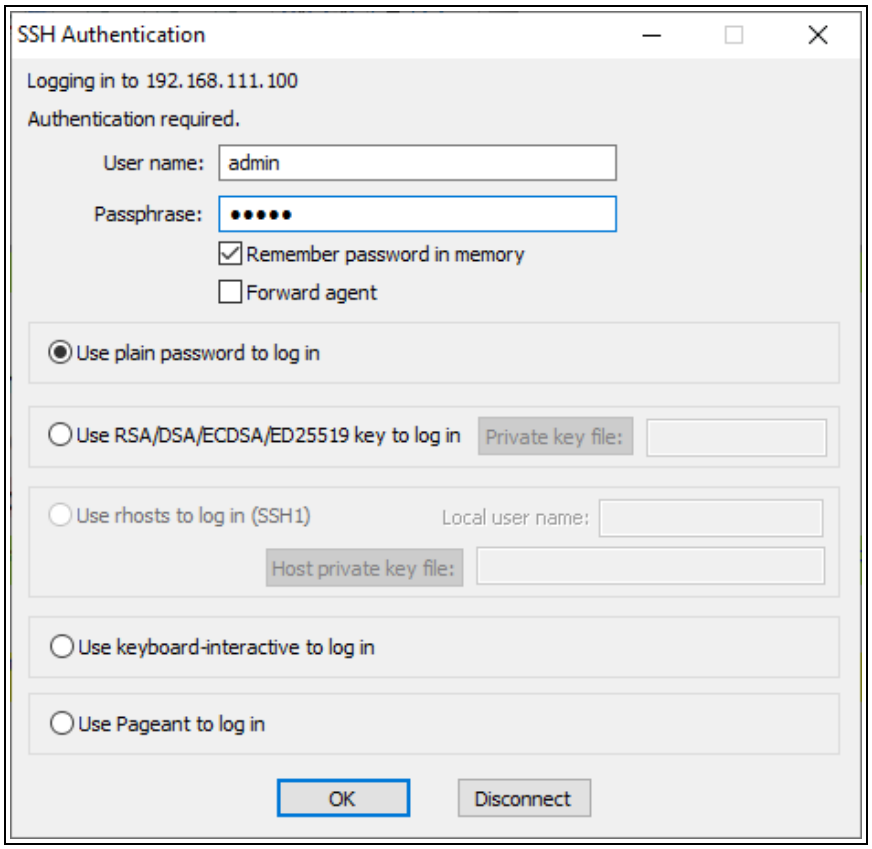
3. Click **OK**.
   The **Tera Term New Connection** dialog box closes.
   The **SSH Authentication** window opens. Figure 79
4. 

Figure 79: SSH Authentication window

5. Enter **admin** for the **User name** and **Passphrase**.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
   The password does not appear when typing - it looks blank.

   The **FreeWave Shell** returns.
6. Type **rteReset=Hard** and press <Enter>. Figure 80

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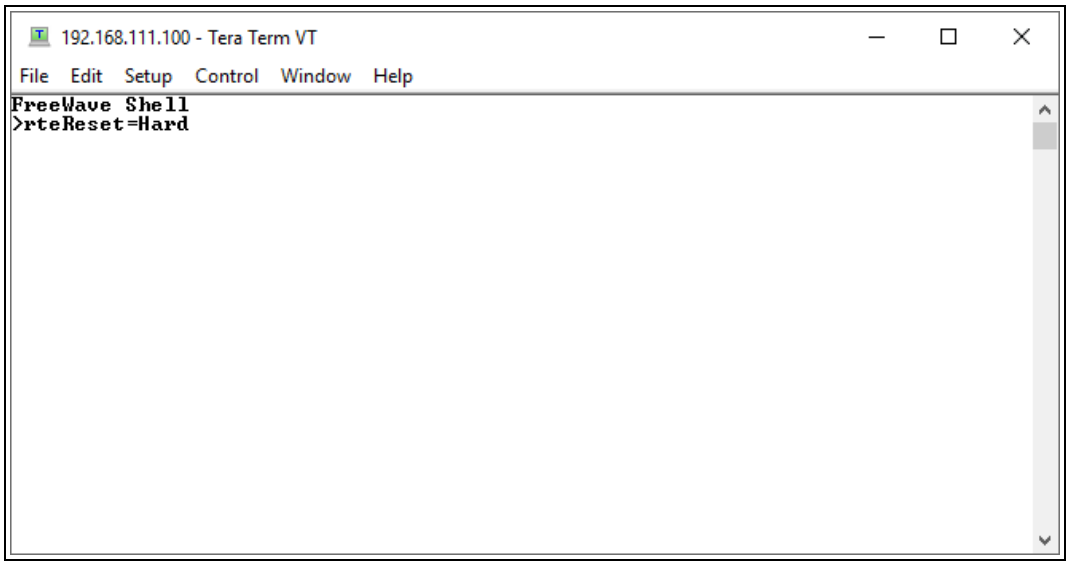

Figure 80: FreeWave Shell window

The **rteReset** message appears. Figure 81

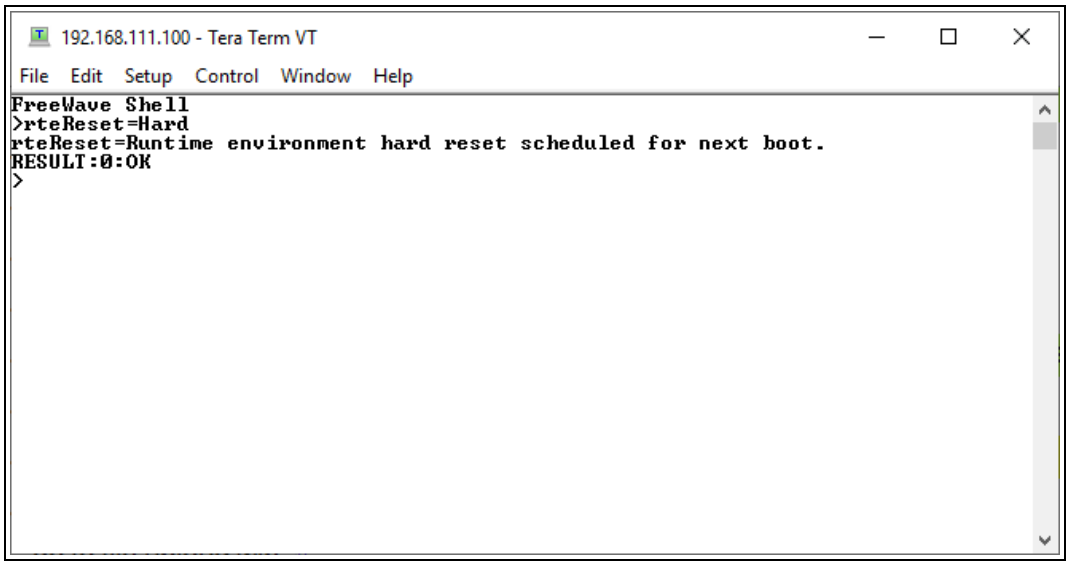

Figure 81: rteReset message

7. Type **reset=now** and press <Enter>. Figure 82

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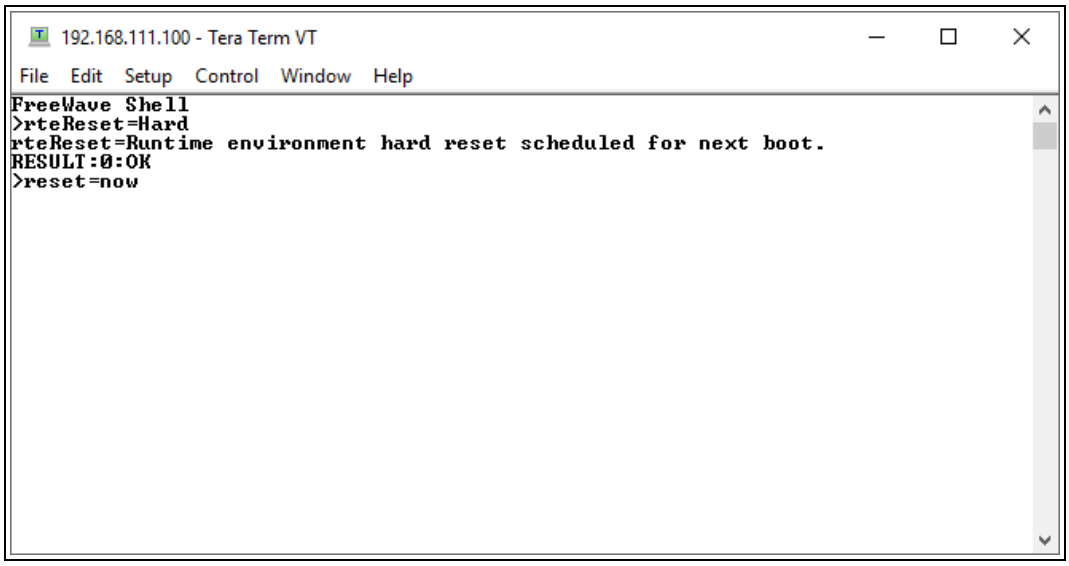

Figure 82: reset=Now window

The Z9-P2 or Z9-PE2 reboots.

The **FreeWave Drivers** and Z9-P2 or Z9-PE2 windows open.

12. Enter **admin** for the **Username** and press <Enter>.
13. Enter **admin** for the **Password** and press <Enter>.
    The **FreeWave Shell** returns.

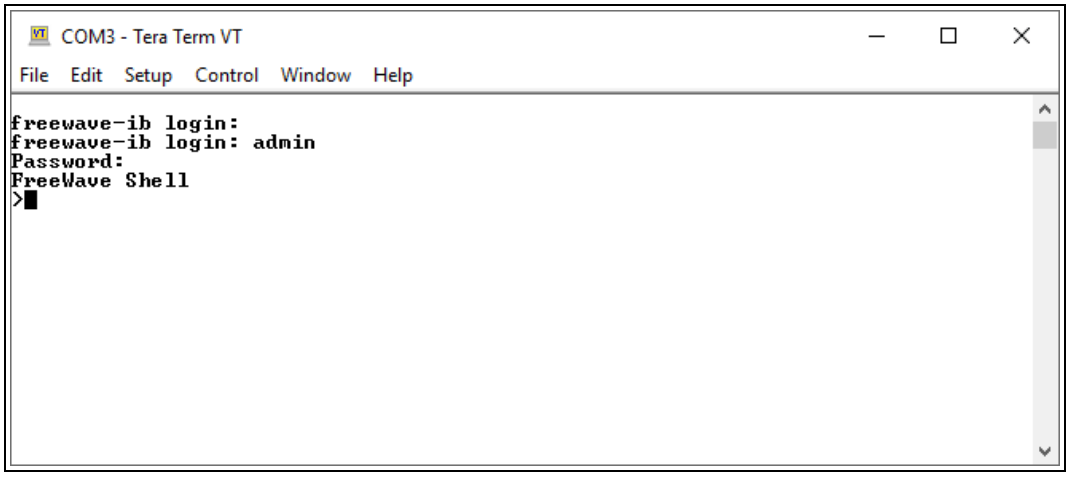

Figure 83: FreeWave Shell window

14. Continue with Verify Successful Licensing and Activation (on page 81).

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7.5.5. Verify Successful Licensing and Activation

1. Re-open the terminal emulator application.

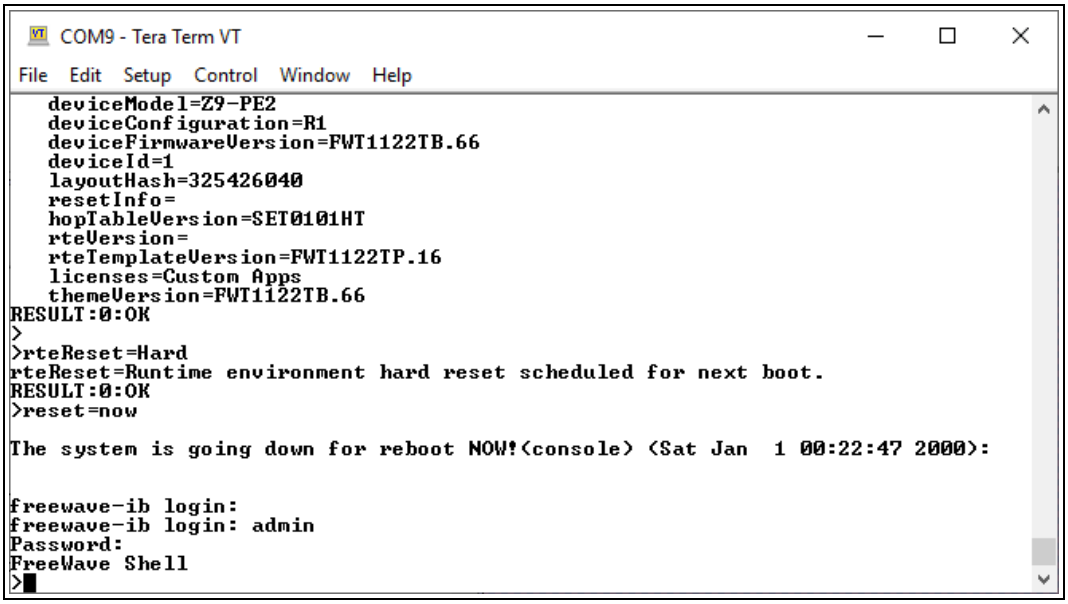

Figure 84: FreeWave Shell window

2. At the > prompt, type **systeminfo** and press <Enter>. Figure 85

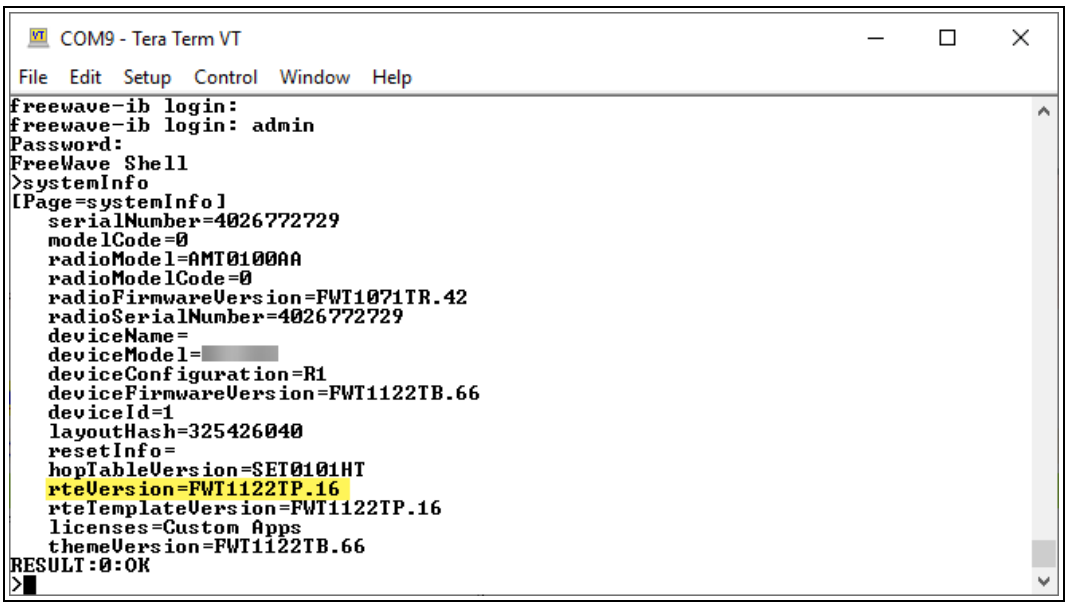

Figure 85: The rteVersion is FWT1122TP.16

Important!: The image provides example information only.
Each Z9-P2 or Z9-PE2 provides its own unique information.

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3. Verify these parameters have these values:

Verification Settings	
Parameter	**Value**
Radio Firmware Version (on page 341)	FWT1071TR.42
Device Firmware Version (on page 337)	FWT1122TB.66
Rte Version (on page 344)	FWT1122TP.16
Rte Template Version (on page 344)	FWT1122TP.16
Licenses (on page 340)	Custom Apps

4. Continue with Access the IQ Linux Environment (on page 83).

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7.6. Access the IQ Linux Environment

Note: The **Developer Edition IQ Application Environment** is the standard installation on all **Zum** products.

There are different Editions of IQ available that incorporate developer tools and/or 3rd-party software. All IQ Editions allow access to the Linux environment through the **devuser** login.

Once a developer is ready to integrate an application into IQ or build an application within IQ, they should first visit FreeWave's GitHub wiki environment that provides guidance on a wide range of topics. (https://github.com/FreeWaveTechnologies/ZumIQ)

Procedure

1. Verify Successful Licensing and Activation (on page 81) is completed.
2. Log in to the FreeWave CLI as **devuser**.
   The default password is **devuser**.
   A Linux Bash prompt appears. Figure 86

   Note: A unique password can be added at the time of purchase.
   Contact FreeWave Technical Support (on page 14) for this password.

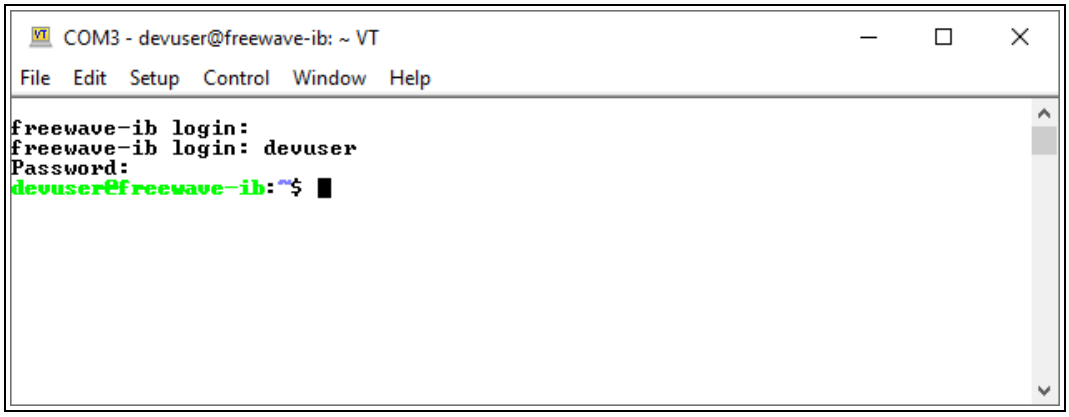

Figure 86: Linux Bash Prompt for the Z9-P2 or Z9-PE2 DEVUSER

3. Open a web browser.
4. Go to: https://github.com/FreeWaveTechnologies/ZumIQ.
   The FreeWave Github IQ Main Page opens. Figure 87

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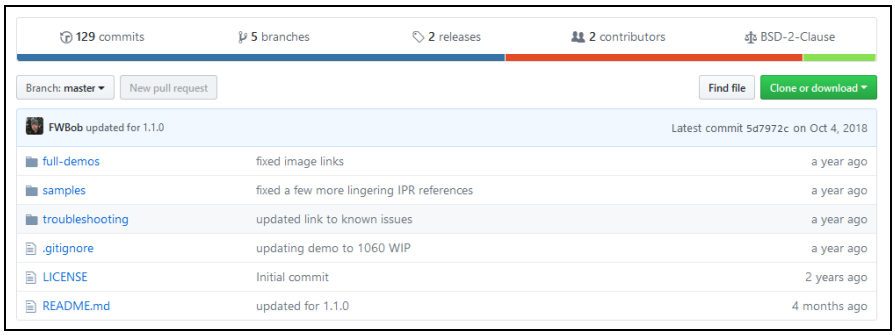

Figure 87: FreeWave GitHub IQ Main Page

Note: The IQ GitHub site contains many valuable tools including demonstrations, sample applications, troubleshooting guides and other information that can be very useful.

5. Scroll to the bottom of the **Main** page and click the Wiki link for IQ app development information. Figure 88

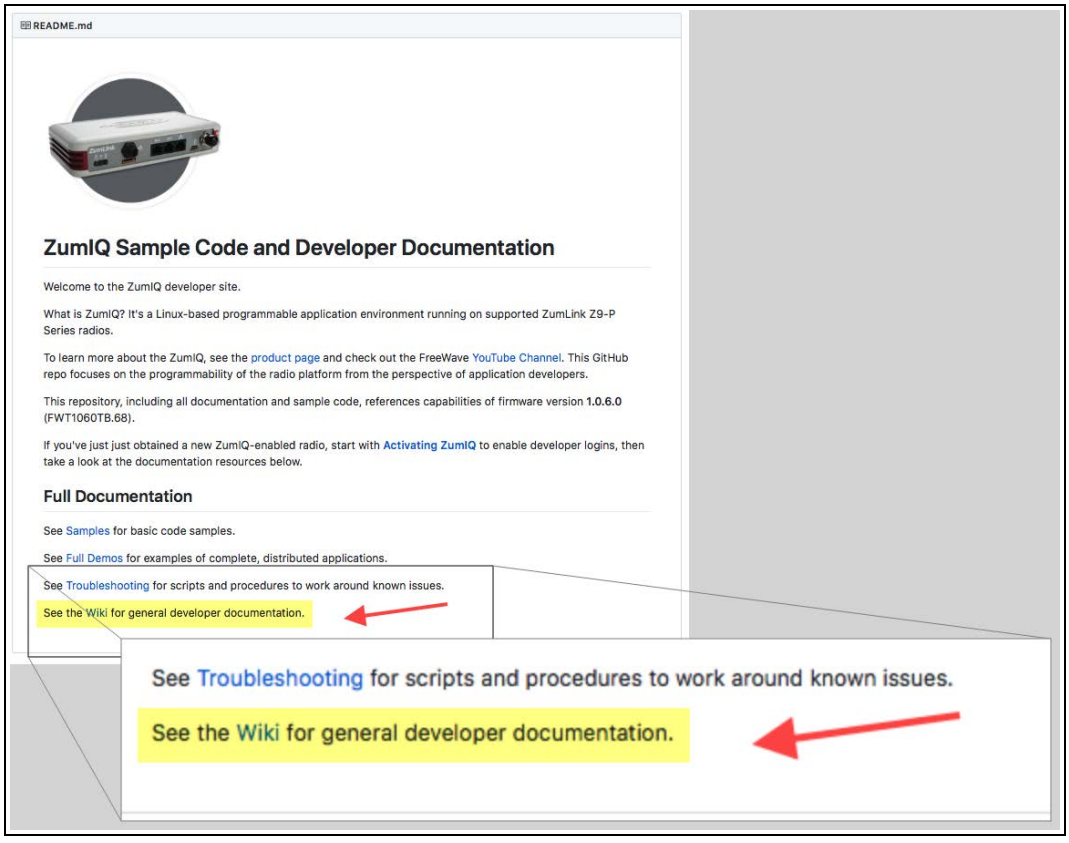

Figure 88: Wiki link on the FreeWave GitHub ZumIQ Main Page

6. In the Wiki, go to **Contents** sidebar > **Reference** to locate the **Installed Packages** for the version on the Z9-P2 or Z9-PE2.

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8. Web Interface - Administration

This section provides procedure information about administration of the Z9-P2 or Z9-PE2 parameters.

- Change the COM Parameters (on page 91)
- Change the Data Path Parameters (on page 94)
- Change the Encryption Parameters (on page 96)
- Change the Io Ex Com Parameters (on page 98)
- Change the Local Diagnostics - Monitored Node (on page 99)
- Change the Modbus Parameters (on page 101)
- Change the Network Parameters (on page 103)
- Change the NTP Parameters (on page 105)
- Change the Radio Settings Parameters - Endpoint (on page 107)
- Change the Radio Settings Parameters - Endpoint-Repeater (on page 109)
- Change the Radio Settings Parameters - Gateway (on page 111)
- Change the Radio Settings Parameters - Gateway-Repeater (on page 114)
- Change the Security Parameters (on page 117)
- Change the Services Parameters (on page 119)
- Change the SNMP Parameters (on page 121)
- Change the System Info Parameters (on page 123)
- Change the Terminal Server Relay Parameters (on page 125)
- Web Interface - Network Diagnostics (on page 127)

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8.1. Setup the Computer IP Address Configuration

Note: This procedure is required to access the Web Interface of the Z9-P2 or Z9-PE2.
The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

1. Connect the CAT5e / CAT6 Ethernet cable to the Z9-P2 or Z9-PE2 Ethernet port and the Ethernet port on the computer.
2. On the computer, open the **Windows**® **Control Panel**.
3. View the **Control Panel** window by **Category** and click **Network and Sharing Center**. Figure 89

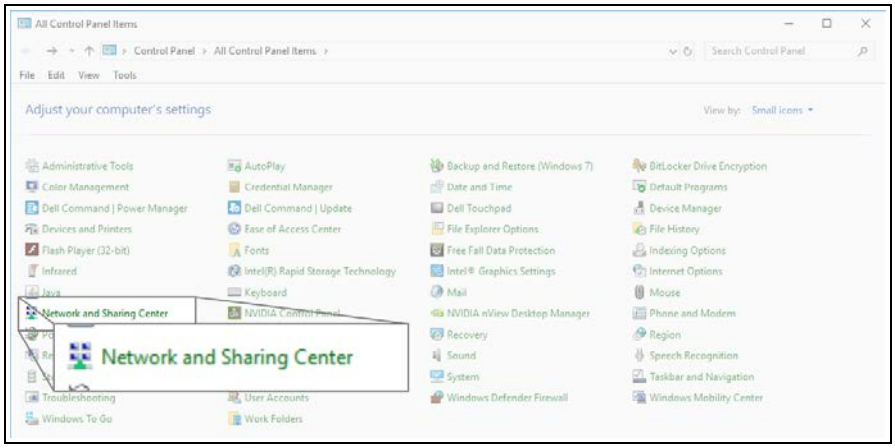

Figure 89: Control Panel > Network and Sharing Center

The **Network and Sharing Center** window opens.

4. Click the **Change Adapter Settings** link. Figure 90

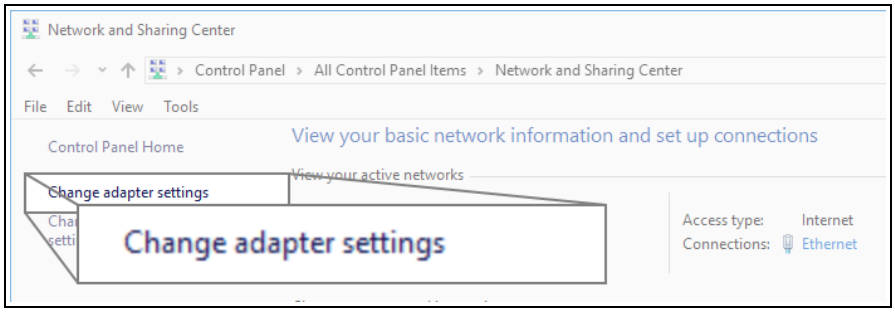

Figure 90: Change Adapter Settings Link

The **Network Connections** window opens. Figure 91

5. Double-click the **Local Area Connection** link or the connected **Network Connection**.

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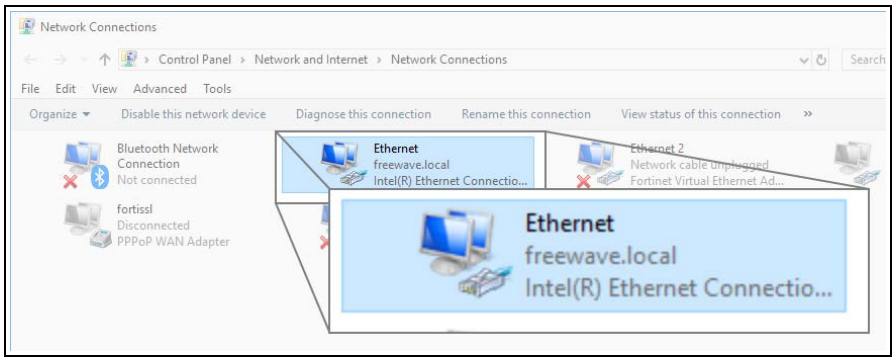

Figure 91: Network Connections window

The **Ethernet Status** dialog box opens. Figure 92

6. Click the **Properties** button.

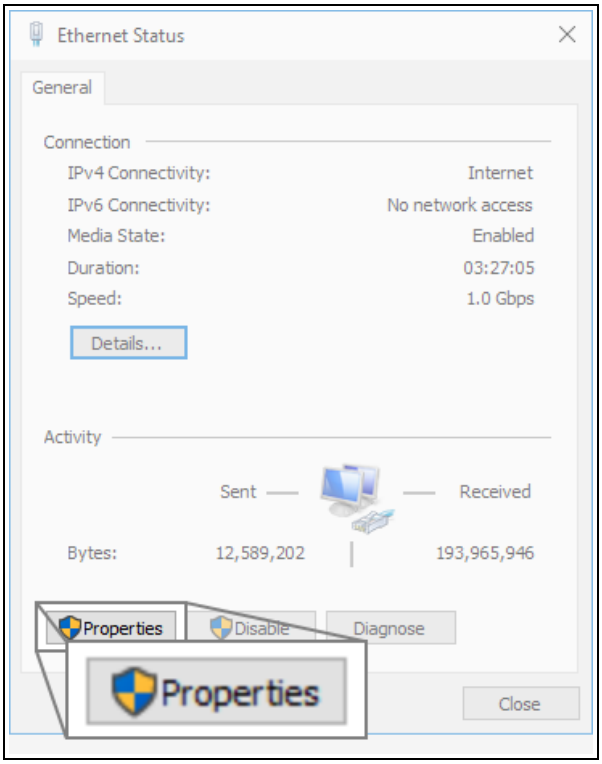

Figure 92: Ethernet Status dialog box

The **Ethernet Properties** dialog box opens.

7. Select the **Internet Protocol Version 4 (TCP/IPv4)** option. Figure 93
8. Click the **Properties** button.

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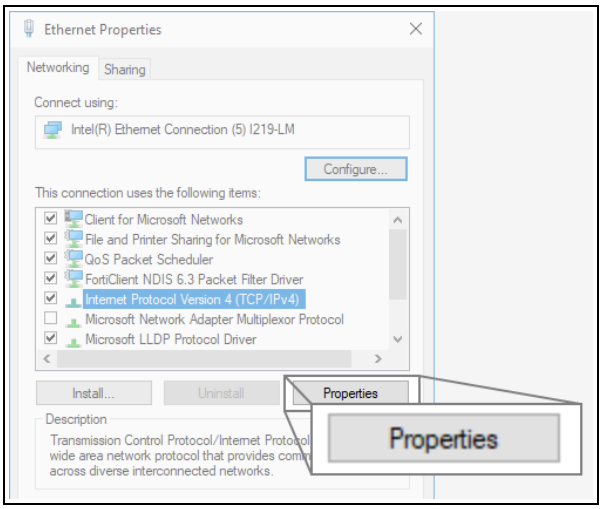

Figure 93: Ethernet Properties dialog box

The **Internet Protocol Version 4 (TCP/IPv4) Properties** dialog box opens. Figure 94

9. **IMPORTANT**: Make a note of the current settings (to reverse this procedure later).

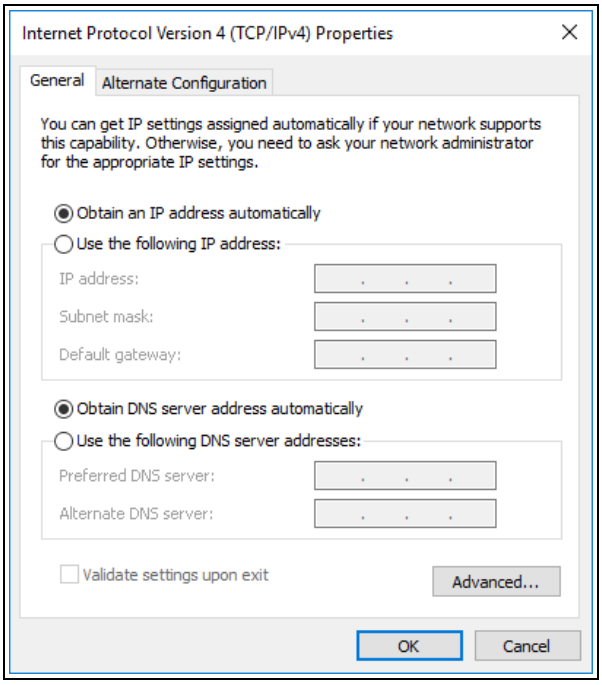

Figure 94: Default Example of Internet Protocol Version 4 (TCP/IPv4) Properties dialog box

10. Select the **Use the following IP address** option button.
11. In the **IP Address** text box, enter an IP Address that is **in the same subnet range but a DIFFERENT IP Address** than the Z9-P2 or Z9-PE2 or all other units in the network. Figure 95

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Example: Enter an **IP Address** from **192.168.111.1** to **192.168.111.254** (but NOT **192.168.111.100**) and the **Subnet Mask** to **255.255.255.0**.

Note: The default Z9-P2 or Z9-PE2 IP Address is **192.168.111.100**.
The default subnet mask is **255.255.255.0**.

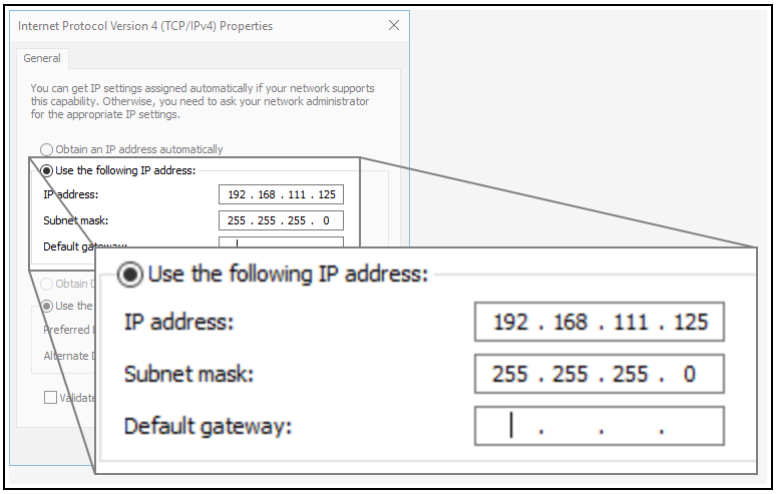

Figure 95: Changed Internet Protocol Version 4 (TCP/IPv4) Properties dialog box

Note: An IP Address is NOT required in the **Default Gateway** text box.

12. Click **OK** to save the changes and close the dialog box.
13. Click **Close** twice to close the **Local Area Connection Properties** and **Local Area Connection Status** dialog boxes.
14. Optional: Continue with these Web Interface administration procedures:
    - Change the COM Parameters (on page 91)
    - Change the Data Path Parameters (on page 94)
    - Change the Encryption Parameters (on page 96)
    - Change the Io Ex Com Parameters (on page 98)
    - Change the Local Diagnostics - Monitored Node (on page 99)
    - Change the Modbus Parameters (on page 101)
    - Change the Network Parameters (on page 103)
    - Change the NTP Parameters (on page 105)
    - Change the Radio Settings Parameters - Endpoint (on page 107)
    - Change the Radio Settings Parameters - Endpoint-Repeater (on page 109)
    - Change the Radio Settings Parameters - Gateway (on page 111)
    - Change the Radio Settings Parameters - Gateway-Repeater (on page 114)

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- Change the Security Parameters (on page 117)
- Change the Services Parameters (on page 119)
- Change the SNMP Parameters (on page 121)
- Change the System Info Parameters (on page 123)
- Change the Terminal Server Relay Parameters (on page 125)

15. Optional: Continue with the Web Interface - Network Diagnostics (on page 127).

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8.2. Change the COM Parameters

Note: See the COM Parameters (on page 198) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 96

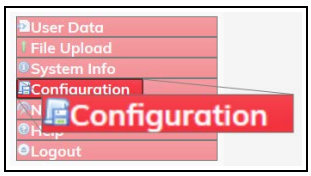

Figure 96: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click either the **COM1** or **COM2** tab to access their respective COM parameters. Figure 97 or Figure 98

   Note: See the COM Parameters (on page 198) for detailed information about the parameters. The parameters for **COM1** and **COM2** are the same except for the Terminal Server Port (on page 209) parameter setting.

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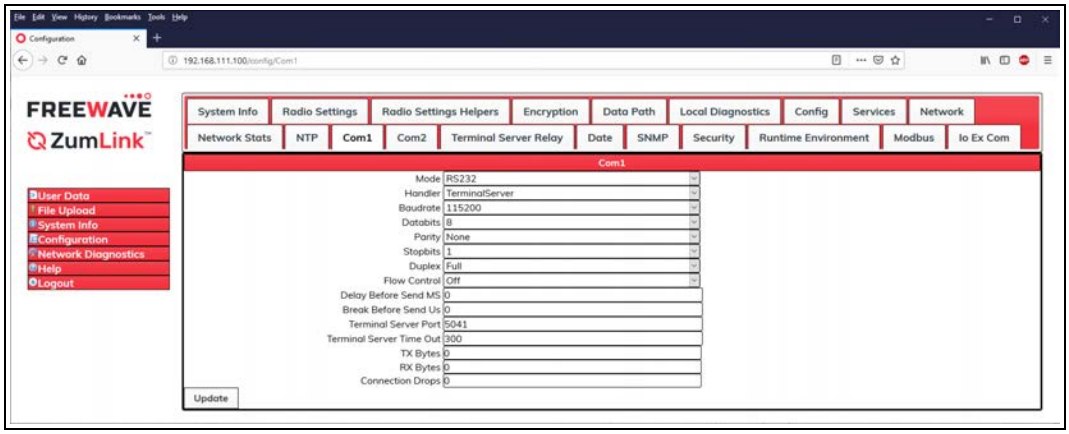

Figure 97: COM1 window

Figure 98: COM2 window

7. As applicable, change these parameters:
   a. Click the **Mode** list box arrow and select the COM port mode.
   b. Click the **Handler** list box arrow and select the designated protocol handler.
   c. Click the **Baudrate** list box arrow and select a COM port baud rate.
   d. Click the **Databits** list box arrow and select the number of data bits in the frame for COM1 or COM2.
   e. Click the **Parity** list box arrow and select the COM port parity bits for the system.
   f. Click the **Stopbits** list box arrow and select the COM port number of stop bits.
   g. Click the **Duplex** list box arrow and select the duplex designation.
   h. If applicable for COM2, click the **Flow Control** list box arrow and select **Hardware** to activate **flowControl**.

      > **Important!**: The RTS and CTS signals are **ONLY** available for COM2.
      > The RTS and CTS signals are **NOT supported for COM1**.

   i. In the **Delay Before Send MS** text box, enter the milliseconds of time delay.

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j. In the **Break Before Send Us** text box, enter the number of milliseconds the COM port will send a break signal.

k. In the **Terminal Server Port** text box, enter the designated TCP port number.

> **FREEWAVE Recommends**: If using the Terminal Server Port parameter, keep the TCP port numbers as their defaults.

l. In the **Terminal Server Time Out** text box, enter the number of seconds the Terminal Server remains open without transmitting or receiving data from the network.

> **Important!**: TX Bytes (on page 211), RX Bytes (on page 208), and Connection Drops (on page 200) are Read-only parameters.

8. Click the **Update** button to save the changed information.

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8.3. Change the Data Path Parameters

Note: See the Data Path Parameters (on page 216) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 99

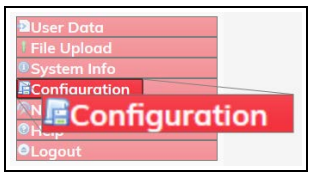

Figure 99: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Data Path** tab to access the **Data Path** parameters. Figure 100

   Note: See the Data Path Parameters (on page 216) for detailed information about the parameters.

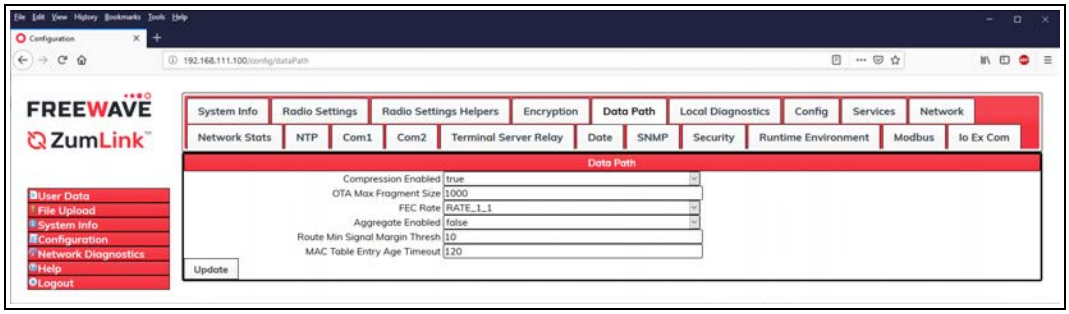

Figure 100: Data Path window

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7. As applicable, change these parameters:
   a. Click the **Compression Enabled** list box arrow and select **False** to disable compression of outgoing packets.

      Note: By default, the **Compression Enabled** is enabled (set to True).

   b. In the **OTA Max Fragment Size** text box, enter the maximum fragment size, in bytes, sent over the air.
   c. Click the **FEC Rate** list box arrow and select the Forward Error Correction (FEC) rate.
   d. Click the **Aggregate Enabled** list box arrow and select **True** to enable this parameter and increase throughput of small packets.

      Note: By default, the **Aggregate Enabled** is NOT enabled (set to False).

   e. In the **Route Min Signal Margin Thresh** text box, enter the minimum threshold signal margin in dB.
   f. In the **MAC Table Entry Age Timeout** text box, enter the number of seconds before an inactive entry in the MAC Table ages out and expires.
8. Click the **Update** button to save the changed information.

FREEWAVE Recommends: When viewing local diagnostics, if the Radio Bad CRC (on page 241) count is more than 15-20% of the total transmitted packets (the Radio LL Tx (on page 244) count), enabling the FEC Rate (on page 220) setting is beneficial.

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8.4. Change the Encryption Parameters

Note: See the Encryption Parameters (on page 230) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 101

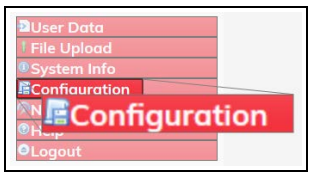

Figure 101: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Encryption** tab to access the **Encryption** parameters. Figure 102

   Note: See the Encryption Parameters (on page 230) for detailed information about the parameters.

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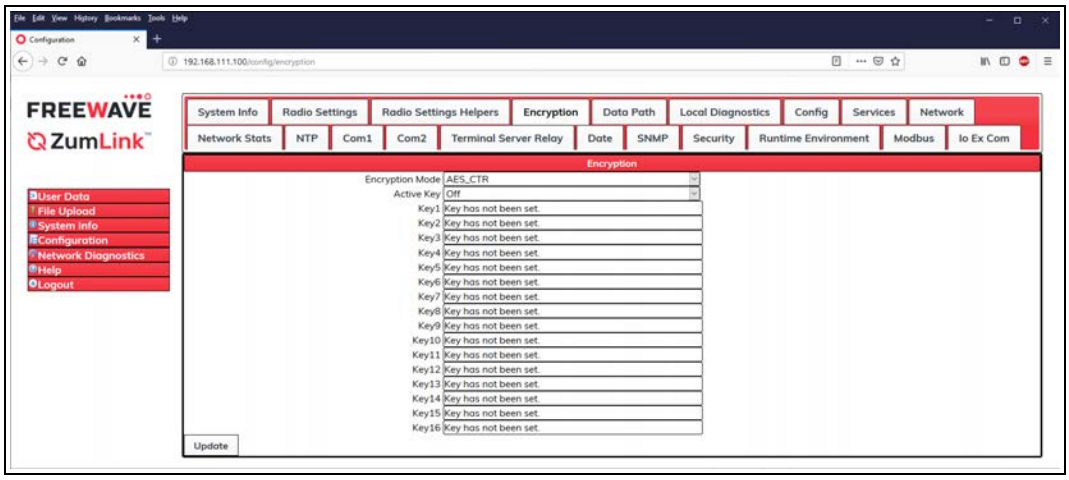

Figure 102: Encryption window

7. Click the **Encryption Mode** list box arrow and select the designated encryption mode.
8. In the **KeyX** text box, enter either the 128- or 256-bit key in 16 or 32 hexadecimal format respectively.

   Note: Enter **Clear** to erase a previously enter key.
   See the Key1 to Key 16 (on page 233) parameter for additional information.

9. Click the **Active Key** list box arrow and select the designated active key.

   Note: See the Active Key (on page 231) parameter for additional information.

10. Click the **Update** button to save the changed information.
    The encryption changes take effect immediately.

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8.5. Change the Io Ex Com Parameters

Note: This parameter is read-only in the Web Interface.

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8.6. Change the Local Diagnostics - Monitored Node

Note: See the Local Diagnostics Parameters (on page 235) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 103

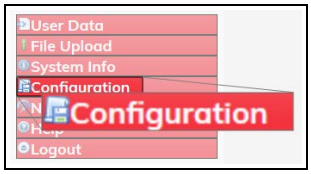

Figure 103: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Local Diagnostics** tab to access the **Local Diagnostics** parameters.

   Note: See the Local Diagnostics Parameters (on page 235) for detailed information about the parameters.
7. Scroll to the **Monitored Node** text box. Figure 104

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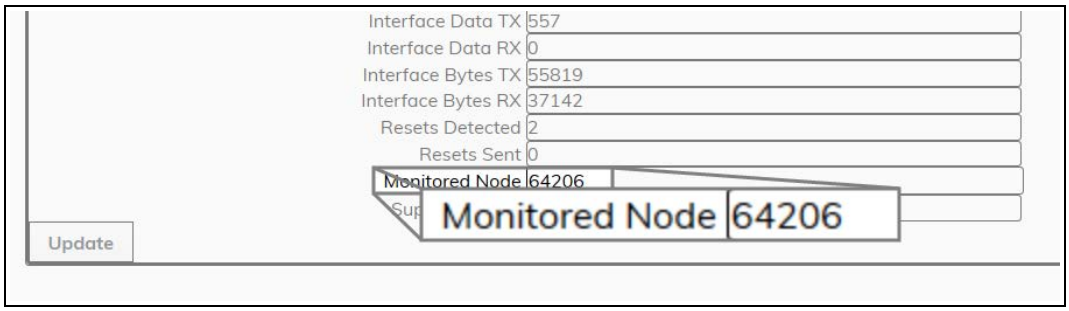

Figure 104: Local Diagnostics window

8. In the **Monitored Node** text box, enter the Node ID (on page 297) to monitor.
9. Click the **Update** button to save the changed information.

FREEWAVE Recommends: When viewing local diagnostics, if the Radio Bad CRC (on page 241) count is more than 15-20% of the total transmitted packets (the Radio LL Tx (on page 244) count), enabling the FEC Rate (on page 220) setting is beneficial.

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8.7. Change the Modbus Parameters

Note: See the Modbus Parameters (on page 252) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 105

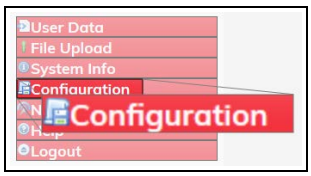

Figure 105: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Modbus** tab to access the **Modbus** parameters. Figure 106

   Note: See the Modbus Parameters (on page 252) for detailed information about the parameters.

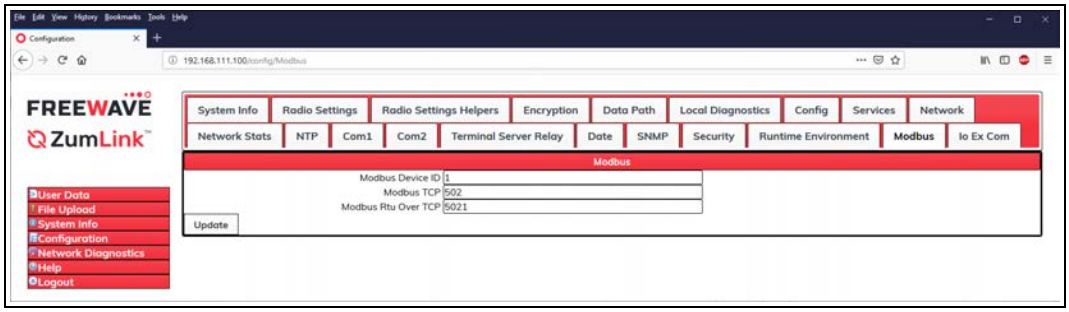

Figure 106: Modbus window

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7. As applicable, change these parameters:
   a. In the **Modbus Device ID** text box, enter a user-defined Modbus device ID.
   b. In the **Modbus TCP** text box, enter the TCP port used for the Modbus TCP requests.
   c. In the **Modbus Rtu Over TCP** text box, enter the TCP port used for the Modbus RTU over TCP requests.
8. Click the **Update** button to save the changed information.

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8.8. Change the Network Parameters

Note: See the Network Parameters (on page 262) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 107

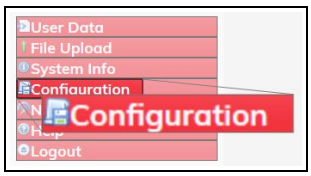

Figure 107: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Network** tab to access the **Network** parameters. Figure 108

   Note: See the Network Parameters (on page 262) for detailed information about the parameters.

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Figure 108: Network window

Note: The MAC Address (on page 264) parameter is Read-only.

7. As applicable, change these parameters:
   a. In the **IP Address** text box, enter the IP address of the Z9-P2 or Z9-PE2 assigned by the IT department for the network.
   b. In the **Netmask** text box, enter the Netmask of the Z9-P2 or Z9-PE2.
   c. In the **Gateway** text box, enter the Gateway IP address for the network.
   d. Click the **STP Enabled** list box arrow and select **True** to enable the Spanning Tree Protocol.

      Note: By default, the **STP Enabled** is NOT enabled (set to False).

   e. In the **Txqueuelen** text box, enter the maximum number of packets to hold in the transmit queue.
   f. In the **MTU** text box, enter the maximum transmission unit.
   g. Click the **Netmask Filter Enabled** list box arrow and select **True** to enable the bridge firewall and restrict network communication to current IPv4 subnet.

      Note: By default, the **Netmask Filter Enabled** is enabled (set to False).

   h. In the **Nameserver Address 1** text box, enter a user-defined DNS IP address.
   i. In the **Nameserver Address 2** text box, enter a user-defined DNS IP address..
   j. Click the **Arp Filter Enabled** list box arrow and select **True** to enable the parameter.
   k. In the **Vlan MGMT** text box, enter the Management VLAN ID.
   l. In the **Vlan Tag Port 1** and/or **Vlan Tag Port 2** text boxes, enter the VLAN ID for the designated port.
8. Click the **Update** button to save the changed information.

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8.9. Change the NTP Parameters

Note: See the NTP Parameters (on page 280) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 109

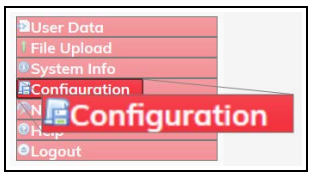

Figure 109: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **NTP** tab to access the **NTP** parameters. Figure 110

   Note: See the NTP Parameters (on page 280) for detailed information about the parameters.

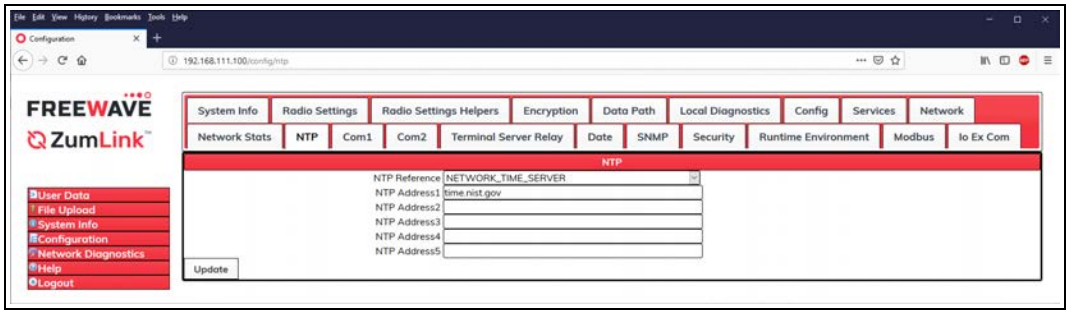

Figure 110: NTP window

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7. As applicable, change these parameters:
   a. Click the **NTP Reference** list box arrow and select either **NETWORK_TIME_SERVER** or **REFCLK_LOCALCLOCK**.
   b. In the **NTP Restart** text box, enter **Now** to restart the the NTP system.
   c. In the **NTP Date** text box, enter **Now** to synchronize the local clock with the time from the NTP servers specified in the NTP Address (1 to 5) (on page 281) settings.
   d. In the **NTP Address 2 to 5** text boxes, enter the IP address of the servers used for synchronizing time.

   > **Note**: By default, the **NTP Address 1** is time.nist.gov.

8. Click the **Update** button to save the changed information.

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8.10. Change the Radio Settings Parameters - Endpoint

Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 111

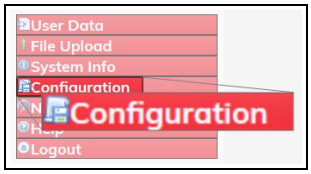

Figure 111: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Radio Settings** tab to access the **Radio Settings** parameters.
7. Click the **Radio Mode** list box arrow and select the device type to designate the Z9-P2 or Z9-PE2 as an **Endpoint**. Figure 112

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Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

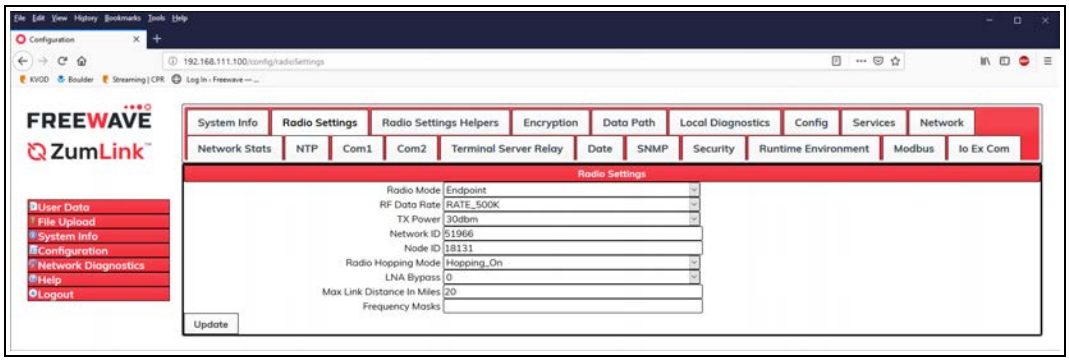

Figure 112: Radio Settings window - Endpoint

8. As applicable, change these parameters:
   a. Click the **RF Data Rate** list box arrow and select the RF link data rate in bits per second.
   b. Click the **Tx Power** list box arrow and select the dB RF output transmit power level for the Z9-P2 or Z9-PE2.
   c. In the **Network ID** text box, enter the network identifier that subdivides traffic on radio units.
   d. In the **Node ID** text box, enter a user-designated **nodeId** instead of the auto-generated **nodeId**.
   e. Optional: Click the **Radio Hopping Mode** list box arrow and select **Off** to disable frequency hopping.

      Note: By default, the **Radio Hopping Mode** is enabled (set to Hopping_On).

   f. Optional: In the **LNA Bypass** text box, enter **1** to bypass the Low Noise Amplifier (LNA) and reduce the radio module receive signal by 10dB.

      Note: By default, the **LNA Bypass** is enabled (set to 0 (zero)).

   g. In the **Max Link Distance in Miles** text box, enter the maximum one-way distance (in miles) used to set the maximum expected propagation delay between any Endpoints in the network.
   h. In the **Frequency Masks** text box, enter the exact specified format of the frequency range to mask.

      Caution: The exact syntax is required in the **Frequency Masks** text box. See Frequency Masks (on page 290) for detailed information.

9. Click the **Update** button to save the changed information.

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8.11. Change the Radio Settings Parameters - Endpoint-Repeater

Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 113

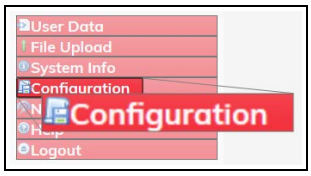

Figure 113: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Radio Settings** tab to access the **Radio Settings** parameters.
7. Click the **Radio Mode** list box arrow and select the device type to designate the Z9-P2 or Z9-PE2 as an **Endpoint_Repeater**. Figure 114

   Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

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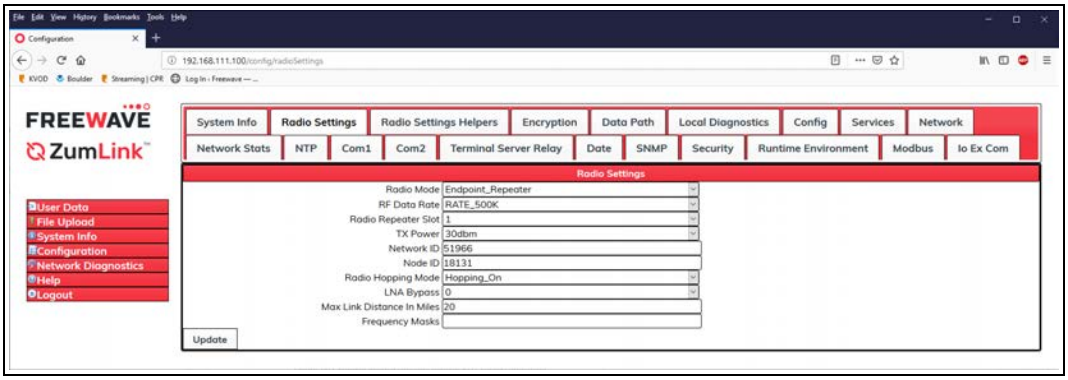

Figure 114: Radio Settings window - Endpoint_Repeater

8. As applicable, change these parameters:
   a. Click the **RF Data Rate** list box arrow and select the RF link data rate in bits per second.
   b. In the **Radio Repeater Slot** text box, enter which repeater slot the Endpoint-Repeater uses.
   c. Click the **Tx Power** list box arrow and select the dB RF output transmit power level for the Z9-P2 or Z9-PE2.
   d. In the **Network ID** text box, enter the network identifier that subdivides traffic on radio units.
   e. In the **Node ID** text box, enter a user-designated **nodeId** instead of the auto-generated **nodeId**.
   f. Optional: Click the **Radio Hopping Mode** list box arrow and select **Off** to disable frequency hopping.

      Note: By default, the **Radio Hopping Mode** is enabled (set to Hopping_On).

   g. Optional: In the **LNA Bypass** text box, enter **1** to bypass the Low Noise Amplifier (LNA) and reduce the radio module receive signal by 10dB.

      Note: By default, the **LNA Bypass** is enabled (set to 0 (zero)).

   h. In the **Max Link Distance in Miles** text box, enter the maximum one-way distance (in miles) used to set the maximum expected propagation delay between any Endpoints in the network.
   i. In the **Frequency Masks** text box, enter the exact specified format of the frequency range to mask.

      Caution: The exact syntax is required in the **Frequency Masks** text box. See Frequency Masks (on page 290) for detailed information.

9. Click the **Update** button to save the changed information.

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8.12. Change the Radio Settings Parameters - Gateway

Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 115

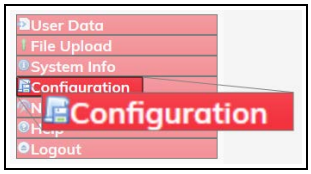

Figure 115: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Radio Settings** tab to access the **Radio Settings** parameters.
7. Accept the **Radio Mode** default of **Gateway**. Figure 116

   Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

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Figure 116: Radio Settings window - Gateway

8. As applicable, change these parameters:
   a. Click the **RF Data Rate** list box arrow and select the RF link data rate in bits per second.
   b. In the **Radio Max Repeaters** text box, enter the number of Repeater slots in the network.
   c. Click the **Tx Power** list box arrow and select the dB RF output transmit power level for the Z9-P2 or Z9-PE2.
   d. In the **Network ID** text box, enter the network identifier that subdivides traffic on radio units.
   e. Click the **Frequency Key** list box arrow and select the Key number used as an index to select a hopping table.
   f. Optional: Click the **Radio Hopping Mode** list box arrow and select **Off** to disable frequency hopping.

      Note: By default, the **Radio Hopping Mode** is enabled (set to Hopping_On).

   g. Click the **Beacon Interval** list box arrow and select how often a Gateway radio sends out a beacon packet and changes to the next radio frequency in the hopping pattern.
   h. In the **Beacon Burst Count** text box, enter the number of consecutive beacons to send per Beacon Interval time.
   i. Optional: In the **LNA Bypass** text box, enter **1** to bypass the Low Noise Amplifier (LNA) and reduce the radio module receive signal by 10dB.

      Note: By default, the **LNA Bypass** is enabled (set to 0 (zero)).

   j. In the **Max Link Distance in Miles** text box, enter the maximum one-way distance (in miles) used to set the maximum expected propagation delay between any Endpoints in the network.
   k. In the **Frequency Masks** text box, enter the exact specified format of the frequency range to mask.

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Caution: The exact syntax is required in the **Frequency Masks** text box. See Frequency Masks (on page 290) for detailed information.

9. Click the **Update** button to save the changed information.

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8.13. Change the Radio Settings Parameters - Gateway-Repeater

Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 117

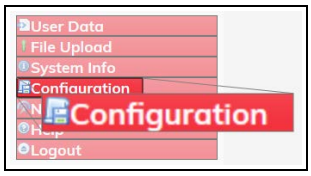

Figure 117: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Radio Settings** tab to access the **Radio Settings** parameters.
7. Click the **Radio Mode** list box arrow and select the device type to designate the Z9-P2 or Z9-PE2 as a **Gateway_Repeater**. Figure 118

   Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

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Figure 118: Radio Settings window - Gateway_Repeater

8. As applicable, change these parameters:
   a. Click the **RF Data Rate** list box arrow and select the RF link data rate in bits per second.
   b. In the **Radio Max Repeaters** text box, enter the number of Repeater slots in the network.
   c. Click the **Tx Power** list box arrow and select the dB RF output transmit power level for the Z9-P2 or Z9-PE2.
   d. In the **Network ID** text box, enter the network identifier that subdivides traffic on radio units.
   e. Click the **Frequency Key** list box arrow and select the Key number used as an index to select a hopping table.
   f. Optional: Click the **Radio Hopping Mode** list box arrow and select **Off** to disable frequency hopping.

      Note: By default, the **Radio Hopping Mode** is enabled (set to Hopping_On).

   g. Click the **Beacon Interval** list box arrow and select how often a Gateway radio sends out a beacon packet and changes to the next radio frequency in the hopping pattern.
   h. In the **Beacon Burst Count** text box, enter the number of consecutive beacons to send per Beacon Interval time.
   i. Optional: In the **LNA Bypass** text box, enter **1** to bypass the Low Noise Amplifier (LNA) and reduce the radio module receive signal by 10dB.

      Note: By default, the **LNA Bypass** is enabled (set to 0 (zero)).

   j. In the **Max Link Distance in Miles** text box, enter the maximum one-way distance (in miles) used to set the maximum expected propagation delay between any Endpoints in the network.
   k. In the **Frequency Masks** text box, enter the exact specified format of the frequency range to mask.

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Caution: The exact syntax is required in the **Frequency Masks** text box. See Frequency Masks (on page 290) for detailed information.

9. Click the **Update** button to save the changed information.

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8.14. Change the Security Parameters

Note: See the Security Parameters (on page 317) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 119

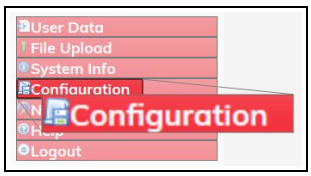

Figure 119: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Security** tab to access the **Security** parameters. Figure 120

   Note: See the Security Parameters (on page 317) for detailed information about the parameters.

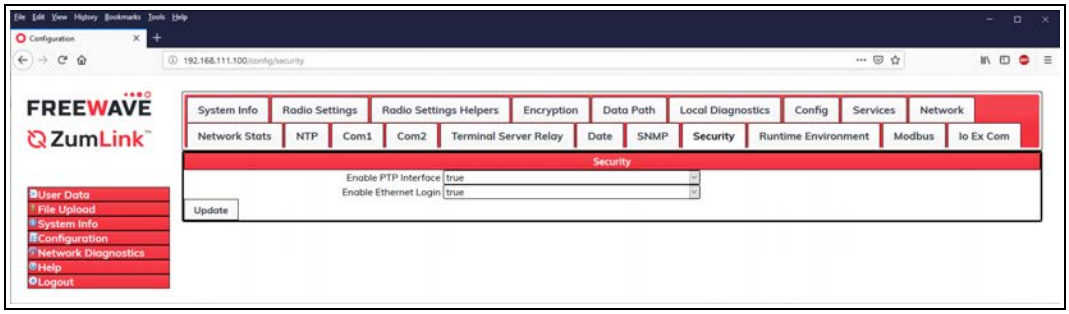

Figure 120: Security window

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7. As applicable, change these parameters:
   a. Optional: Click the **Ethernet PTP Interface** list box arrow and select **False** to disable the PTP (drag-and-drop) interface.

      Note: By default, the **Enable Ethernet Login** is enabled (set to True).
      See the Enable Ethernet Login (on page 318) parameter for additional information.

   b. Optional: Click the **Enable Ethernet Login** list box arrow and select **False** to disable SSH logins.

      Note: By default, the **Ethernet PTP Interface** is enabled (set to True).
      See the Ethernet PTP Interface (on page 318) parameter for additional information.

8. Click the **Update** button to save the changed information.

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8.15. Change the Services Parameters

Note: See the Services Parameters (on page 320) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 121

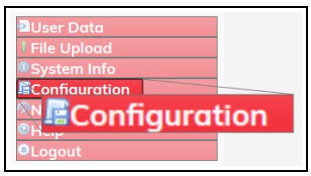

Figure 121: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Services** tab to access the **Services** parameters. Figure 122

   Note: See the Services Parameters (on page 320) for detailed information about the parameters.

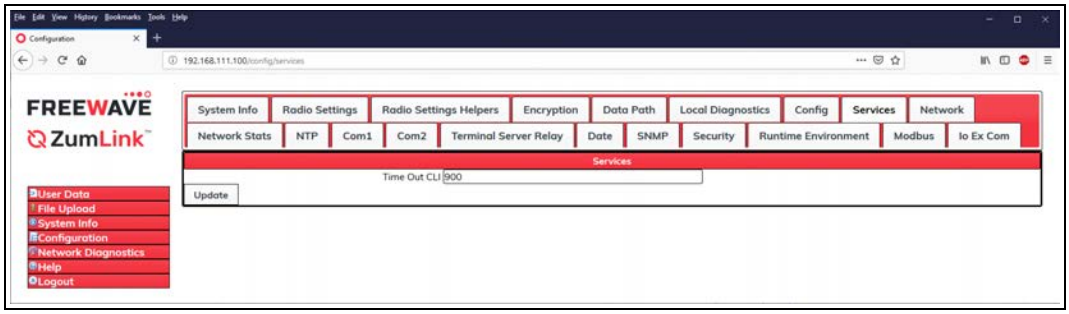

Figure 122: Services window

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7. In the **Time Out CLI** text box, enter the number of seconds of idle time before the CLI connection is closed.
8. Click the **Update** button to save the changed information.

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8.16. Change the SNMP Parameters

Note: See the SNMP Parameters (on page 322) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 123

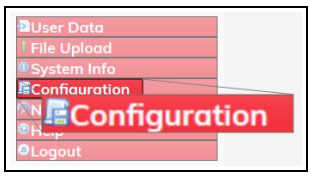

Figure 123: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **SNMP** tab to access the **SNMP** parameters.

   Note: See the SNMP Parameters (on page 322) for detailed information about the parameters.

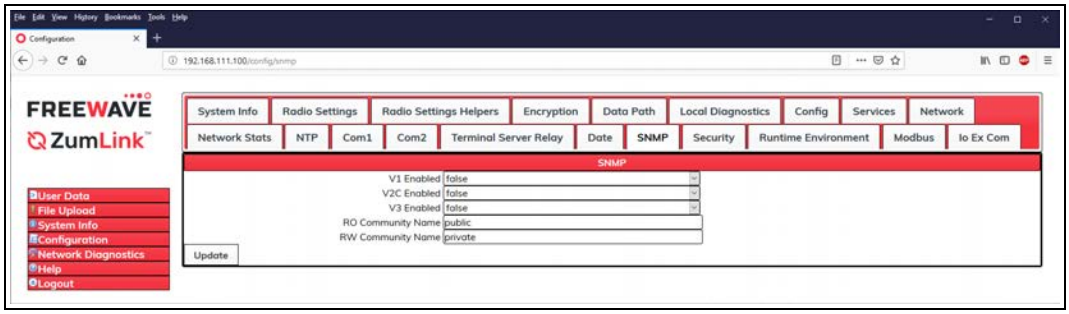

Figure 124: SNMP window

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7. As applicable, change these parameters:
   a. Click the **V1 Enabled** list box arrow and select **True** to enable SNMP V1.

      Note: For security, the protocol **SNMP v1** is read-only.
      See the V1 Enabled (on page 325) parameter for additional information.

   b. Click the **V2C Enabled** list box arrow and select **True** to enable SNMP V2C.

      Note: By default, the **v2c Enabled** is NOT enabled (set to False).
      See the V2C Enabled (on page 326) parameter for additional information.

   c. Click the **V3 Enabled** list box arrow and select **True** to enable SNMP V3.

      Note: By default, the **v3 Enabled** is NOT enabled (set to False).
      See the V3 Enabled (on page 327) parameter for additional information.

   d. In the **RO Community Name** text box, enter the user-designated name for SNMP V1/V2C Read-only access.
   e. In the **RW Community Name** text box, enter the user-designated name for SNMP V1/V2C Read-Write access.

      Note: The **SNMP User** text box is Read-only in the Web Interface.
      Use the CLI to change this parameter.

8. Click the **Update** button to save the changed information.

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8.17. Change the System Info Parameters

Note: See the System Info Parameters (on page 336) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 125

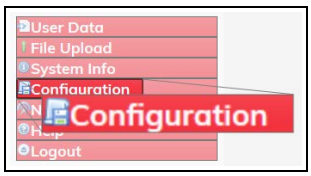

Figure 125: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **System Info** tab to access the **System Info** parameters. Figure 126

   Note: See the System Info Parameters (on page 336) for detailed information about the parameters.

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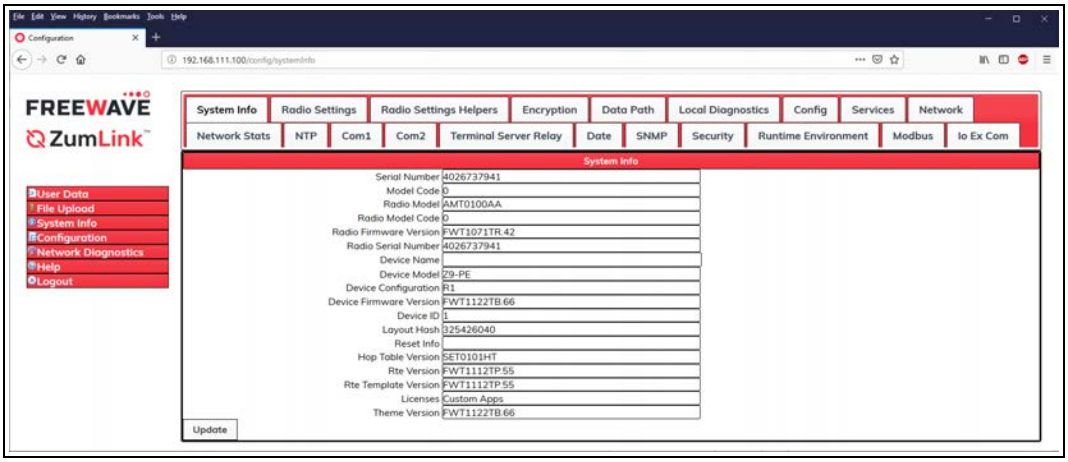

Figure 126: System Info window

7. As applicable, change these parameters:
   a. In the **Device Name** text box, enter the user-defined name for the Z9-P2 or Z9-PE2.
   b. In the **Device ID** text box, enter the user-defined Device ID identifier for the Z9-P2 or Z9-PE2.

   Note: All other parameters in the **System Info** window are Read-only.

8. Click the **Update** button to save the changed information.

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8.18. Change the Terminal Server Relay Parameters

Note: See the Terminal Server Relay Parameters (on page 347) for detailed information about the parameters.

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 127

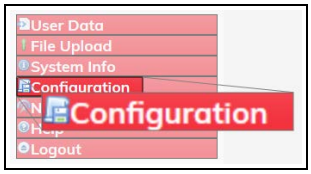

Figure 127: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Terminal Server Relay** tab to access the **Terminal Server Relay** parameters. Figure 128

   Note: See the Terminal Server Relay Parameters (on page 347) for detailed information about the parameters.

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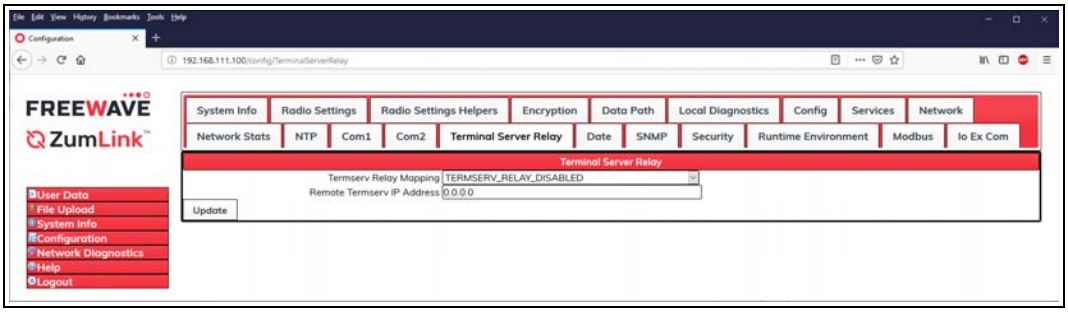

Figure 128: Terminal Server Relay window

7. As applicable, change these parameters:
   a. Click the **Termserv Relay Mapping** list box arrow and select a setting used for the transfer of a bi-directional byte stream between two serial device servers.
   b. In the **Remote Termserv IP Address** text box, enter the IP address for the remote terminal server.
8. Click the **Update** button to save the changed information.
9. Restart the Z9-P2 or Z9-PE2 for the changes to be implemented.

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9. Web Interface - Network Diagnostics

This section provides procedure information about adding, saving, and viewing the Z9-P2 or Z9-PE2 **Network Diagnostic** diagrams.

- Add a Gateway Device IP Address (on page 128)
- Download a Support Bundle (on page 131)
- Save Network Diagnostics (on page 134)
- Save a Network Diagram Image (on page 137)
- Show Table in the Network Diagnostics Window (on page 141)
- View the Network Diagnostics - Breadthfirst (on page 143)
- View the Network Diagnostics - Cose-bilkent (on page 145)
- View the Network Diagnostics - Grid (on page 147)
- View the Network Diagnostics - Margin (on page 149)
- View the Network Diagnostics - Margin with Neighbors (on page 151)
- View the Network Diagnostics - RSSI (on page 154)
- View the Network Diagnostics - RSSI with Neighbors (on page 156)
- View the Network Diagnostics - Rx Rate (on page 159)
- View the Network Diagnostics - Tx Rate (on page 161)

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9.1. Add a Gateway Device IP Address

Usually the Gateway is auto-detected but sometimes this might not happen. This procedure allows the user to designate a specific Gateway IP address.

Note: The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

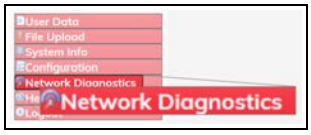

Figure 129: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 130

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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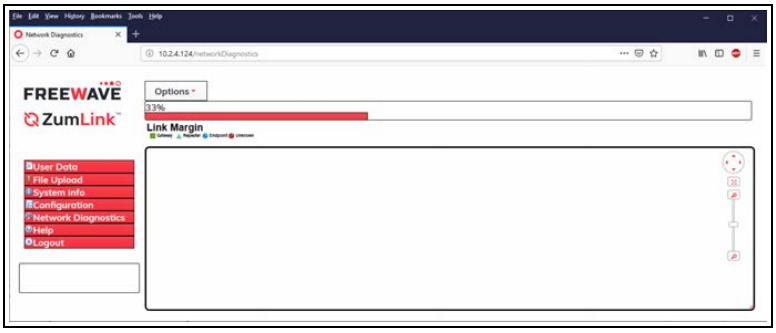

Figure 130: Network Diagnostics window - Scanning Network

Tip: To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

6. Click the **Options** list box arrow and select the **Gateway IP** option. Figure 131

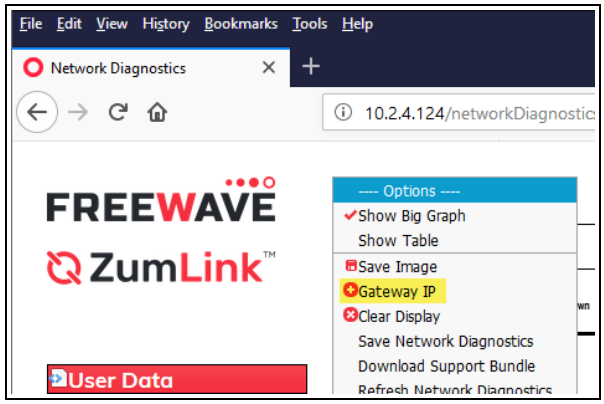

Figure 131: Options list box - Gateway IP option Selected

The **Add Device IP** dialog box opens showing the currently designated Gateway IP address. Figure 132

Note: The image shows the IP address blocked out.

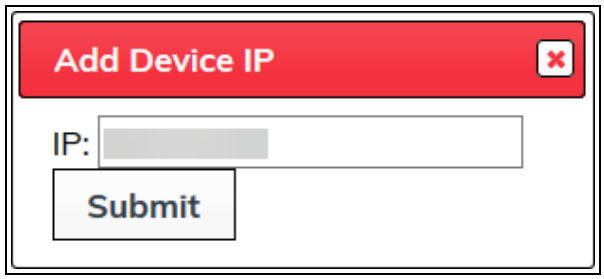

Figure 132: Add Device IP dialog box

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7. In the **IP** text box, enter the IP address of the designated a Gateway device and click **Submit**.

> **Important!**: Network settings are NOT changed when the Gateway IP address is specified.

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9.2. Download a Support Bundle

Save the current network performance reading to send to FreeWave Technical Support for faster issue resolution.

Note: The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

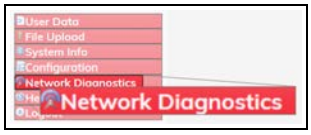

Figure 133: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 134

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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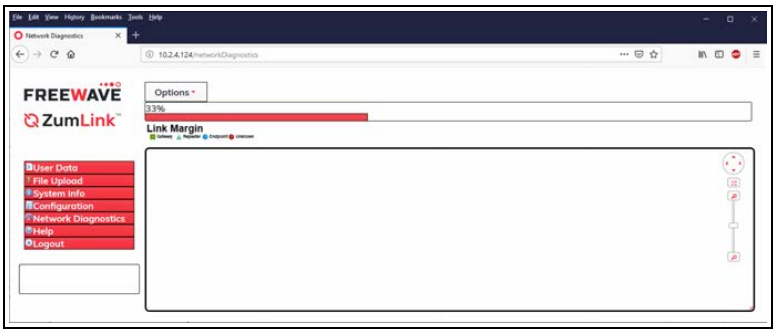

Figure 134: Network Diagnostics window - Scanning Network

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

6. Click the **Options** list box arrow and select the **Download Support Bundle** option. Figure 135

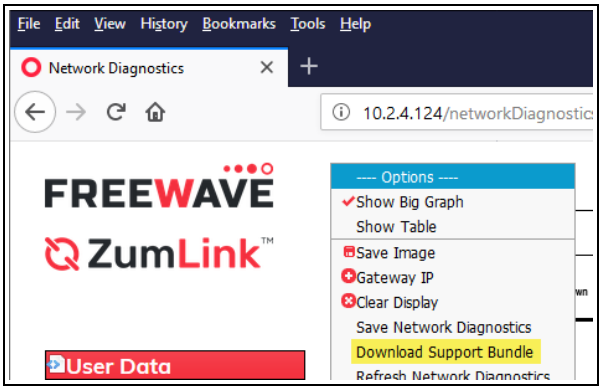

Figure 135: Options list box - Download Support Bundle option Selected

The **Opening support_bundle_nnn.zip** dialog box opens. Figure 136

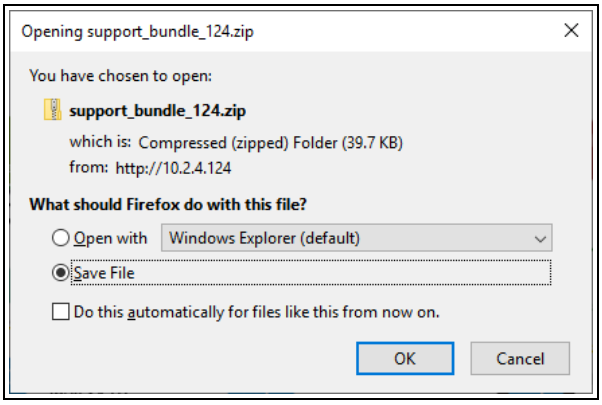

Figure 136: Opening support_bundle_nnn.zip dialog box

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> **Note**: Where `nnn` is the selected device in the **Network Diagram**.

7. Click **OK**.
   The **Enter name of file to save to** dialog box opens.
8. Search for and select a location to save the **.zip** file to and click **Save**.
   The **Enter name of file to save to** dialog box closes.
9. Contact FreeWave Technical Support (on page 14) for information on where to send the saved **.zip** file.

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9.3. Save Network Diagnostics

Use this procedure to save the current network performance reading for later review and to monitor network performance over time.

Note: The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

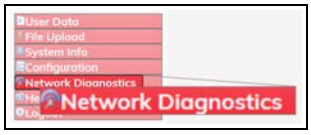

Figure 137: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 138

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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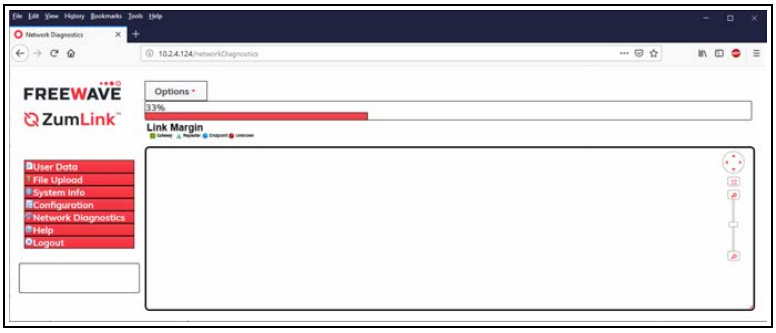

Figure 138: Network Diagnostics window - Scanning Network

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

6. Click the **Options** list box arrow and select the **Save Network Diagnostics** option. Figure 139

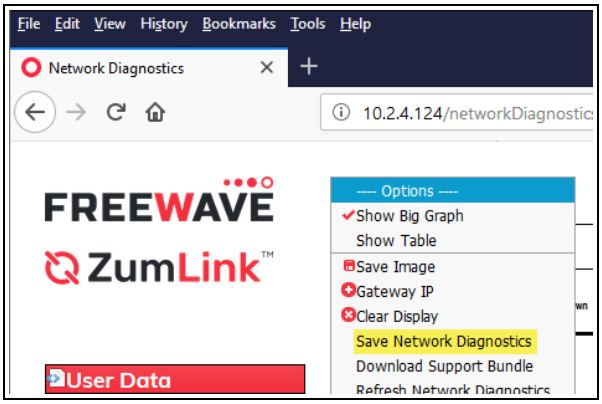

Figure 139: Options list box - Save Network Diagnostics option Selected

The **Opening network_diag.json** dialog box opens. Figure 140

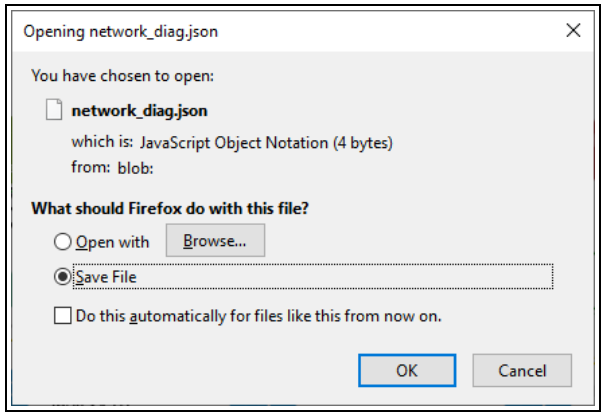

Figure 140: Opening network_diag.json dialog box

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7. Click **OK**.
   The **Enter name of file to save to** dialog box opens.

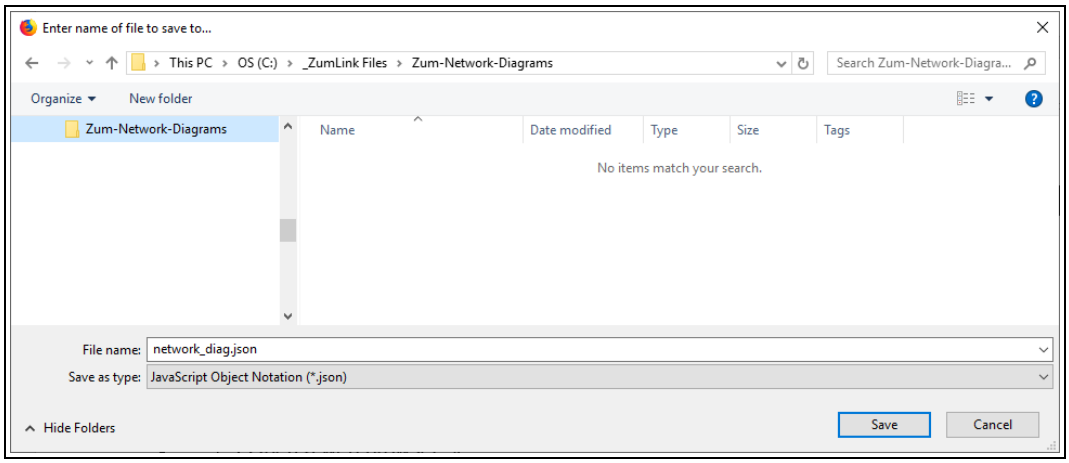

Figure 141: Opening network_diag.json dialog box

8. Search for and select a location to save the **.json** file to and click **Save**.
   The **Enter name of file to save to** dialog box closes.
9. Open a **Windows® File Explorer** window and find the location where the **.json** file was saved.
10. Open the **.json** file to review the current network performance reading and monitor network performance over time.

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9.4. Save a Network Diagram Image

This procedure is used to track changes in the network using images of the **Network Diagram**.

Note: The diagram is saved as a **.PNG** file.
The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

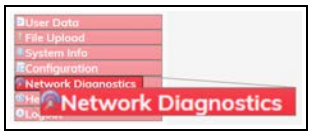

Figure 142: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 143

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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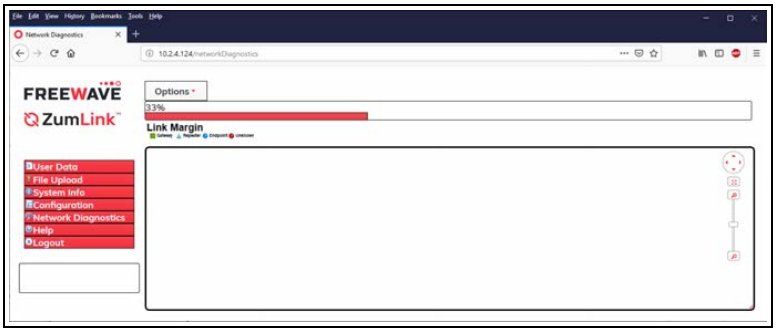

Figure 143: Network Diagnostics window - Scanning Network

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

6. Click the **Options** list box arrow and select the **Save Image** option. Figure 144

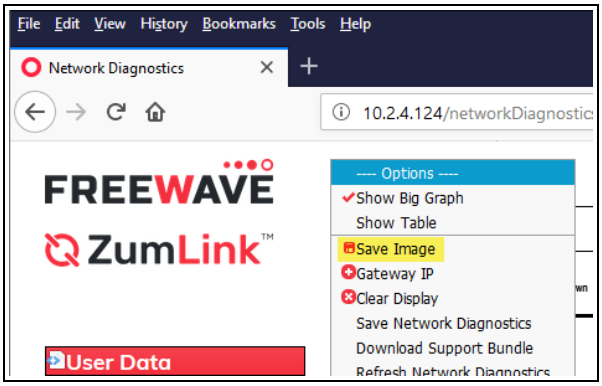

Figure 144: Options list box - Save Image option Selected

The **Save Image** dialog box opens.

7. In the **Save Image** text box, enter a descriptive name for the network image and click **Submit**. Figure 145

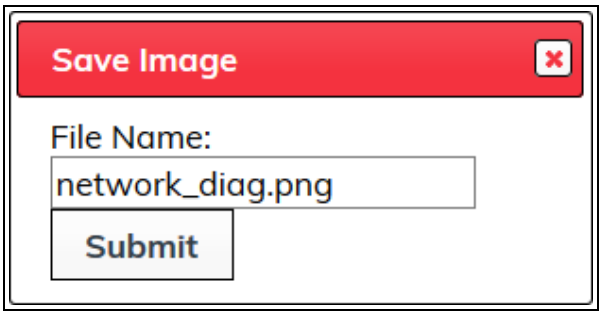

Figure 145: Save Image dialog box

The **Opening _____.png** dialog box opens. Figure 146

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Note: Where _____ is the entered name of the image file.

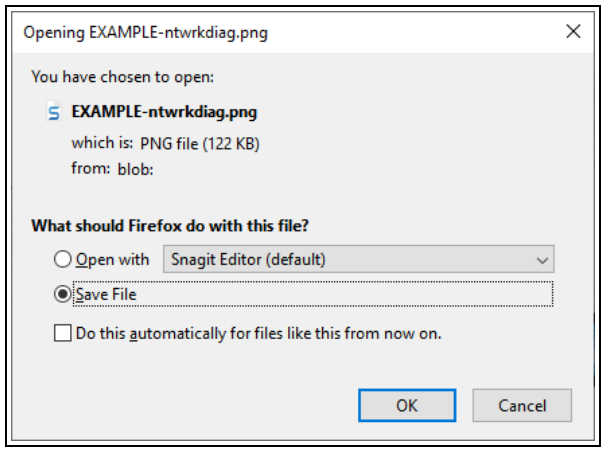

Figure 146: Opening _____.png dialog box

8. Click **OK**.
   The **Enter name of file to save to** dialog box opens. Figure 147

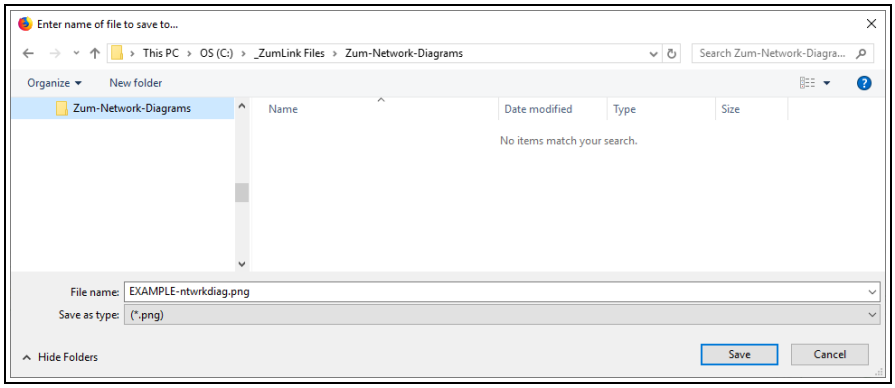

Figure 147: Enter name of file to save to dialog box

9. Search for and select a location to save the **.PNG** file to and click **Save**.
10. Open a Windows® Explorer window and find the location where the **.PNG** file was saved.
11. Open the **.PNG** file to review the changes in the network using the **Network Diagram**. Figure 148

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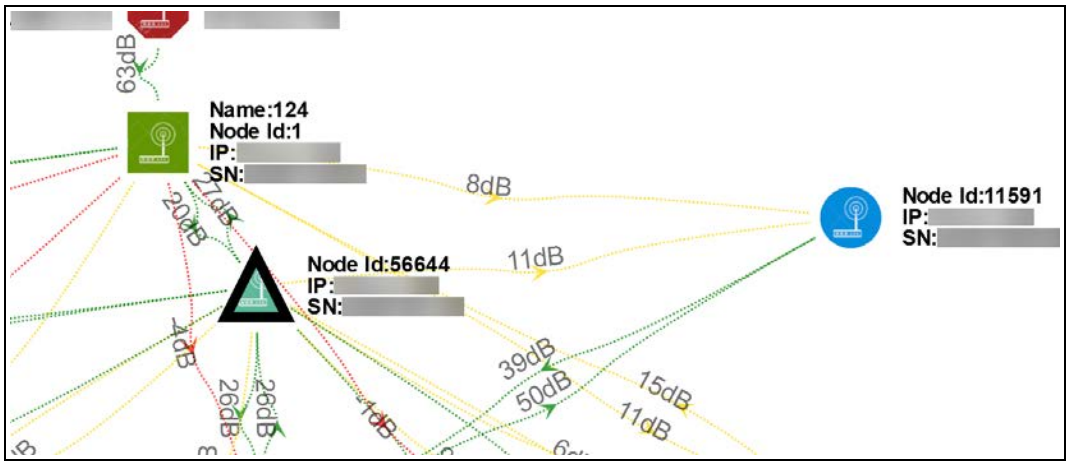

Figure 148: Opened .PNG File

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9.5. Show Table in the Network Diagnostics Window

Use this procedure to view the connection table of the device selected in the **Network Diagram**.

Note: The images in this procedure are for **Windows**® 10 and/or **Firefox**®.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

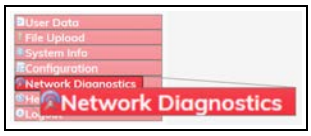

Figure 149: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 150

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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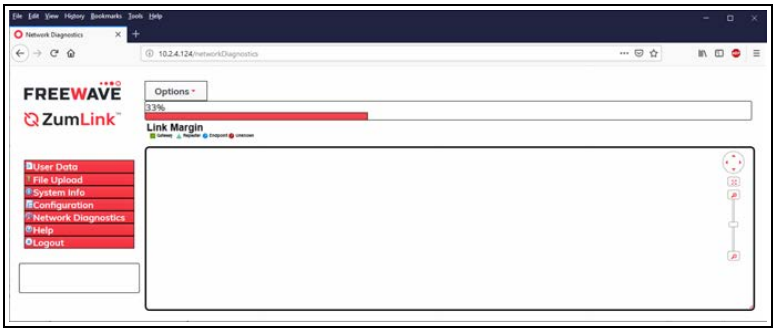

Figure 150: Network Diagnostics window - Scanning Network

The **Link Margin** connections appear in the **Network Diagram**.

6. In the **Options** list box, select the **Show Table** option to view the radio connection table of the selected device below the **Network Diagram**. Figure 151

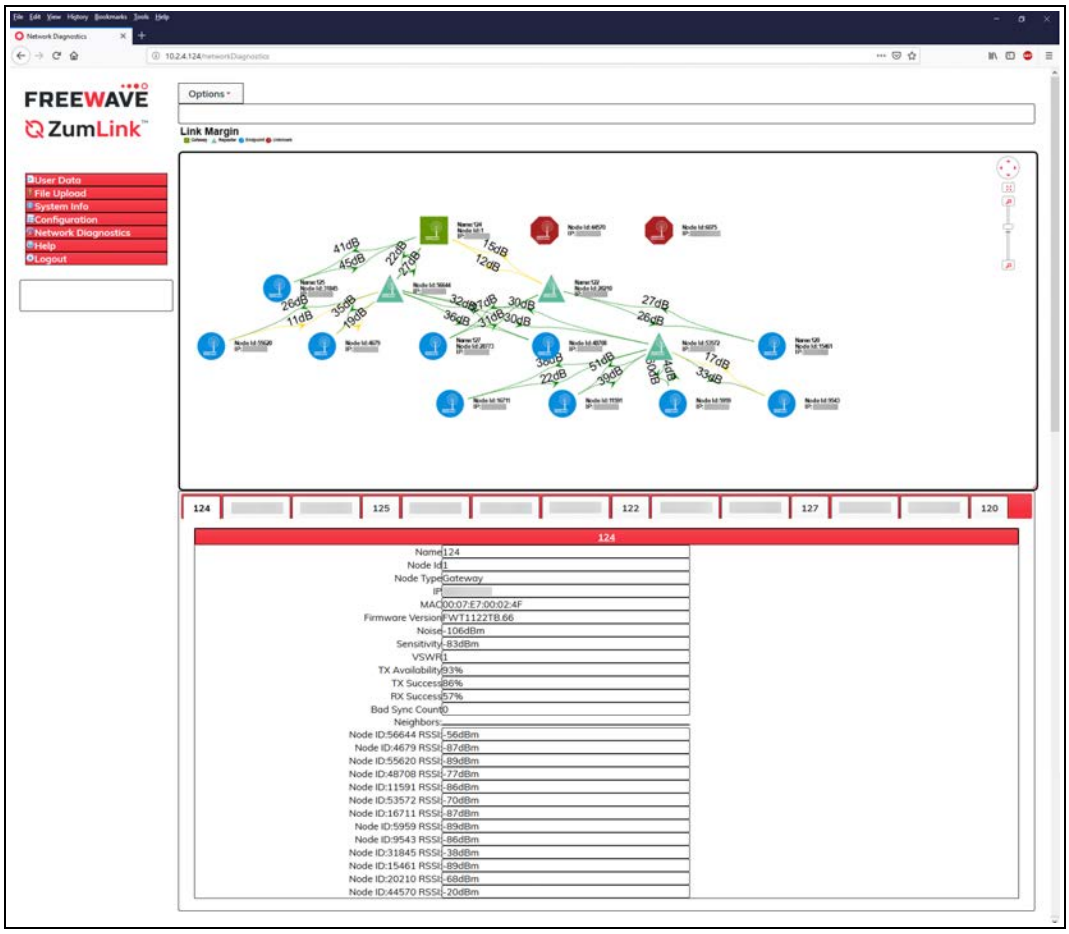

Figure 151: Network Diagnostics window with Show Tables Selected

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9.6. View the Network Diagnostics - Breadthfirst

Use the **Breadthfirst Network Diagram** to view the network in a top-down, organization chart-like view.

- The Gateway is always on top of the network diagram.
- The next layers in the network diagram show Repeaters and Endpoints.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

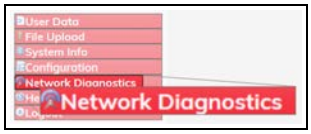

Figure 152: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 153

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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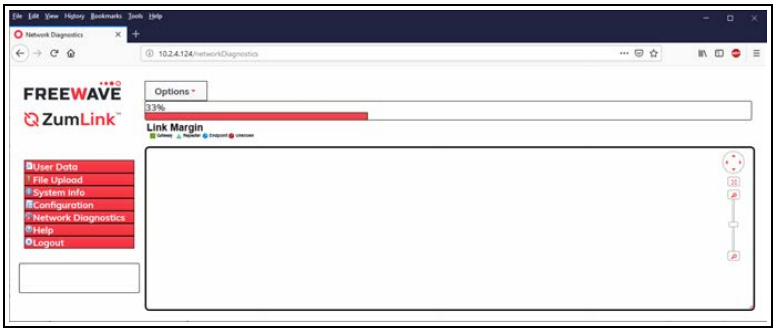

Figure 153: Network Diagnostics window - Scanning Network

6. Click the **Options** list box arrow and select the **Breadthfirst** option to show the **Breadthfirst** connections in the **Network Diagram**. Figure 154

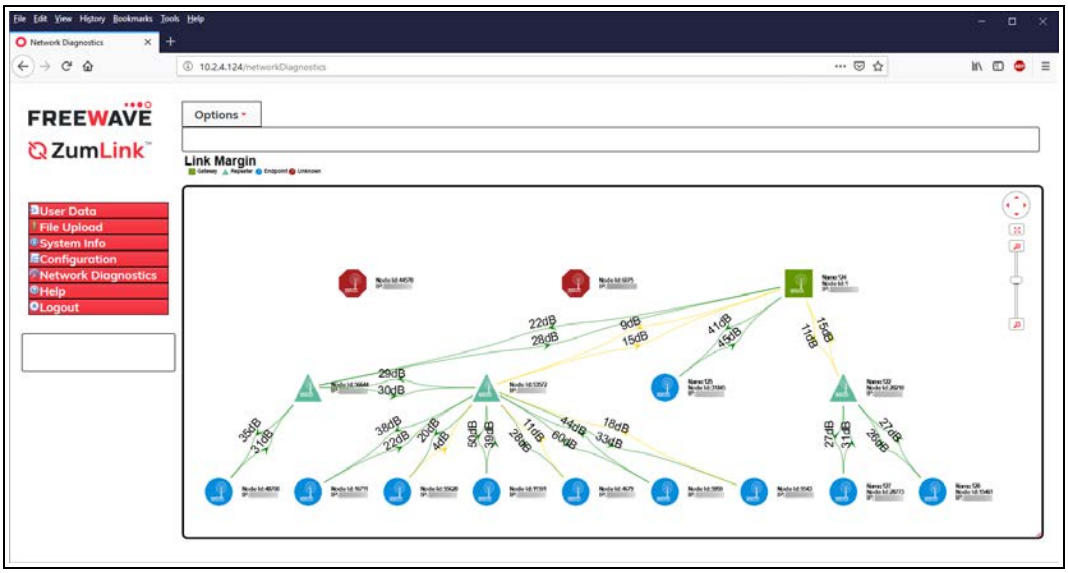

Figure 154: Network Diagnostics window - Breadthfirst

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

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9.7. View the Network Diagnostics - Cose-bilkent

Use the **Cose-bilkent Network Diagram** to view the Gateway surrounded by the Repeaters and Endpoints.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

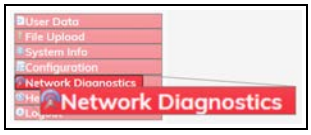

Figure 155: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 156

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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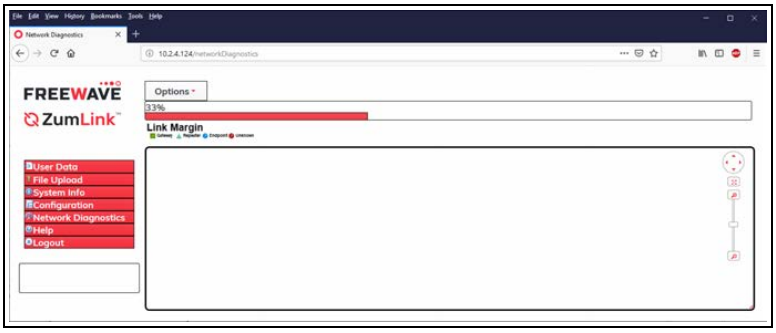

Figure 156: Network Diagnostics window - Scanning Network

6. Click the **Options** list box arrow and select the **Cose-bilkent** option to show the **Cose-bilkent** connections in the **Network Diagram**. Figure 157

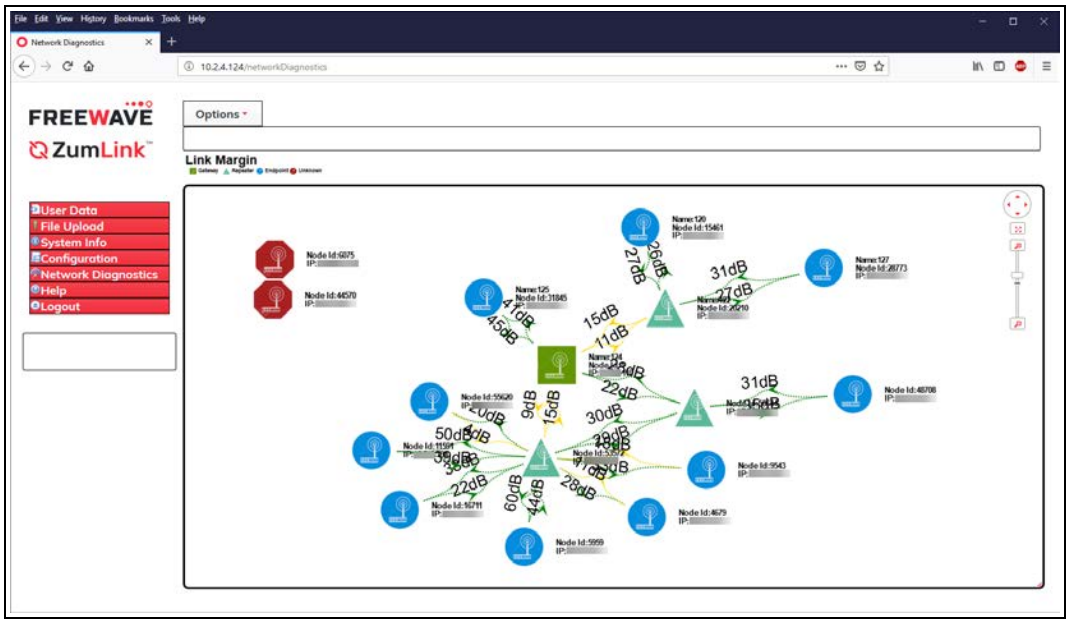

Figure 157: Network Diagnostics window - Cose-bilkent

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

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9.8. View the Network Diagnostics - Grid

View a **Grid Network Diagram** to show the network in a column - row layout.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

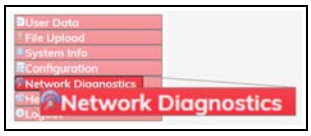

Figure 158: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 159

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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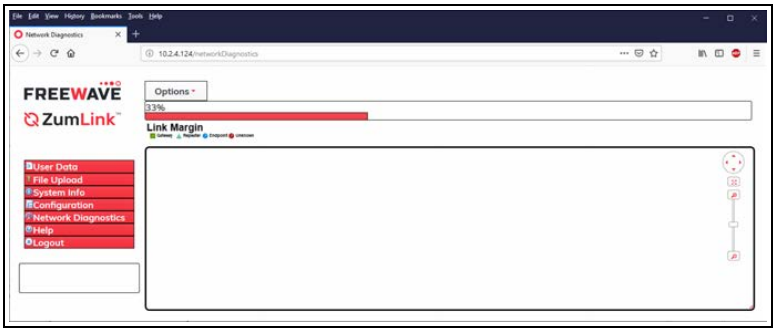

Figure 159: Network Diagnostics window - Scanning Network

6. Click the **Options** list box arrow and select the **Grid** option to show the **Grid** connections in the **Network Diagram**. Figure 160

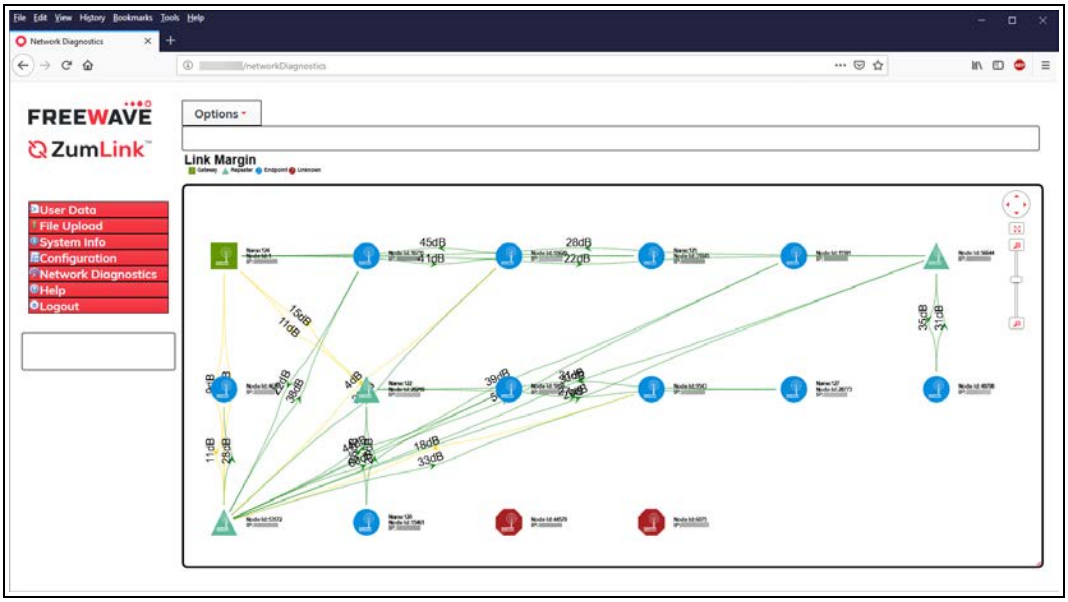

Figure 160: Network Diagnostics window - Grid

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

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9.9. View the Network Diagnostics - Margin

The **Network Diagnostics** window is used to:

- Discover other Endpoints in the network.
- Show hops and their paths from the Gateway.
- Show the link quality (RSSI and Margin).
- Show neighbors.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

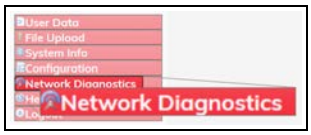

Figure 161: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 162

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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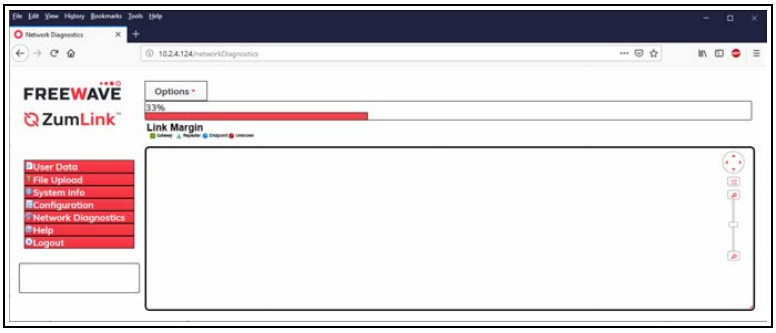

Figure 162: Network Diagnostics window - Scanning Network

The **Link Margin** connections appear in the **Network Diagram** Figure 163

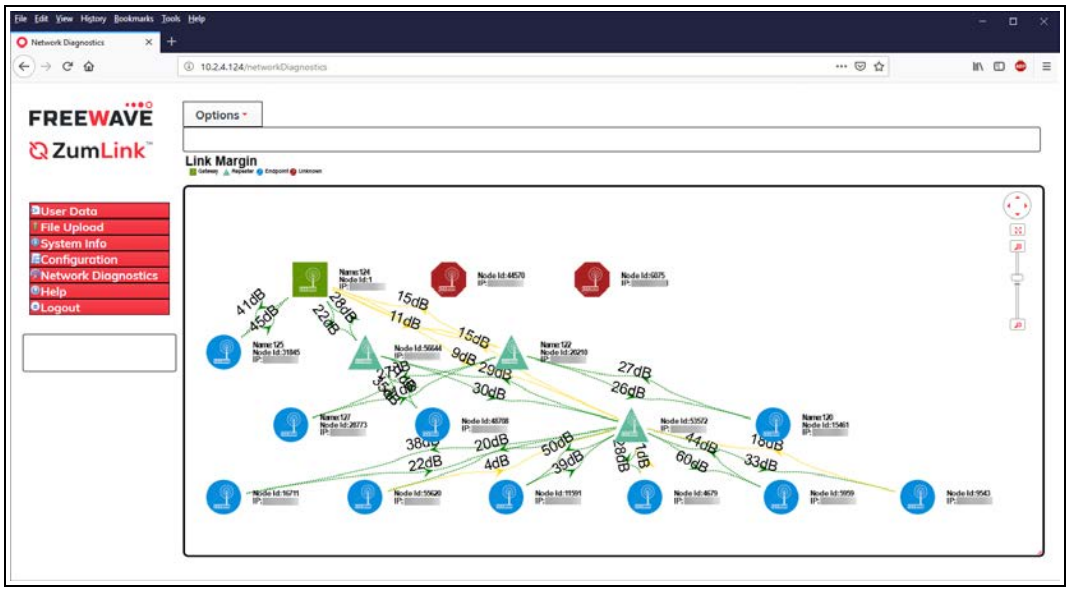

Figure 163: Network Diagnostics window - Link Margin

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

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9.10. View the Network Diagnostics - Margin with Neighbors

The **Network Diagnostics** window is used to:

- Discover other Endpoints in the network.
- Show hops and their paths from the Gateway.
- Show the link quality (RSSI and Margin).
- Show neighbors.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

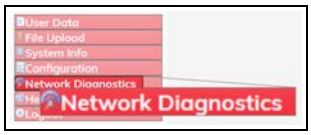

Figure 164: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 165

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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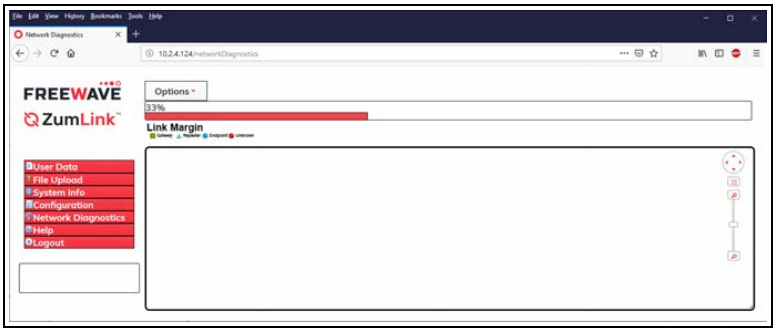

Figure 165: Network Diagnostics window - Scanning Network

6. Click the **Options** list box arrow and select the **Margin with Neighbors** option to show the **Margin with Neighbors** connections in the **Network Diagram**. Figure 166

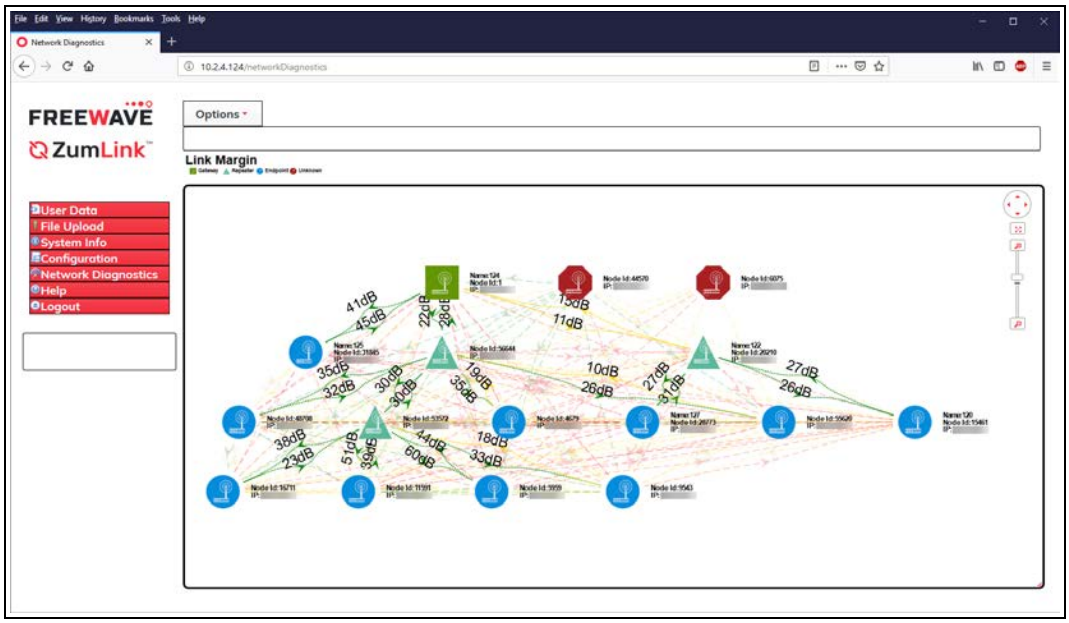

Figure 166: Network Diagnostics window - Margin with Neighbors

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

7. Optional: Use the cursor to hover over the Gateway-Endpoint link to view the dBm rate. Figure 167

Note: The image provides example information only.
Each Z9-P2 or Z9-PE2 provides its own unique information.

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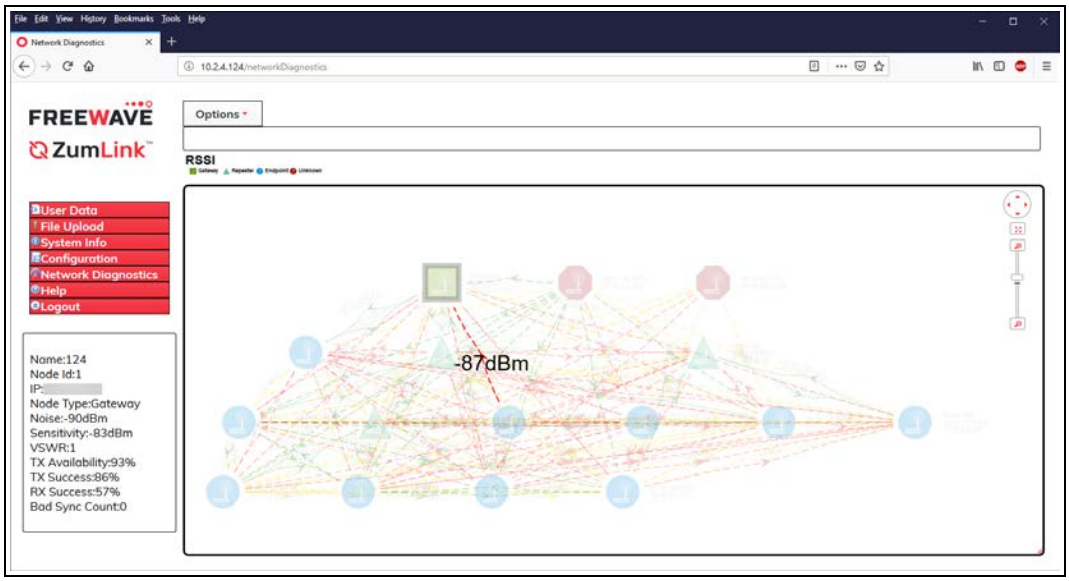

Figure 167: Network Diagnostics window - Margin with Neighbors - Gateway-Endpoint Link

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9.11. View the Network Diagnostics - RSSI

The **Network Diagnostics** window is used to:

- Discover other Endpoints in the network.
- Show hops and their paths from the Gateway.
- Show the link quality (RSSI and Margin).
- Show neighbors.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

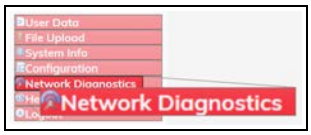

Figure 168: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 169

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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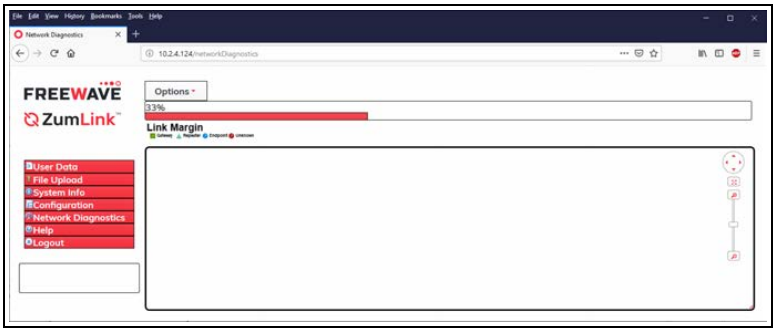

Figure 169: Network Diagnostics window - Scanning Network

6. Click the **Options** list box arrow and select the **RSSI** option to show the **RSSI** connections in the **Network Diagram**. Figure 170

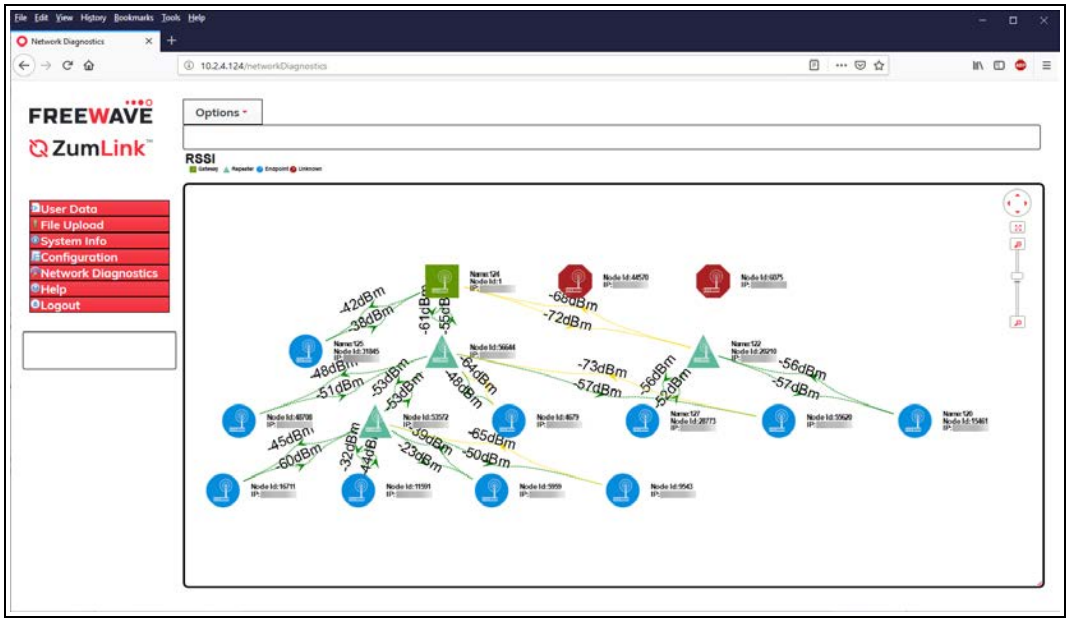

Figure 170: Network Diagnostics window - RSSI

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

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9.12. View the Network Diagnostics - RSSI with Neighbors

The **Network Diagnostics** window is used to:

- Discover other Endpoints in the network.
- Show hops and their paths from the Gateway.
- Show the link quality (RSSI and Margin).
- Show neighbors.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

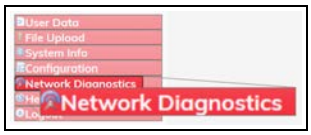

Figure 171: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 172

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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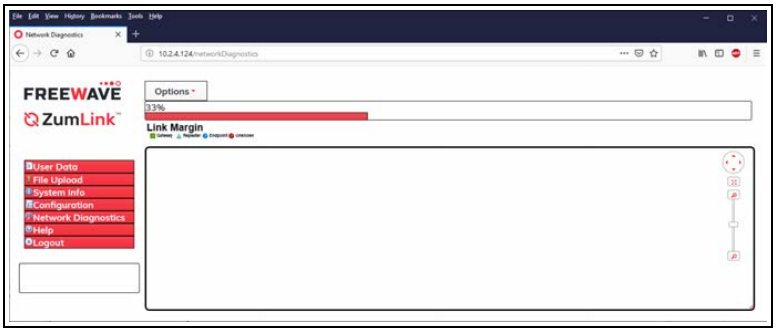

Figure 172: Network Diagnostics window - Scanning Network

6. Click the **Options** list box arrow and select the **RSSI with Neighbors** option to show the **RSSI with Neighbors** connections in the **Network Diagram**. Figure 173

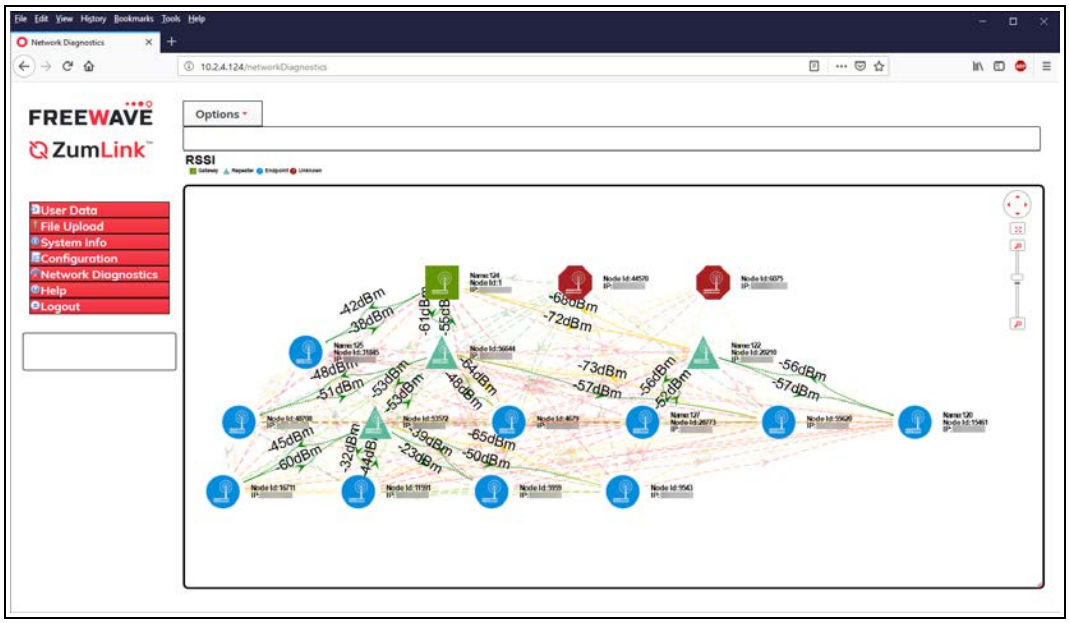

Figure 173: Network Diagnostics window - RSSI with Neighbors

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

7. Optional: Use the cursor to hover over the Gateway-Endpoint link to view the dBm rate. Figure 174

Note: The image provides example information only.
Each Z9-P2 or Z9-PE2 provides its own unique information.

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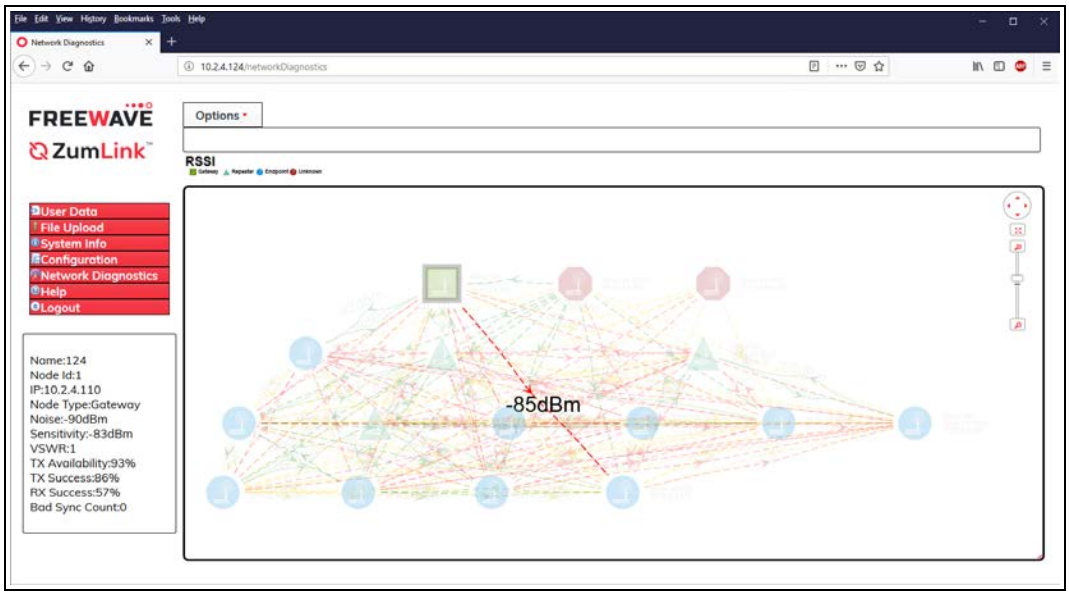

Figure 174: Network Diagnostics window - RSSI with Neighbors - Gateway-Endpoint Link

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9.13. View the Network Diagnostics - Rx Rate

The **Network Diagnostics** window is used to:

- Discover other Endpoints in the network.
- Show hops and their paths from the Gateway.
- Show the link quality (RSSI and Margin).
- Show neighbors.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

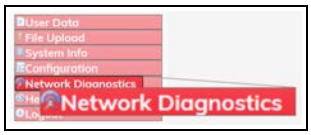

Figure 175: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 176

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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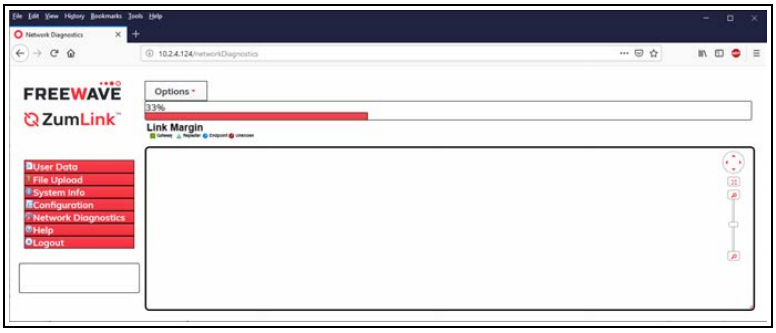

Figure 176: Network Diagnostics window - Scanning Network

6. Click the **Options** list box arrow and select the **Rx Rate** option to show the **Rx Rate** connections in the **Network Diagram**. Figure 177

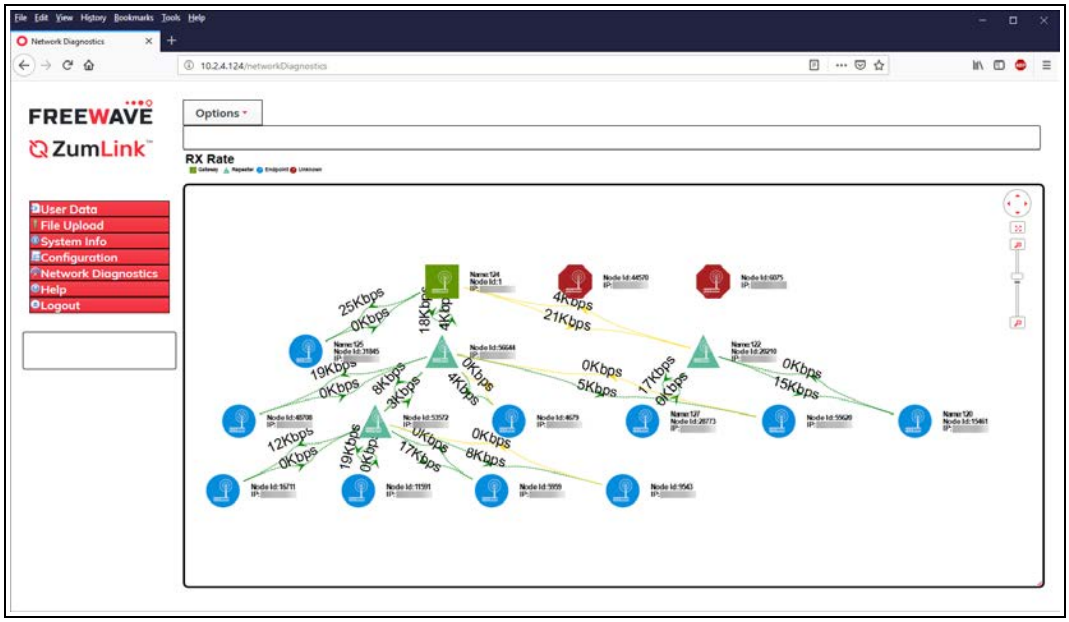

Figure 177: Network Diagnostics window - RX Rate

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

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9.14. View the Network Diagnostics - Tx Rate

The **Network Diagnostics** window is used to:

- Discover other Endpoints in the network.
- Show hops and their paths from the Gateway.
- Show the link quality (RSSI and Margin).
- Show neighbors.

Important!: A Gateway is required in the network to use this window.

Procedure

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

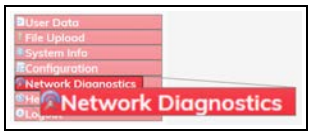

Figure 178: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 179

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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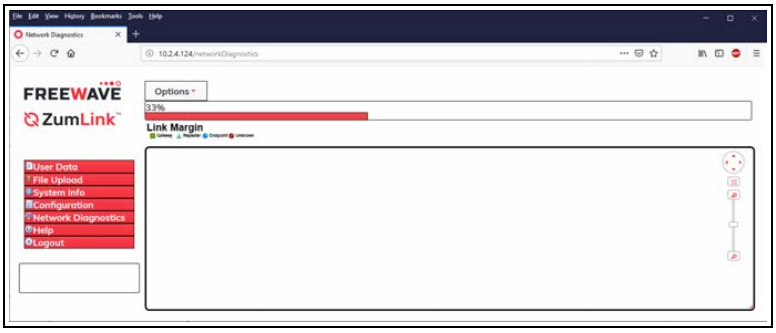

Figure 179: Network Diagnostics window - Scanning Network

6. Click the **Options** list box arrow and select the **Tx Rate** option to show the **Tx Rate** connections in the **Network Diagram**. Figure 180

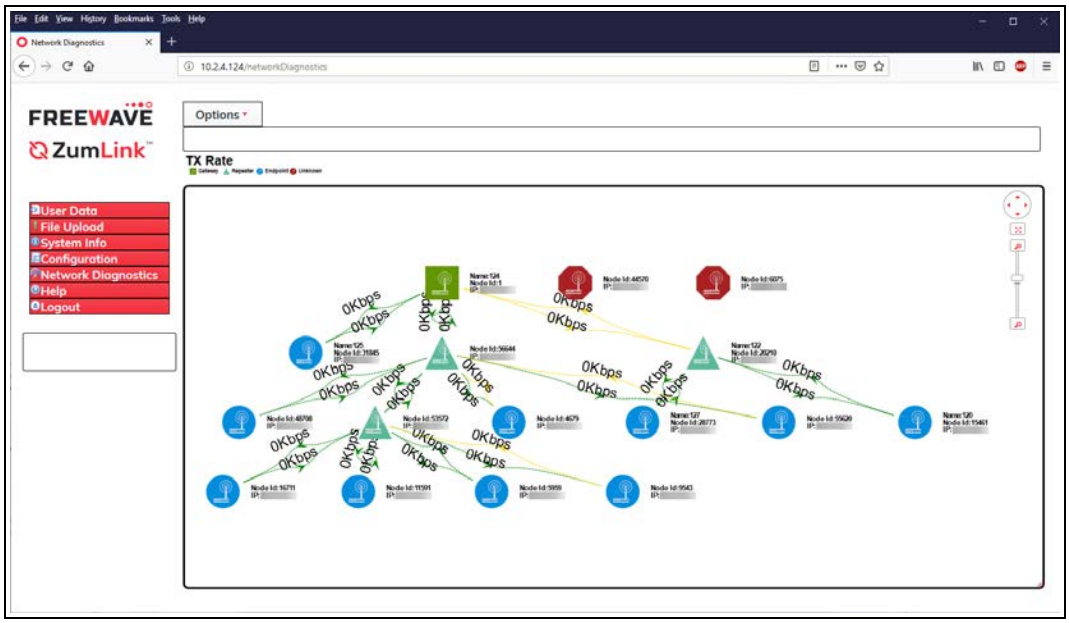

Figure 180: Network Diagnostics window - TX Rate

To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.

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10. Change the Passwords

Important!: The Z9-P2 or Z9-PE2 password is ONLY changed through the CLI.
See CLI Configuration (on page 34) to connect via CLI.

FREEWAVE Recommends: From a security standpoint, it is best practice to change **both** the **admin** password and the **devuser** passwords.

- Change the ADMIN Password (on page 164)
- Change the DEVUSER Password (on page 164)

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10.1. Change the ADMIN Password

1. Login to the FreeWave CLI using **admin** and the current **password**.
2. Use this command format to change the password:
   system.password=[oldpassword],[newpassword],[newpassword] and press <Enter>.

   Example: **system.password=admin,12345,12345**.

   Note: An error message appears when there is an error in typing the new password command.

10.2. Change the DEVUSER Password

Warning! Do NOT use the Linux command `passwd` to change passwords. Passwords **must be changed** using the FreeWave CLI to keep them synchronized between the FreeWave CLI and the Linux Bash shell.

1. Login to the FreeWave CLI using **admin** and the current **password**.
   The **FreeWave Shell** returns. Figure 181

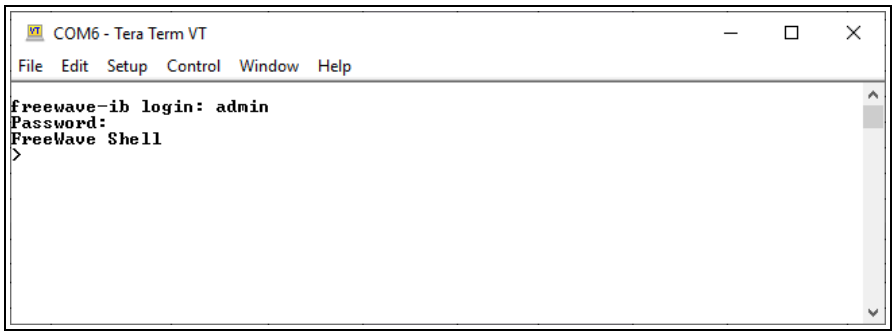

Figure 181: FreeWave Shell

2. At the > prompt, type **system.login=devuser,devuser** and press <Enter>.
   The **devuser** is now logged in. Figure 182

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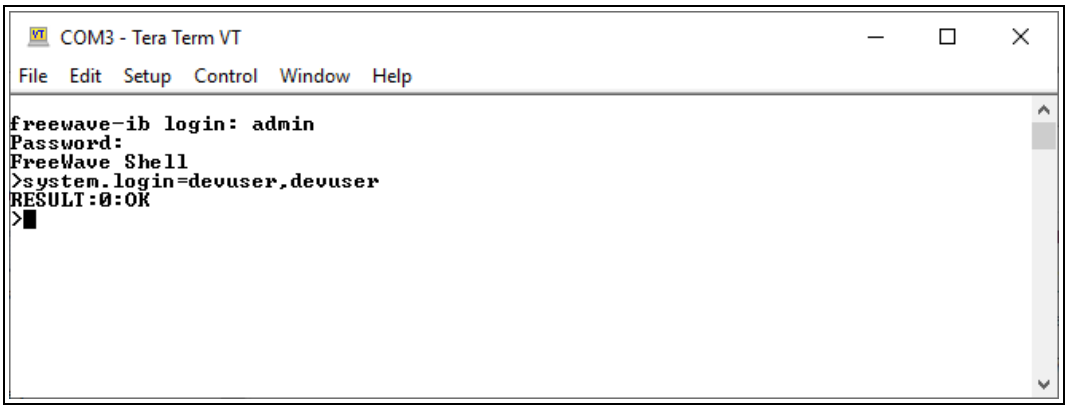

Figure 182: devuser Logged In

3. At the > prompt, type **`system.password=devuser,nnnnn,nnnnn`** and press <Enter>.

   Note: Where **`devuser`** is the current password and **`nnnnn`** is the new devuser password.

   The CLI shows the new password was accepted. Figure 183

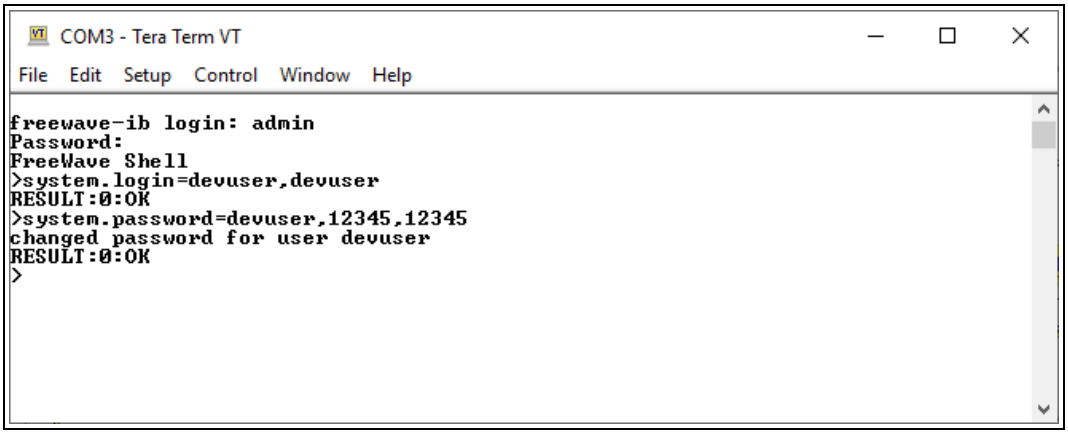

Figure 183: Accepted devuser New Password

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11. IP Filtering

IP Filtering is used to allow only traffic in a designated IP subnet to traverse the radio network.

- Within the radio subnet, the IPv4, TCP, ICMP (ping), ARP, and UDP traffic is permitted to traverse the radio network, while all other Ethernet traffic is blocked.
- The IP Filtering setting does NOT need to match on all the radios in the network.
  Only enable IP Filtering on individual radios with incoming LAN Ethernet traffic to filter from the network.

IP Filtering can prevent non-radio Ethernet traffic from adversely affecting the performance and capacity of the radio network.

Procedure

Note: This procedure provides a **Tera Term** terminal connection to the FreeWave CLI. Other terminal emulators (e.g., **HyperTerminal**, **PuTTY**) may be used.
The images in this procedure are for **Windows**® 7 and/or **Windows**® 10 and **Firefox**®.

1. On the computer connected to the Z9-P2 or Z9-PE2, open a terminal program (e.g., **Tera Term** http://ttssh2.osdn.jp/).
2. In **Tera Term**, click the **File** menu and select **New Connection**. Figure 184

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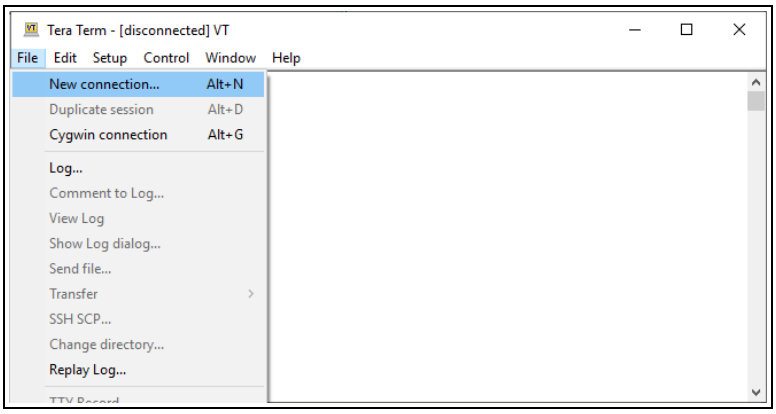

Figure 184: File menu > New Connection

The **Tera Term New Connection** dialog box opens.

3. Click the **Port** list box arrow and select the COM port the Z9-P2 or Z9-PE2 is connected to. Figure 185

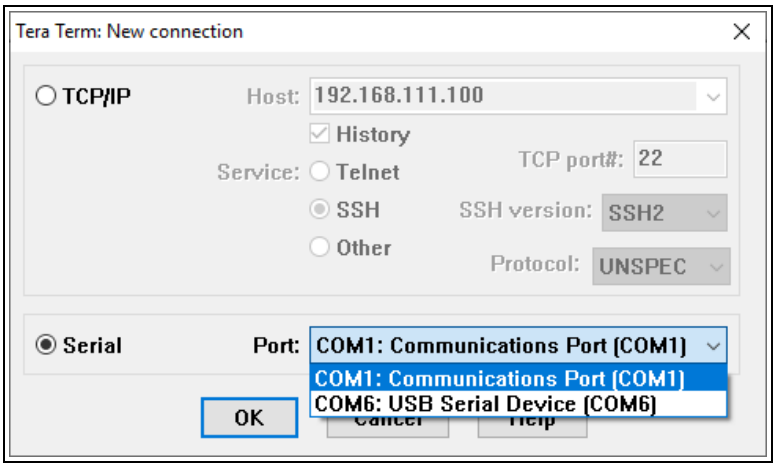

Figure 185: Select the Z9-P2 or Z9-PE2 COM Port

> **Important!**: The **Port** assignment varies from computer to computer.

4. Click **OK** to save the changes and close the dialog box.
   The **Tera Term** window shows the connected COM port and Baud rate in the title bar of the window.
5. In the **Tera Term** window, click the **Setup** menu and select **Serial Port**. Figure 186

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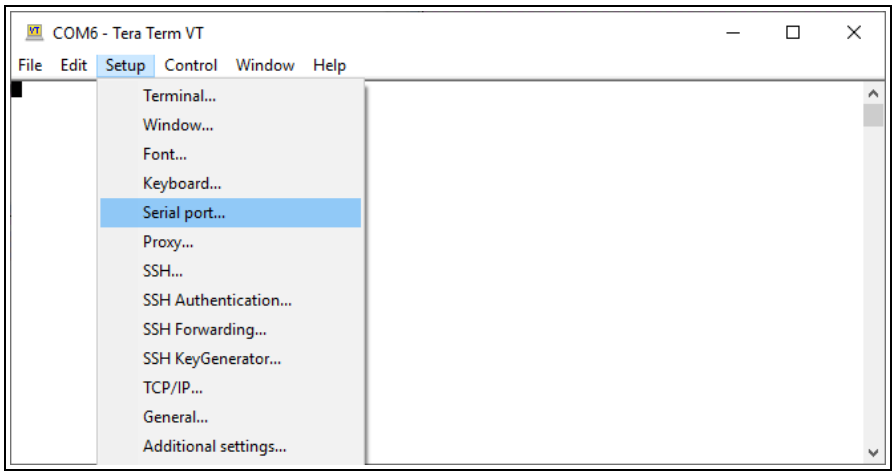

Figure 186: Setup menu > Serial Port

The **Tera Term: Serial Port Setup** dialog box opens. Figure 187

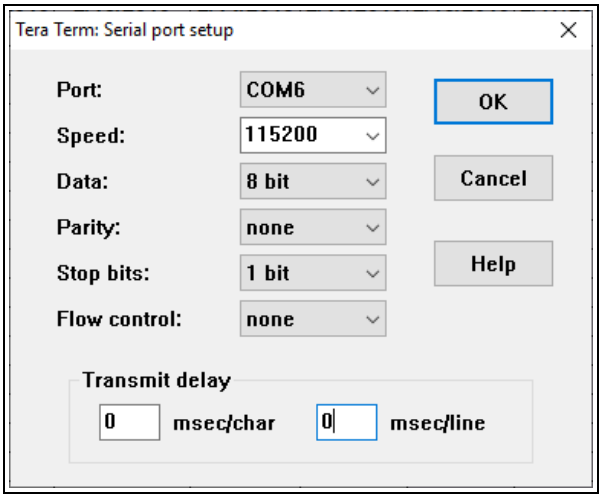

Figure 187: Tera Term: Serial Port Setup dialog box with Default Settings

6. Using Figure 187 as the example, verify the COM port settings are:
   Speed (Baud Rate): 115200
   Data (Databits): 8 bit
   Parity: none
   Stop bits: 1 bit
7. Click **OK** to save the changes and close the dialog box.
8. In the **Tera Term** window, press <Enter>.
   The FreeWave CLI Login returns.
9. Enter `admin` for the **Username** and press <Enter>.
10. Enter `admin` for the **Password** and press <Enter>.

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Note: The default username and password is **admin**.
If the **User Name** or **Password** were changed, enter the applicable information.
The password does not appear when typing - it looks blank.

The **FreeWave Shell** opens. Figure 188

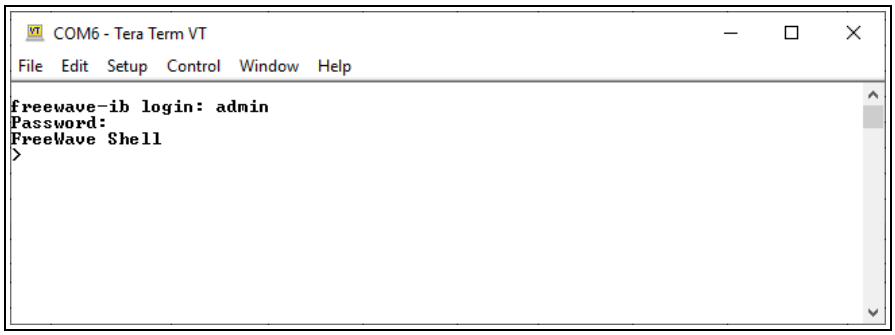

Figure 188: FreeWave Shell

11. At the > prompt, type **network** and press <Enter>.
The Z9-P2 or Z9-PE2 **network** settings appear.

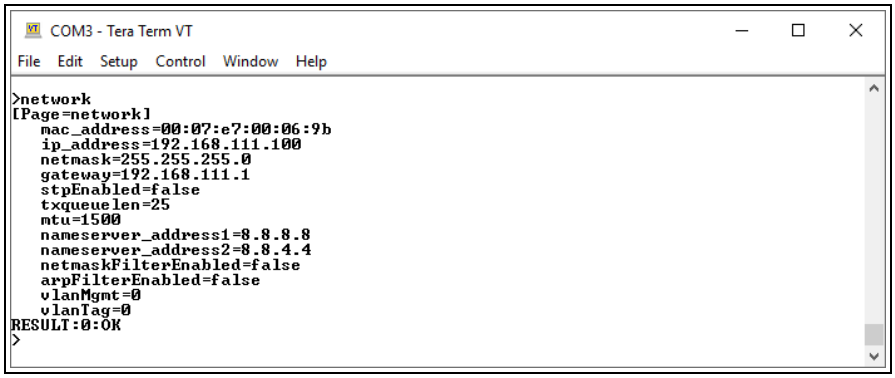

Figure 189: network Settings Page

12. At the > prompt, type **network.netmaskFilterEnabled=true** and press <Enter>.
The IP Filtering is now active on the **ZumLink** device.

The IP Filtering setting does NOT need to match on all the radios in the network. Only enable IP Filtering on individual radios with incoming LAN Ethernet traffic to filter from the network.

13. At the > prompt, type **save** and press <Enter>.

Note: See Example: Network Topology with Traffic at the Gateway (on page 170)

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11.1. Example: Network Topology with Traffic at the Gateway

In Figure 190:

- The yellow communication link arrows are used to denote which of the radio units can directly communicate.
- Devices in green can communicate with IPv4.
- Devices in red and other traffic is excluded from **ZumLink** network.

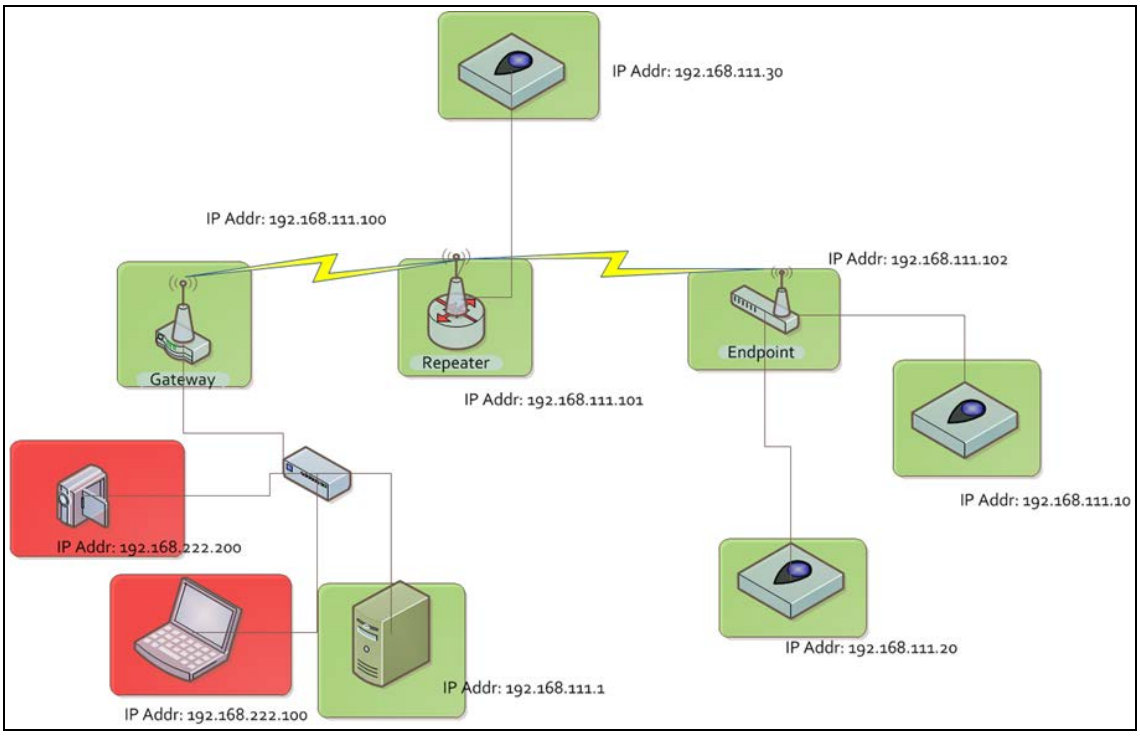

Figure 190: Network Topology with Traffic at the Gateway but not Desired on the Rest of the Network

Figure 190 is a common network topology where IP filtering on the Gateway radio reduces unwanted traffic on the radio network.

In this example:

- Only traffic on the 192.168.111.255 netmask passes over the radio network.
- The red laptop and the camera traffic are on the 222.nnn subnet; their traffic is blocked at the Gateway radio.
- Only IPv4. TCP, UDP, ICMP (ping), and ARP traffic destined to and from the desired subnet is transmitted over the radio network.
- VLAN tagged packets are filtered out because the radio is not considered on the VLAN and therefore VLAN packets cannot be on the same subnet.

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12. Repeaters

ZumLink Repeater allows the extension of the **ZumLink** network, forwarding packets between **ZumLink** devices that could otherwise not communicate directly with each other. The advantage of using Repeaters is to reach very long distances and "hop" over or around obstacles like buildings or hills.

The **ZumLink** Repeater can be configured as either a Gateway-Repeater or Endpoint-Repeater.

- The Gateway-Repeater is a Gateway that also repeats packets.
- The Endpoint-Repeater is an Endpoint able to repeat packets and master beacons.

> **Note**: An Endpoint-Repeater strongly favors its wired device over Endpoints it's repeating for.

This section has this information:

- Repeater - Setup Table (on page 173)
  - Hopping OFF Repeater Setup (on page 173)
  - Hopping ON Repeater Setup (on page 174)
- Basic Gateway and Endpoint-Repeater Setup (on page 176)
  - Open a Terminal Emulator Application (on page 177)
  - Hopping On: Gateway and Endpoint-Repeater Setup (on page 180)
  - Hopping Off: Gateway and Endpoint-Repeater Setup (on page 182)
- Repeater - Examples (on page 184)
  - Gateway-Repeater (on page 185)
  - Endpoint-Repeater (on page 186)
  - Multiple Repeaters: Gateway-Repeater and Endpoint-Repeater (on page 187)
  - Multiple Repeaters: Four Endpoint-Repeaters (on page 188)
  - Back-to-Back Repeaters (on page 190)

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ZumLink Repeaters support all 5 data rates; 115.2kbps, 250kbps, 500kbps, 1Mbps, and 4Mbps.

- At 115.2kbps and 250kbps data rates, hopping capability must be enabled for the ZumLink Repeaters.
- At 500kbps, 1Mbps, and 4Mbps data rates, hopping capability is optional.

When hopping capability is employed, one radio must be configured as the Gateway (or Gateway-Repeater).

- The beacon from the Gateway radio must be heard by the Repeater.
- The Repeater must also re-send the beacon so that the Endpoints, and downstream Repeaters, it communicates with can stay synchronized with the frequency hopping pattern.
- To keep the Gateway and Endpoint-Repeater beacons from colliding, the Endpoint-Repeaters must have their own time slot (radio Repeater slot).
- The Endpoint-Repeater has a radio Repeater slot range from 1-3.
  - A maximum number of 3 Endpoint-Repeaters are supported in an overlapping communication space or RF coverage area.
  - The radio Repeater slot numbers can be reused where there is no RF connectivity or overlap between the reused radio Repeater slots.

Where multiple communication paths are available, the **ZumLink** Repeater can be influenced to a preferred communication path by optimizing the minimum signal level margin. The minimum signal level margin establishes a minimum signal threshold required for a Repeater hop to be considered.

FREEWAVE Recommends: Set the Beacon Burst Count (on page 286) to **2** or more for optimal throughput when Repeaters are used and the RF environment is noisy.
This increases the number of beacons sent in a beacon interval.

Caution: The repeating operation occurs on the same frequencies normally used for transmit and receive.
This causes the throughput of the communication path utilizing the Repeater to be reduced by approximately 50 percent with each Repeater hop.
Only communication paths via Repeaters are impacted, communication paths that do not utilize the Repeater remain at full throughput.

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12.1. Repeater - Setup Table

These tables show the basic setting configurations in a Repeater network with either:

- Hopping OFF Repeater Setup (on page 173)
- Hopping ON Repeater Setup (on page 174)

Note: For detailed procedures, see Basic Gateway and Endpoint-Repeater Setup (on page 176).

12.1.1. Hopping OFF Repeater Setup

The settings in this table assumes that `radiosettings.radioHoppingMode=Hopping_Off`.

- Hopping is required at data rates below 500kbps.
- Hopping is optional at data rate 500kbps or above.
- With hopping disabled, a Gateway or Gateway-Repeater is optional.

Repeater Network Configuration			
radioSettings Setting*	**Gateway Setup**	**Endpoint-Repeater Setup**	**Endpoint Setup**
radioMode=	Gateway	Endpoint_Repeater	Endpoint
nodeId=	N/A	= **unique** Node ID for each device	= **unique** Node ID for each device
networkId=	= **same** Network ID for all devices	= **same** Network ID for all devices	= **same** Network ID for all devices
rfDataRate=	= **same** Data Rate for all devices	= **same** Data Rate for all devices	= **same** Data Rate for all devices
dataPath Setting*	**Gateway Setup**	**Endpoint-Repeater Setup**	**Endpoint Setup**
routeMinSignalMarginThresh=	= **desired** Link Signal Margin minus 4dB	= **desired** Link Signal Margin minus 4dB	= **desired** Link Signal Margin minus 4dB
network Setting*	**Gateway Setup**	**Endpoint-Repeater Setup**	**Endpoint Setup**
ip_address=	= **unique** IP address for each device.	= **unique** IP address for each device.	= **unique** IP address for each device.

Note: *See the Data Path Parameters (on page 216), Network Parameters (on page 262), or Radio Settings Parameters (on page 285) for additional information.

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12.1.2. Hopping ON Repeater Setup

The settings in this table assumes that `radiosettings.radioHoppingMode=Hopping_On`.

- Hopping is required at data rates below 500kbps.
- Hopping is optional at data rate 500kbps or above.
- With hopping enabled, a Gateway or Gateway-Repeater must be configured.

Repeater Network Configuration			
radioSettings Setting****	**Gateway Setup**	**Endpoint-Repeater Setup**	**Endpoint Setup**
radioMode=	Gateway	Endpoint_Repeater	Endpoint
nodeId=	N/A	= **unique** Node ID for each device	= **unique** Node ID for each device
networkId=	= **same** Network ID for all devices	= **same** Network ID for all devices	= **same** Network ID for all devices
rfDataRate=	= **same** Data Rate for all devices	= **same** Data Rate for all devices	= **same** Data Rate for all devices
radioMaxRepeaters=	0-3 [1]	NA	NA
radioRepeaterSlot=	NA	1-3 [2]	NA
beaconBurstCount=	1-7 [3]	NA	NA
dataPath Setting****	**Gateway Setup**	**Endpoint-Repeater Setup**	**Endpoint Setup**
routeMinSignalMarginThresh=	= **desired** Link Signal Margin minus 4dB	= **desired** Link Signal Margin minus 4dB	= **desired** Link Signal Margin minus 4dB
network Setting****	**Gateway Setup**	**Endpoint-Repeater Setup**	**Endpoint Setup**
ip_address=	= **unique** IP address for each device.	= **unique** IP address for each device.	= **unique** IP address for each device.

1. Set the **radioMaxRepeaters** to match the number of overlapping Repeaters with a maximum of 3.
   - Setting this value too high adds unnecessary latency to the network.
   - In this example, set this to 1.
2. Set the **radioRepeaterSlot** to designate which Repeater slot to use, up to the **radioMaxRepeaters** setting.
   - In this example, set this to 1.

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3. Set the Beacon Burst Count (on page 286) to 2 or more for optimal throughput when Repeaters are used and the RF environment is noisy.
   This increases the number of beacons sent in a beacon interval.

Note: ****See the Data Path Parameters (on page 216), Network Parameters (on page 262), or Radio Settings Parameters (on page 285) for additional information.

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12.2. Basic Gateway and Endpoint-Repeater Setup

Important!: This procedure assumes the user has 3 new **ZumLink** devices.
The number of Endpoint-Repeaters in the network **must be known before** starting this procedure.

The basic setup procedures are:

A. Open a Terminal Emulator Application (on page 177)
B. Configure using either:
Hopping On: Gateway and Endpoint-Repeater Setup (on page 180)
or
Hopping Off: Gateway and Endpoint-Repeater Setup (on page 182)

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12.2.1. Open a Terminal Emulator Application

Note: This procedure provides a **Tera Term** terminal connection to the FreeWave CLI. Other terminal emulators (e.g., **HyperTerminal**, **PuTTY**) may be used.
The images in this procedure are for **Windows**® 7 and/or **Windows**® 10 and **Firefox**®.

1. On the computer connected to the Z9-P2 or Z9-PE2, open a terminal program (e.g., **Tera Term** http://ttssh2.osdn.jp/).
2. In **Tera Term**, click the **File** menu and select **New Connection**. Figure 191

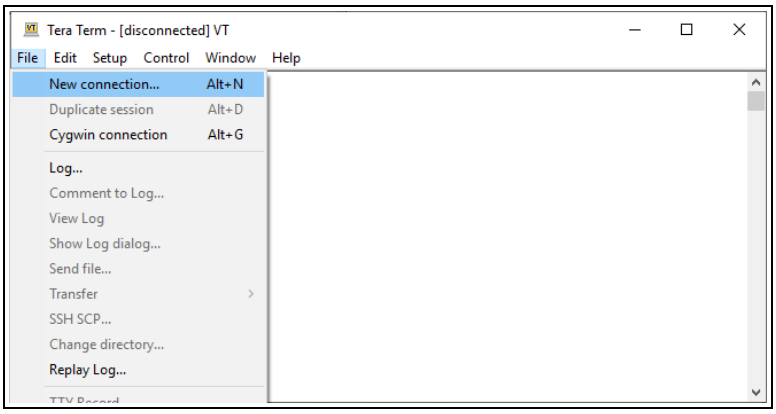

Figure 191: File menu > New Connection

The **Tera Term New Connection** dialog box opens.

3. Click the **Port** list box arrow and select the COM port the Z9-P2 or Z9-PE2 is connected to. Figure 192

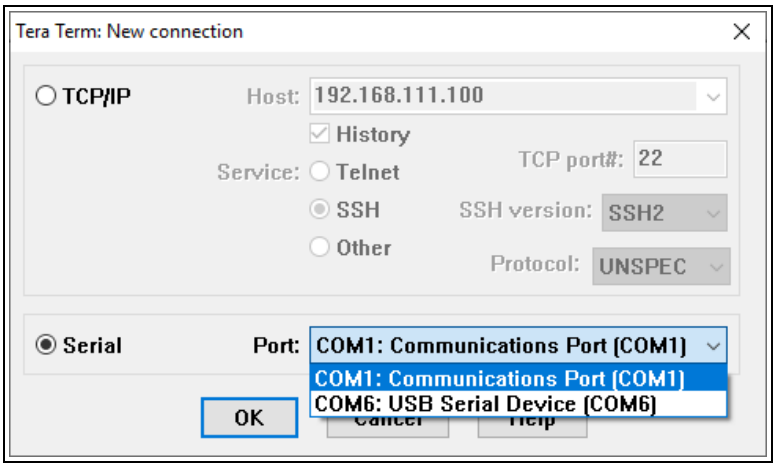

Figure 192: Select the Z9-P2 or Z9-PE2 COM Port

Important!: The **Port** assignment varies from computer to computer.

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4. Click **OK** to save the changes and close the dialog box.
   The **Tera Term** window shows the connected COM port and Baud rate in the title bar of the window.
5. In the **Tera Term** window, click the **Setup** menu and select **Serial Port**. Figure 193

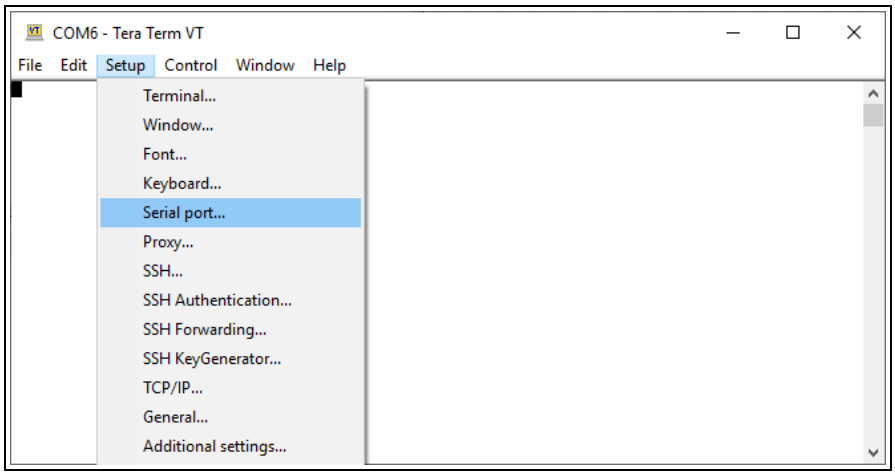

Figure 193: Setup menu > Serial Port

The **Tera Term: Serial Port Setup** dialog box opens. Figure 194

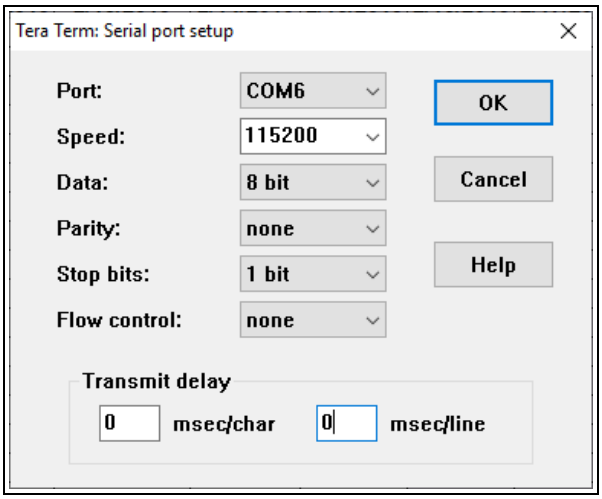

Figure 194: Tera Term: Serial Port Setup dialog box with Default Settings

6. Using Figure 194 as the example, verify the COM port settings are:
   Speed (Baud Rate): 115200
   Data (Databits): 8 bit
   Parity: none
   Stop bits: 1 bit
7. Click **OK** to save the changes and close the dialog box.
8. In the **Tera Term** window, press <Enter>.
   The FreeWave CLI Login returns.
9. Enter `admin` for the **Username** and press <Enter>.

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10. Enter **admin** for the **Password** and press <Enter>.

> **Note**: The default username and password is **admin**.
> If the **User Name** or **Password** were changed, enter the applicable information.
> The password does not appear when typing - it looks blank.

The **FreeWave Shell** opens. Figure 195

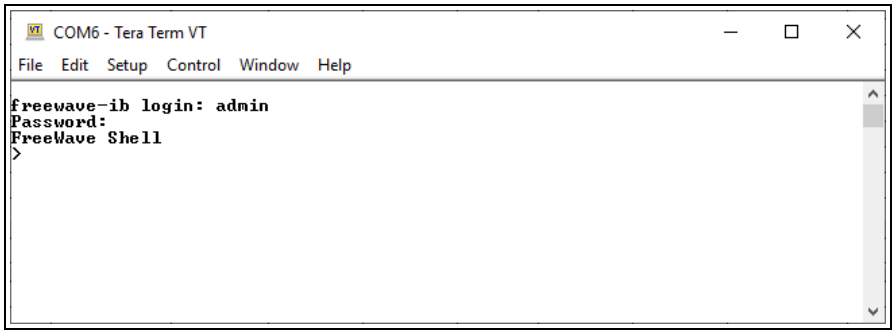

Figure 195: FreeWave Shell

11. At the > prompt, type **radioSettings** and press <Enter>.
The current [Page=radioSettings] appears. (Figure 196)

Figure 196: radioSettings Page

12. Continue with either:
    - Hopping On: Gateway and Endpoint-Repeater Setup (on page 180)
    - Hopping Off: Gateway and Endpoint-Repeater Setup (on page 182)

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12.2.2. Hopping On: Gateway and Endpoint-Repeater Setup

Important!: This procedure has **HOPPING ON** (`radiosettings.radioHoppingMode=Hopping_On`).

If Hopping is OFF (`radiosettings.radioHoppingMode=Hopping_Off`) go to Hopping Off: Gateway and Endpoint-Repeater Setup (on page 182).

1. On the **Gateway** ZumLink device:
   a. Complete the Open a Terminal Emulator Application (on page 177) procedure.
   b. At the > prompt, type:
      i. `radioSettings.radioMode=Gateway` and press <Enter>.
      ii. `radioSettings.networkId=nnnnn` where nnnnn is the designated Network ID and press <Enter>.
      iii. `network.ip_address=nnn.nnn.nnn.nnn` where nnn.nnn.nnn.nnn is the **unique** IP address for each device and press <Enter>.
      iv. `radioSettings.rfDataRate=Rate_nnnn.nn` where nnnn.nn is the RF data rate in Kilobytes or Megabytes and press <Enter>.

      Note: See RF Data Rate (on page 307) for the correct command format of the RF Data Rate.

      v. `radiosettings.radioHoppingMode=Hopping_On` and press <Enter>.
      vi. `radioSettings.maxRepeater=1` and press <Enter>.
      vii. `radioSettings.beaconBurstCount=2` and press <Enter>.
   c. At the > prompt, type `save` and press <Enter>.
2. Disconnect the computer from the **Gateway** ZumLink device.
3. On the **Endpoint-Repeater** ZumLink device:
   a. Complete the Open a Terminal Emulator Application (on page 177) procedure.
   b. At the > prompt, type:
      i. `radioSettings.radioMode=Endpoint_Repeater` and press <Enter>.
      ii. `radioSettings.networkId=nnnnn` where nnnnn is the designated Network IDused when configuring the Gateway ZumLink device and press <Enter>.
      iii. `network.ip_address=nnn.nnn.nnn.nnn` where nnn.nnn.nnn.nnn is the **unique** IP address for each device and press <Enter>.
      iv. `radioSettings.rfDataRate=Rate_nnnn.nn` where nnnn.nn is the same data rate in Kilobytes or Megabytes used when configuring the Gateway ZumLink device and press <Enter>.

      Note: See RF Data Rate (on page 307) for the correct command format of the RF Data Rate.

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v. `radioSettings.nodeId=nnnnn` where nnnnn is the unique ID of the device and press <Enter>.

vi. Verify the `radioSettings.radioRepeaterSlot=1` and press <Enter>.

c. At the > prompt, type `save` and press <Enter>.

4. Disconnect the computer from the **Endpoint-Repeater** ZumLink device.
5. On the **Endpoint** ZumLink device:
   a. Complete the Open a Terminal Emulator Application (on page 177) procedure.
   b. At the > prompt, type:
      i. `radioSettings.radioMode=Endpoint` and press <Enter>.
      ii. `radioSettings.networkId=nnnnn` where nnnnn is the designated Network ID used when configuring the Gateway ZumLink device and press <Enter>.
      iii. `network.ip_address=nnn.nnn.nnn.nnn` where nnn.nnn.nnn.nnn is the **unique** IP address for each device and press <Enter>.
      iv. `radioSettings.rfDataRate=Rate_nnnn.nn` where nnnn.nn is the same data rate in Kilobytes or Megabytes used when configuring the Gateway ZumLink device and press <Enter>.

      Note: See RF Data Rate (on page 307) for the correct command format of the RF Data Rate.

      v. `radioSettings.nodeId=nnnnn` where nnnnn is the unique ID of the device and press <Enter>
   c. At the > prompt, type `save` and press <Enter>.

Note: The LEDs indicate a successful setup.
See LEDs (on page 467) for additional information.

See the Gateway-Repeater (on page 185) example.

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12.2.3. Hopping Off: Gateway and Endpoint-Repeater Setup

> **Important!**: This procedure has **HOPPING OFF** (`radiosettings.radioHoppingMode=Hopping_Off`).
>
> If Hopping is ON (`radiosettings.radioHoppingMode=Hopping_On`) go to Hopping On: Gateway and Endpoint-Repeater Setup (on page 180).

1. On the **Gateway** ZumLink device:
   a. Complete the Open a Terminal Emulator Application (on page 177) procedure.
   b. At the > prompt, type:
      i. `radioSettings.radioMode=Gateway` and press <Enter>.
      ii. `radioSettings.networkId=nnnnn`where nnnnn is the designated Network ID and press <Enter>.
      iii. `network.ip_address=nnn.nnn.nnn.nnn`where nnn.nnn.nnn.nnn is the **unique** IP address for each device and press <Enter>.
      iv. `radioSettings.rfDataRate=Rate_nnnn.nn`where nnnn.nn is the RF data rate in Kilobytes or Megabytes and press <Enter>.

      > **Note**: See RF Data Rate (on page 307) for the correct command format of the RF Data Rate.

      v. Verify `radiosettings.radioHoppingMode=Hopping_Off` and press <Enter>.
   c. At the > prompt, type `save` and press <Enter>.
2. Disconnect the computer from the **Gateway**ZumLink device.
3. On the **Endpoint-Repeater** ZumLink device:
   a. Repeat Steps 1 to 12.
   b. At the > prompt, type:
      i. `radioSettings.radioMode=Endpoint_Repeater` and press <Enter>.
      ii. `radioSettings.networkId=nnnnn`where nnnnn is the designated Network IDused when configuring the Gateway ZumLink device and press <Enter>.
      iii. `network.ip_address=nnn.nnn.nnn.nnn`where nnn.nnn.nnn.nnn is the **unique** IP address for each device and press <Enter>.
      iv. `radioSettings.rfDataRate=Rate_nnnn.nn`where nnnn.nn is the same data rate in Kilobytes or Megabytesused when configuring the Gateway ZumLink device and press <Enter>.

      > **Note**: See RF Data Rate (on page 307) for the correct command format of the RF Data Rate.

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v. `radioSettings.nodeId=nnnnn`where nnnnn is the unique ID of the device and press <Enter>.

vi. Verify `radiosettings.radioHoppingMode=Hopping_Off` and press <Enter>.

c. At the > prompt, type `save` and press <Enter>.

4. Disconnect the computer from the **Endpoint-Repeater** ZumLink device.
5. On the **Endpoint** ZumLink device:
   a. Complete the Open a Terminal Emulator Application (on page 177) procedure.
   b. At the > prompt, type:
      i. `radioSettings.radioMode=Endpoint` and press <Enter>.
      ii. `radioSettings.networkId=nnnnn`where nnnnn is the designated Network IDused when configuring the Gateway ZumLink device and press <Enter>.
      iii. `network.ip_address=nnn.nnn.nnn.nnn`where nnn.nnn.nnn.nnn is the **unique** IP address for each device and press <Enter>.
      iv. `radioSettings.rfDataRate=Rate_nnnn.nn`where nnnn.nn is the same data rate in Kilobytes or Megabytesused when configuring the Gateway ZumLink device and press <Enter>.

      Note: See RF Data Rate (on page 307) for the correct command format of the RF Data Rate.

      v. `radioSettings.nodeId=nnnnn`where nnnnn is the unique ID of the device and press <Enter>
   c. At the > prompt, type `save` and press <Enter>.

Note: The LEDs indicate a successful setup.
See LEDs (on page 467) for additional information.

See the Gateway-Repeater (on page 185) example.

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12.3. Repeater - Examples

Note: The yellow communication link arrows are used to denote which of the radio units can directly communicate.
Radio units that DO NOT have yellow communication links between them are considered to be in different communication spaces.

- Gateway-Repeater (on page 185)
- Endpoint-Repeater (on page 186)
- Multiple Repeaters: Gateway-Repeater and Endpoint-Repeater (on page 187)
- Multiple Repeaters: Four Endpoint-Repeaters (on page 188)
- Back-to-Back Repeaters (on page 190)

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12.3.1. Gateway-Repeater

Note: The yellow communication link arrows are used to denote which of the radio units can directly communicate.
Radio units that DO NOT have yellow communication links between them are considered to be in different communication spaces.

Figure 197 shows:

- Endpoints that cannot peer directly can communicate through a Gateway-Repeater, extending the length of a point-to-multipoint network.
- Repeater is operating in Gateway-Repeater mode.
- No performance loss for Gateway-Repeater to Endpoint 1-Endpoint 2-Endpoint 3 communication.
- The throughput for Endpoint 2 to Endpoint 3 communication via Gateway-Repeater is reduced by approximately 50 percent.

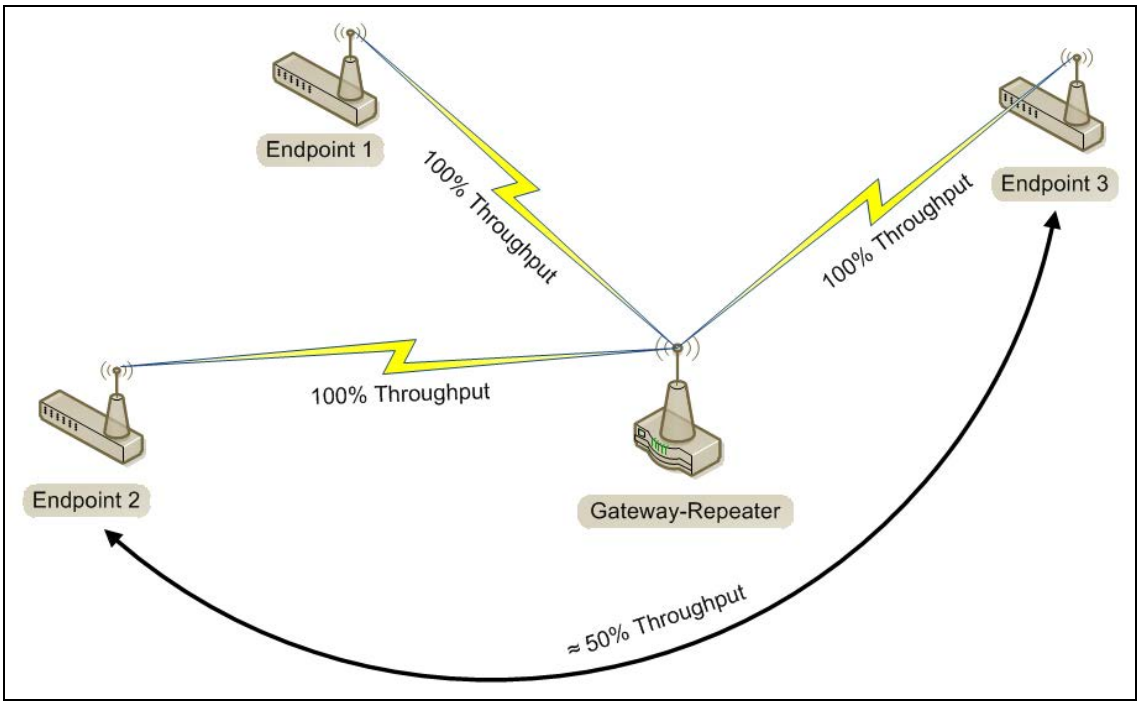

Figure 197: Gateway-Repeater

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12.3.2. Endpoint-Repeater

Note: The yellow communication link arrows are used to denote which of the radio units can directly communicate.
Radio units that DO NOT have yellow communication links between them are considered to be in different communication spaces.

Figure 198 shows:

- Endpoints that cannot peer directly can communicate through an Endpoint-Repeater, extending the length of a point-to-point network.
- Repeater is operating in Endpoint-Repeater mode.
- No performance loss for Gateway to Endpoint 3, Gateway to Endpoint-Repeater, or Endpoint-Repeater to Endpoint 1-Endpoint 2 communication.
- The throughput for Endpoint 1-Endpoint 2 to Gateway communication via Endpoint-Repeater is reduced by approximately 50 percent.

Note: An Endpoint-Repeater strongly favors its wired device over Endpoints it's repeating for.

Tip User devices can be physically attached to the Endpoint-Repeater.

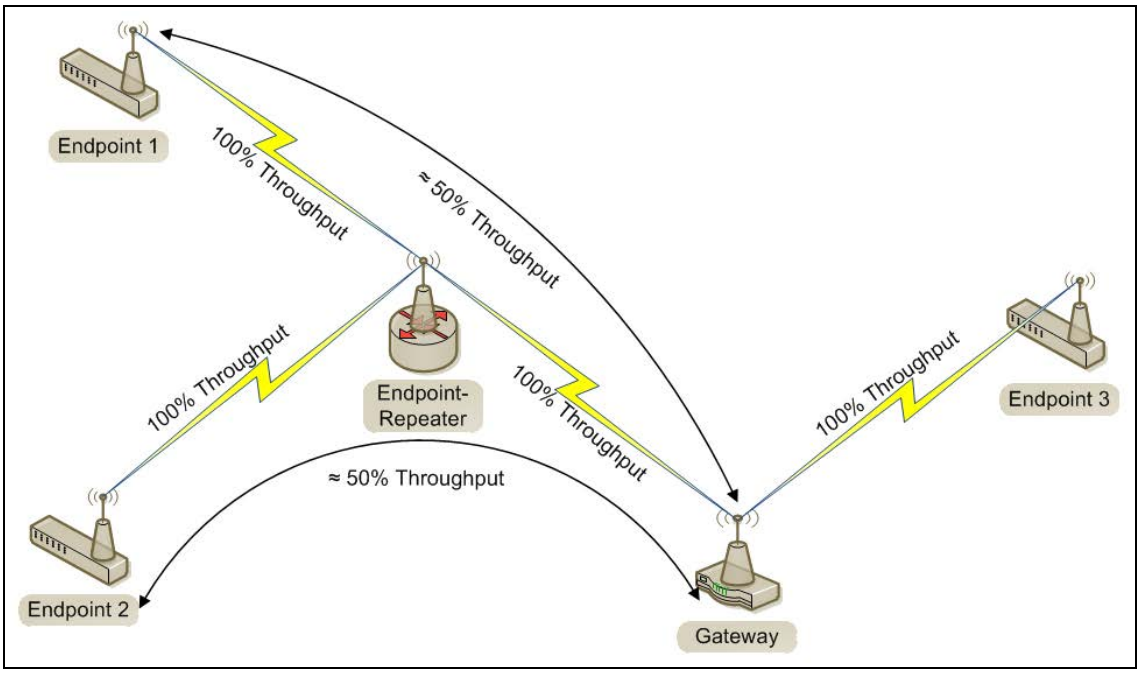

Figure 198: Endpoint-Repeater

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12.3.3. Multiple Repeaters: Gateway-Repeater and Endpoint-Repeater

Note: The yellow communication link arrows are used to denote which of the radio units can directly communicate.
Radio units that DO NOT have yellow communication links between them are considered to be in different communication spaces.

Figure 199 shows:

- Repeaters are operating in Gateway-Repeater and Endpoint-Repeater mode.
- No performance loss for Endpoint-Repeater to Gateway-Repeater, Endpoint 1 to Endpoint-Repeater, Endpoint 2 to Gateway-Repeater communication.
- The throughput for Endpoint 1 to Gateway communication via Endpoint-Repeater is reduced by approximately 50 percent.
- The throughput for Endpoint 2 to Endpoint-Repeater via the Gateway-Repeater is reduced by approximately 50 percent.
- Endpoint 1 to Endpoint 2 communicate via the Endpoint-Repeater and Gateway-Repeater, or 2 repeater hops.
- The throughput for Endpoint 1 to Endpoint 2 communication is approximately 25%.
- As Repeaters are chained in the network, round trip delay increases.
  - When issuing pings of large packet sizes at the lower data rates, such as 115.2K, and a Beacon Interval=`TWENTY_FIVE_MS`, the latency can increase causing the pings to fail.
  - **Workaround**: Allow an appropriate delay between pings.

FREEWAVE Recommends: Set the `beaconBurstCount=1` or more and `beaconInterval=ONE_HUNDRED_MS` or more for optimal throughput when extended Repeater networks are used.

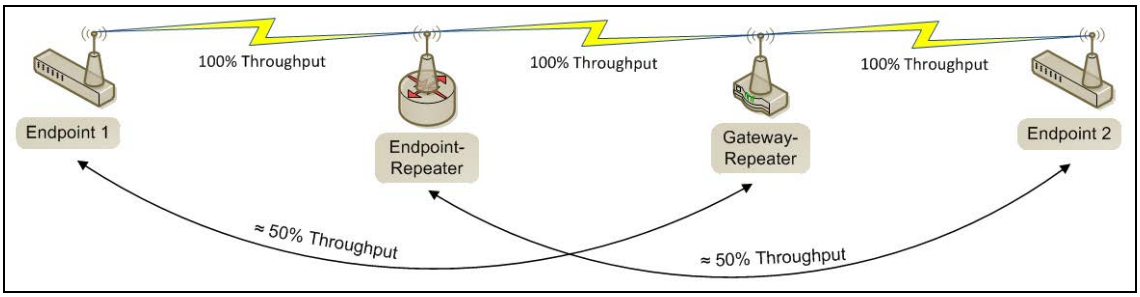

Figure 199: Repeater with Additional Endpoint to Enhance Connectivity

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12.3.4. Multiple Repeaters: Four Endpoint-Repeaters

Note: The yellow communication link arrows are used to denote which of the radio units can directly communicate.
Radio units that DO NOT have yellow communication links between them are considered to be in different communication spaces.

Figure 200 shows:

- Gateway has radio maximum of three Repeaters slots.
- Repeaters are operating in Endpoint-Repeater mode.
- Repeaters in the same network that have overlapping RF coverage must have unique radio Repeater slots.
  - Endpoint-Repeater 1 has a Repeater slot of 1.
  - Endpoint-Repeater 2 has a Repeater slot of 2.
  - Endpoint-Repeater 3 has a radio Repeater slot of 3.
  - Endpoint-Repeater 4 has a radio Repeater slot of 1.
- Endpoint-Repeater 1 and Endpoint-Repeater 4 do NOT overlap in RF coverage; therefore they can use the same repeater slot number.
- Endpoint 1 to Gateway communicate via the Endpoint-Repeater 1-2-3-4 or 4 Repeater hops.
- The throughput for Endpoint 1 to Gateway communication will be approximately 6.25%.

Important!: Supporting three Repeaters in the same overlapping RF coverage does NOT limit the total number of Repeaters that can be chained together. However, make careful considerations regarding the throughput impact of chained Repeaters.

Note: An Endpoint-Repeater strongly favors its wired device over Endpoints it's repeating for.

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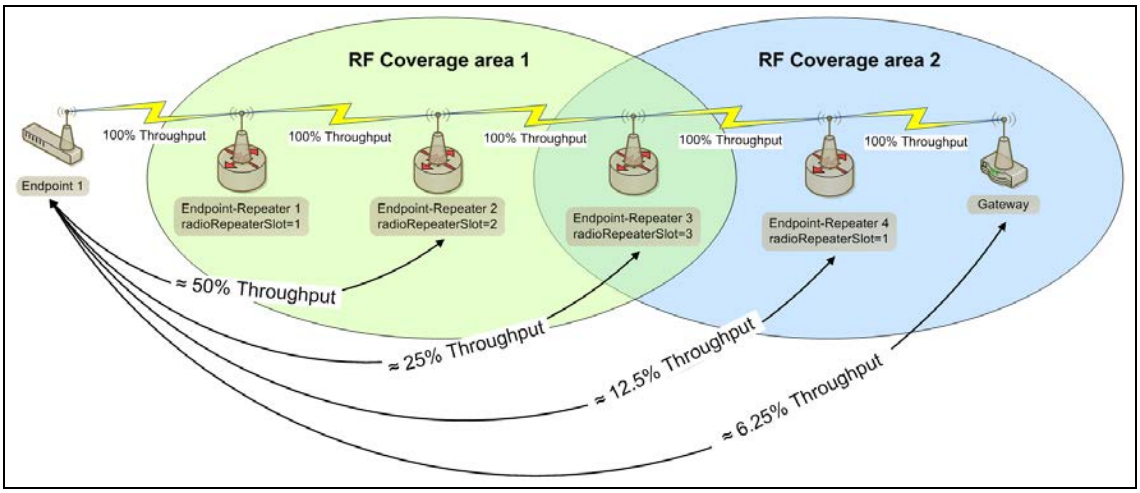

Figure 200: Multiple Repeaters: Four Endpoint-Repeaters

- As Repeaters are chained in the network, round trip delay increases.
  - When issuing pings of large packet sizes at the lower data rates, such as 115.2K, and a Beacon Interval=`TWENTY_FIVE_MS`, the latency can increase causing the pings to fail.
  - **Workaround**: Allow an appropriate delay between pings.

FREEWAVE Recommends: Set the `beaconBurstCount=1` or more and `beaconInterval=ONE_HUNDRED_MS` or more for optimal throughput when extended Repeater networks are used.

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12.3.5. Back-to-Back Repeaters

Note: The yellow communication link arrows are used to denote which of the radio units can directly communicate.
Radio units that DO NOT have yellow communication links between them are considered to be in different communication spaces.

If the network topology requires Repeaters to connect radios over greater distances, use back-to-back Repeaters where data is repeated over a wire instead of over the air. This preserves throughput.

Figure 201 shows:

- Each link in the back to back network should be set to a unique Network ID (on page 296).
- At least one of these parameters should be configured differently between each link in the back-to-back network.
  - Beacon Interval (on page 287)
  - Frequency Key (on page 288)
  - Radio Frequency (on page 298)
  - Radio Hopping Mode (on page 299)
  - RF Data Rate (on page 307)

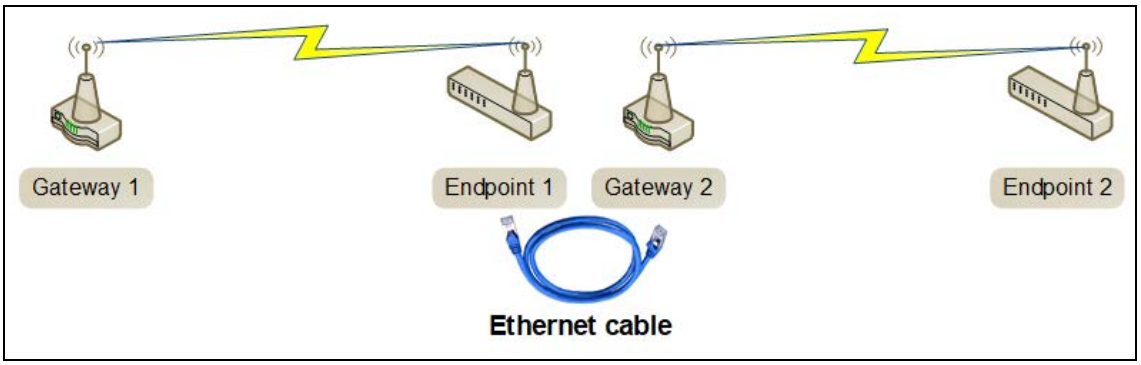

Figure 201: Back-to-Back Repeaters

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13. Mounting the Z9-P2 or Z9-PE2

Separate mounting kits are available for purchase from FreeWave.

- **Z9-P2**
  - FreeWave Part Number: AOH0001HT
- **Z9-PE2**
  - FreeWave Part Number: AOH4003SP

Mounting Procedures

- Z9-P2 Mounting (on page 192)
- Z9-PE2 Mounting (on page 194)

Note: See Remove the Z9-P2 or Z9-PE2 from the DIN Rail (on page 195) for additional information.

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13.1. Z9-P2 Mounting

Mounting Kit - Included Equipment

Z9-P2 Mounting Kit - Included Equipment	
Qty	**Description**
1	DIN Rail Spring Clip
3	Flat-head machine screws, Phillips, M4 x 0.7, 12mm Long
1	DIN Rail Bracket
4	Pan-head machine screws, Phillips, 4-40, 1/4" Long, Lock Patch
1	Mounting Instruction Sheet

User-supplied Equipment

- Medium Phillips-head screwdriver
- Medium Flat-head screwdriver

Procedure

1. Use the Pan-head machine screws to attach the DIN Rail Bracket to the Z9-P2.
2. Orient the DIN Rail Bracket / DIN Rail Spring Clip assembly so:
   a. The spring-loaded end of the DIN Rail Spring Clip is on the bottom lip of the rail.
   b. The **fixed (not spring-loaded)** end of the DIN Rail Spring Clip is on the top.

Caution: Per the manufacturer's instructions, the DIN Rail Spring Clip is oriented with the **spring-loaded end on the bottom lip of the rail**.

   a. Use the Flat-head machine screws to attach the DIN Rail Spring Clip to the DIN Rail Bracket.
   b. Mount the Z9-P2 to the 35mm DIN rail using the rail slide on the enclosure as shown in Figure 202.

Note: The images in this procedure are for the Z9-P.
The equipment and procedure are the same for the Z9-P2.

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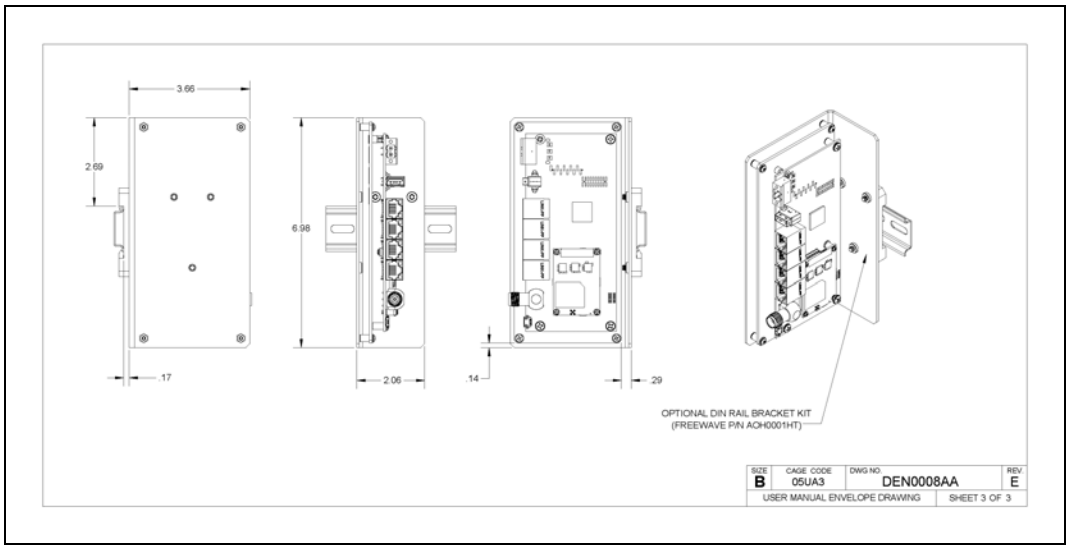

Figure 202: Z9-P2 Attached to a DIN Rail with the Power Connection on Top

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13.2. Z9-PE2 Mounting

Mounting Kit - Included Equipment

Z9-PE2 Mounting Kit - Included Equipment	
Qty	**Description**
1	DIN Rail Spring Clip
3	Flat-head machine screws, Phillips, M4 x 0.7, 12mm Long
1	DIN Rail Bracket
3	Pan-head machine screws, Phillips, 6-32 Unc, 1/4" Long
1	Mounting Instruction Sheet

User-supplied Equipment

- Medium Phillips-head screwdriver
- Medium Flat-head screwdriver

Procedure

Note: The Z9-P2 or Z9-PE2 can be installed using the four corner screws on the bottom of the radio. On the bottom of the Z9-P2 or Z9-PE2, there is a set screw installed in the left-rear mounting hole. This set screw must be removed if the Z9-P2 or Z9-PE2 is mounted using the four corner screws.

1. Use the Pan-head machine screws to attach the DIN Rail Bracket to the Z9-PE2.
2. Orient the DIN Rail Bracket / DIN Rail Spring Clip assembly so:
   a. The spring-loaded end of the DIN Rail Spring Clip is on the bottom lip of the rail.
   b. The **fixed (not spring-loaded)** end of the DIN Rail Spring Clip is on the top.

Caution: Per the manufacturer's instructions, the DIN Rail Spring Clip is oriented with the **spring-loaded end on the bottom lip of the rail**.

   a. Use the Flat-head machine screws to attach the DIN Rail Spring Clip to the DIN Rail Bracket.
   b. Mount the Z9-PE2 to the 35mm DIN rail using the rail slide on the enclosure as shown in Figure 203.

Note: The images in this procedure are for the Z9-PE.
The equipment and procedure are the same for the Z9-PE2.

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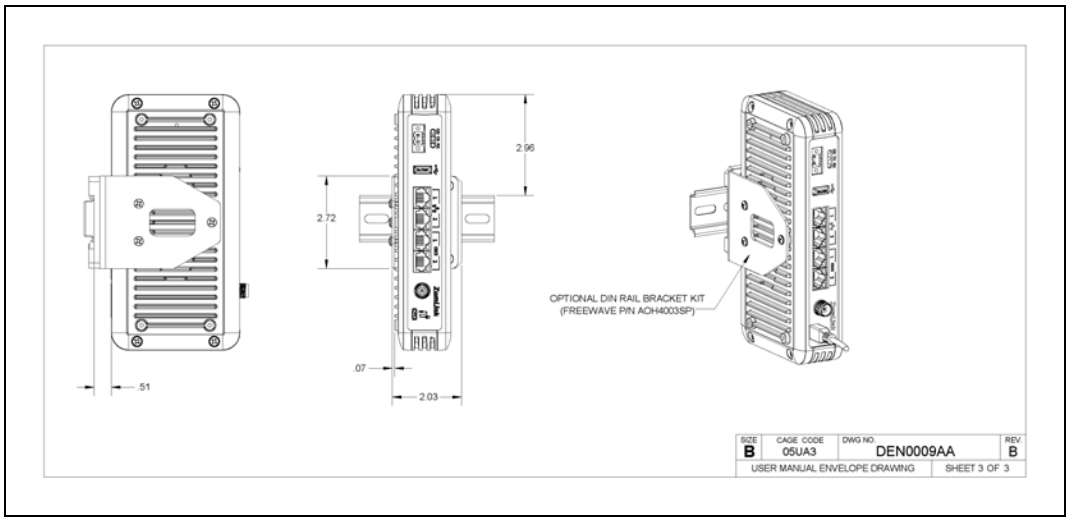

Figure 203: Z9-PE2 Attached to a DIN Rail with the Power Connection on Top

13.3. Remove the Z9-P2 or Z9-PE2 from the DIN Rail

1. Push upwards on the DIN Rail Spring Clip (compressing the springs in the bottom).
2. Pivot the top of the DIN Rail Bracket / DIN Rail Spring Clip assembly off of the rail.
3. Move the whole DIN Rail Spring Clip down to release the bottom of the clip.

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14. Approved Antennas

14.0.1. Yagi Directional Antennas

The 900 MHz is approved by the FCC for use with directional antennas with a dBi gain or less.

900 MHz Yagi Directional Antennas				
Gain (dBd)	**Gain (dBi)**	**Manufacturer**	**Manufacturer Model Number**	**FreeWave Part Number**
6.45	8.6	WaveLink	PRO890-8-40F02N4	EAN0906YC

14.0.2. Omni-directional Antennas

The 900 MHz is approved by the FCC for use with omni-directional antennas with a 10.5dBi gain or less.

Note: These antennas, including antenna gains, are approved for use with the **ZumLink** device.

900 MHz Omni-Directional Antennas				
Gain (dBd)	**Gain (dBi)**	**Manufacturer**	**Manufacturer Model Number**	**FreeWave Part Number**
3.85	5.0	Antenex	EB8965C	EAN0905WC
3.0	5.15	Maxrad	MAX-9053	EAN0900WC
0.85	3.0	Mobile Mark	PSKN3-925S	EAN0900SR
-2.15	0.0	Mobile Mark	PSTG0-915SE	EAN0900SQ

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14.0.3. Alternative Antennas

Antennas other than those listed in this section can potentially be used with the **ZumLink** with provisions.

- The antennas must be of a similar type.
- The antenna gain CANNOT exceed 10.5dBi for Omni-directional.
- The antenna gain CANNOT exceed 16.0dBi for Directional antennas.
- The overall system EIRP does not exceed 36dBm.

Warning! A proper combination with the **ZumLink** is required to ensure the system meets FCC requirements.

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15. COM Parameters

Note: See the COM window (on page 364) for parameter location.
The parameters for **COM1** and **COM2** are the same except for the Terminal Server Port (on page 209) parameter setting.

Baudrate (on page 199)
Break Before Send Us (on page 199)
Connection Drops (on page 200)
Databits (on page 201)
Delay Before Send MS (on page 202)
Duplex (on page 202)
Flow Control (on page 203)
Handler (on page 204)
Mode (on page 206)
Parity (on page 207)
RX Bytes (on page 208)
Stopbits (on page 209)
Terminal Server Port (on page 209)
Terminal Server Time Out (on page 210)
TX Bytes (on page 211)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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15.1. Baudrate

Baudrate	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	• `Com1.baudrate=nnnn` • `Com2.baudrate=nnnn` **Note**: Where `nnnn` is the baud rate value.
Web Interface window	Baudrate 1. Click the **Baudrate** list box arrow and select a COM port baud rate. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	115200
Options	**Rate Options** 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 230400, 250000
Description	The **Com1.baudrate** or **Com2.baudrate** parameter designates the COM port baud rate for COM1 or COM2.

15.2. Break Before Send Us

Break Before Send Us	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	• `Com1.breakBeforeSendUs=nnnn` • `Com2.breakBeforeSendUs=nnnn` **Note**: Where `nnnn` is the break signal value.

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Break Before Send Us	
Setting	**Description**
Web Interface window	Break Before Send Us 1. In the **Break Before Send Us** text box, enter the number of milliseconds the COM port will send a break signal. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	0 (zero)
Options	• The maximum value is0 (zero). • The minimum value is 1000.
Description	The **Com1.breakBeforeSendUs** or **Com2.breakBeforeSendUs** parameter designates how long the COM port will send a break signal for at least the number of microseconds specified before sending the data. **Example**: For COM1, enter `Com1.breakBeforeSendUs=500` to have the COM1 port send a break signal for 500 microseconds.

15.3. Connection Drops

Connection Drops	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	• `Com1.connectionDrops` • `Com2.connectionDrops`
Web Interface window	Connection Drops **Note**: This parameter is read-only in the Web Interface. See the COM window (on page 364) for parameter location.
Default Setting	N/A
Options	N/A

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Connection Drops	
Setting	**Description**
Description	The **Com1.connectionDrops** or **Com2.connectionDrops** command reports the number of terminal server connections dropped due to inactivity on the network socket. • The number of drops only increments if a connection is left open and no data is sent. • Connections that are closed by either side before the time out are not considered a dropped connection. **Note**: This is a Read-only parameter.

15.4. Databits

Databits	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]

CLI Command	• `Com1.databits=7`
	  • `Com2.databits=7`
	• `Com1.databits=8`
	  • `Com2.databits=8`

Web Interface window	Databits 1. Click the **Databits** list box arrow and select the number of data bits in the frame for COM1 or COM2. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	8
Options	• 7 • 8
Description	The **Com1.databits** or **Com2.databits** parameter designates the number of data bits in the frame for COM1 or COM2.

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15.5. Delay Before Send MS

Delay Before Send MS	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	• `Com1.delayBeforeSendMs=nnnn` • `Com2.delayBeforeSendMs=nnnn` **Note**: Where `nnnn` is the amount of time delay in milliseconds.
Web Interface window	Delay Before Send MS 1. In the **Delay Before Send MS** text box, enter the milliseconds of time delay. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	0 (zero)
Options	• The maximum value is0 (zero). • The minimum value is 5000.
Description	The **Com1.delayBeforeSendMs** or **Com2.delayBeforeSendMs** parameter designates the amount of time delay in milliseconds the Z9-P2 or Z9-PE2 waits to allow the device connected to the COM port to switch from transmit (Tx) to receive (Rx) mode. **Example**: For COM1, enter **`Com1.delayBeforeSendMs=100`** for a 100 millisecond delay. Increase this delay if the **ZumLink** is responding **before** a polling system is ready for a response.

15.6. Duplex

Duplex	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]

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Duplex	
Setting	**Description**
CLI Command	• `Com1.duplex=Half` • `Com2.duplex=Half` • `Com1.duplex=Full` • `Com2.duplex=Full`
Web Interface window	Duplex 1. Click the **Duplex** list box arrow and select the duplex designation. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	Full
Options	Half or Full
Description	**Important!**: This parameter applies **ONLY** to the RS485 mode. The **Com1.duplex** or **Com2.duplex** parameter designates whether the COM port is Full or Half-duplex. **Note**: See Ports and Pinouts for input and output information.

15.7. Flow Control

Flow Control	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	**For Com2**, the command is: • **Off**: `Com2.flowControl=Off` • **On**: `Com2.flowControl=Hardware`
Web Interface window	Flow Control 1. If applicable for COM2, click the **Flow Control** list box arrow and select **Hardware** to activate **flowControl**. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	Off

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Flow Control	
Setting	**Description**
Options	• Off • Hardware
Description	The **Com2.flowControl** parameter designates the hardware flow control as either `On (Hardware)` or `Off`.

15.8. Handler

Handler	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]

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Handler	
Setting	**Description**
CLI Command	**CLI** When **CLI** is designated, a configuration CLI is on the COM port. The command is: • `Com1.handler=cli` • `Com2.handler=cli` **ModbusPassthru** When **ModbusPassthru** is designated, modbus requests are sent out to modbus sensors that are received via Modbus TCP or Modbus RTU. The command is: • `Com1.handler=ModbusPassthru` • `Com2.handler=ModbusPassthru` **ModbusRTU** When **ModbusRTU** is designated, receive Modbus RTU requests from a serial modbus RTU device. The command is: • `Com1.handler=ModbusRTU` • `Com2.handler=ModbusRTU` **Off** When **Off** is designated, this allows for application use with no setup. A port is never opened. The command is: • `Com1.handler=Off` • `Com2.handler=Off` **Setup** When **Setup** is designated, the COM port then frees up the port for application use. The command is: • `Com1.handler=Setup` • `Com2.handler=Setup` **Terminal Server** When **Terminal Server** is designated, the COM port acts as a terminal server. • The TCP port number is set by the COM1 Terminal Server Port (on page 209). • The default port number for COM1 is 5041. The command is: • `Com1.handler=TerminalServer`

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Handler	
Setting	**Description**
	• `Com2.handler=TerminalServer` **Trace** When **Trace** is designated, a configuration CLI with trace is on the COM port. • `Com1.handler=trace` • `Com2.handler=trace`
Web Interface window	Handler 1. Click the **Handler** list box arrow and select the designated protocol handler. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	TerminalServer
Options	• CLI (on page 205) • ModbusPassthru (on page 205) • ModbusRTU (on page 205) • Off (on page 205) • Setup (on page 205) • Terminal Server (on page 205) • Trace (on page 206)
Description	The **Com1.handler** or **Com2.handler** parameter designates the protocol of the COM port. **Notes** • The default port number for COM1 is 5041. • The default port number for COM2 is 5042. **FREEWAVE Recommends**: If using the Terminal Server Port parameter, keep the TCP port numbers as their defaults.

15.9. Mode

Mode	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]

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Mode	
Setting	**Description**

CLI Command	• `Com1.mode=RS232`
	  • `Com2.mode=RS232`
	• `Com1.mode=RS485`
	  • `Com2.mode=RS485`

Web Interface window	Mode 1. Click the **Mode** list box arrow and select the COM port mode. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	RS232
Options	• RS232 • RS485
Description	The **Com1.mode** or **Com2.mode** parameter designates the COM port mode as either RS232 or RS485. **Note**: When `Com1.mode=RS485` or `Com2.mode=RS485` AND `Com1.duplex=Full` or `Com2.duplex=Full`, the COM supports RS422.

15.10. Parity

Parity	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]

CLI Command	• `Com1.parity=None`
	  • `Com2.parity=None`
	• `Com1.parity=Even`
	  • `Com2.parity=Even`
	• `Com1.parity=Odd`
	  • `Com2.parity=Odd`

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Parity	
Setting	**Description**
Web Interface window	Parity 1. Click the **Parity** list box arrow and select the COM port parity bits for the system. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	None
Options	• None • Even • Odd
Description	The **Com1.parity** or **Com2.parity** parameter designates the COM port parity bits for the system.

15.11. RX Bytes

RX Bytes	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	• `Com1.RxBytes` • `Com2.RxBytes`
Web Interface window	RX Bytes **Note**: This parameter is read-only in the Web Interface. See the COM window (on page 364) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **Com1.RxBytes** or **Com2.RxBytes** command reports the total bytes received from the COM port. **Note**: This is a Read-only parameter.

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15.12. Stopbits

Stopbits	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]

CLI Command	• `Com1.stopbits=1`
	  • `Com2.stopbits=1`
	• `Com1.stopbits=2`
	  • `Com2.stopbits=2`

Web Interface window	Stopbits 1. Click the **Stopbits** list box arrow and select the COM port number of stop bits. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	1
Options	• 1 • 2
Description	The **Com1.stopbits** or **Com2.stopbits** parameter designates the COM port number of stop bits.

15.13. Terminal Server Port

Note: See Terminal Server Relay Examples (on page 352) for additional information.

Terminal Server Port	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	• `Com1.TerminalServerPort=nnnn` • `Com2.TerminalServerPort=nnnn` **Note**: Where `nnnn` is the TCP port number.

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Terminal Server Port	
Setting	**Description**
Web Interface window	Terminal Server Port 1. In the **Terminal Server Port** text box, enter the designated TCP port number. 2. Click the **Update** button to save the change. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	• The default port number for COM1 is 5041. • The default port number for COM2 is 5042.
Options	• The minimum value is 0 (zero). • The maximum value is 65535.
Description	The **Com1.TerminalServerPort** or **Com2.TerminalServerPort** parameter designates the TCP port number to use when Handler (on page 204) is set to **TerminalServer**. **FREEWAVE Recommends**: If using the Terminal Server Port parameter, keep the TCP port numbers as their defaults.

15.14. Terminal Server Time Out

Note: See Terminal Server Relay Examples (on page 352) for additional information.

Terminal Server Time Out	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	• `Com1.TerminalServerTimeOut=nnnn` • `Com2.TerminalServerTimeOut=nnnn` **Note**: Where `nnnn` is the amount of time, in seconds, the Terminal Server remains open.

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Terminal Server Time Out	
Setting	**Description**
Web Interface window	Terminal Server Time Out 1. In the **Terminal Server Time Out** text box, enter the number of seconds the Terminal Server remains open without transmitting or receiving data from the network. 2. Click the **Update** button to save the change. 3. Reboot the Z9-P2 or Z9-PE2 for changes to take effect. **Note**: See the COM window (on page 364) for parameter location.
Default Setting	300
Options	• The minimum value is 5. • The maximum value is 3600.
Description	The **Com1.TerminalServerTimeOut** or **Com2.TerminalServerTimeOut** parameter designates the amount of time, in seconds, the Terminal Server remains open without transmitting or receiving data from the network. **Note**: This can prevent an idle socket from remaining open indefinitely and preventing new connections.

15.15. TX Bytes

TX Bytes	
Setting	**Description**
CLI / Web Page	• [Page=Com1] • [Page=Com2]
CLI Command	• `Com1.TxBytes` • `Com2.TxBytes`
Web Interface window	TX Bytes **Note**: This parameter is read-only in the Web Interface. See the COM window (on page 364) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **Com1.TxBytes** or **Com2.TxBytes** command reports the total bytes sent out of the COM port. **Note**: This is a Read-only parameter.

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16. Config Parameters

Note: See the Config window (on page 366).

Factory Defaults (on page 213)
License State (on page 213)
Reset (on page 214)
Restore (on page 214)
Save (on page 215)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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16.1. Factory Defaults

Factory Defaults	
Setting	**Description**
CLI / Web Page	[Page=config]
CLI Command	• `config.factoryDefaults=set` • `factoryDefaults=set`
Web Interface window	Factory Defaults **Note**: See the Config window (on page 366) for parameter location. **Important!**: This parameter is read-only in the Web Interface. The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	Idle
Description	The **config.factoryDefaults** command restores the Z9-P2 or Z9-PE2 to its factory default configuration.

16.2. License State

License State	
Setting	**Description**
CLI / Web Page	[Page=config]
CLI Command	• `config.licenseState` • `licenseState`
Web Interface window	License State **Note**: See the Config window (on page 366) for parameter location. **Important!**: This parameter is read-only in the Web Interface. The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A

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License State	
Setting	**Description**
Description	The **config.licenseState** command reports the extra feature licenses in the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

16.3. Reset

Reset	
Setting	**Description**
CLI / Web Page	[Page=config]

CLI Command	• **Reboot** the entire Z9-P2 or Z9-PE2 device:
	  • `config.reset=now`
	  • `config.reset=reboot`
	• **Reset** to restart the main application:
	  • `config.reset=reset`

Web Interface window	Reset **Note**: See the Config window (on page 366) for parameter location. **Important!**: This parameter is read-only in the Web Interface. The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A
Description	The **config.reset** command restarts or reboots the Z9-P2 or Z9-PE2.

16.4. Restore

Restore	
Setting	**Description**
CLI / Web Page	[Page=config]
CLI Command	• `config.restore=now` • `config.restore` • `restore`

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Restore	
Setting	**Description**
Web Interface window	Restore **Note**: See the Config window (on page 366) for parameter location. **Important!**: This parameter is read-only in the Web Interface. The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A
Description	The **config.restore** command reloads a previously saved setting configuration of the Z9-P2 or Z9-PE2. **Note**: Restore happens automatically when the Z9-P2 or Z9-PE2 starts.

16.5. Save

Save	
Setting	**Description**
CLI / Web Page	[Page=config]
CLI Command	• `config.save=now` • `config.save` • `save`
Web Interface window	Save **Note**: See the Config window (on page 366) for parameter location. **Important!**: This parameter is read-only in the Web Interface. The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A
Description	The **config.save** command saves changes made to the Z9-P2 or Z9-PE2 configuration.

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17. Data Path Parameters

Note: See the Data Path window (on page 368).

Aggregate Enabled (on page 217)
Compression Enabled (on page 218)
FEC Rate (on page 220)
MAC Table Entry Age Timeout (on page 221)
OTA Max Fragment Size (on page 223)
Route Min Signal Margin Thresh (on page 223)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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17.1. Aggregate Enabled

Aggregate Enabled	
Setting	**Description**
CLI / Web Page	[Page=dataPath]

CLI Command	• **Enable**:
	  • `dataPath.aggregateEnabled=true`
	  • `aggregateEnabled=true`
	• **Disable**:
	  • `dataPath.aggregateEnabled=false`
	  • `aggregateEnabled=false`

Web Interface window	Aggregate Enabled 1. Click the **Aggregate Enabled** list box arrow and select **True** to enable this parameter and increase throughput of small packets. 2. Click the **Update** button to save the change. **Note**: By default, the **Aggregate Enabled** is NOT enabled (set to False). See the Data Path window (on page 368) for parameter location.
Default Setting	False
Options	• True • False

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Aggregate Enabled	
Setting	**Description**

Description	The Aggregate Enabled (on page 217) setting increases throughput of small packets by combining multiple packets into a single packet minimizing the number of packets required for transmission.
	
	Important!: All radios have the ability to de-aggregate received packets, regardless of the aggregation setting.
	
	FREEWAVE Recommends: Enable this setting on individual radios that send a high percentage of network data packets that are smaller than 900 bytes.
	
	Notes
	• Increases latency by 20msec and reduces poll rates.
	  • When enabled, this setting adds 20 msec of latency.
	  • However, net throughput may increase due to sending fewer, larger packets.
	• If another packet is not received within 20 msec, the aggregated packet is transmitted.
	• This setting does NOT need to match on all radios.
	• Does NOT affect medium and large packets.
	• Packets below 900 bytes are aggregated up to an aggregated packet size of 970 bytes.

17.2. Compression Enabled

Compression Enabled	
Setting	**Description**
CLI / Web Page	[Page=dataPath]

CLI Command	• **Enable**:
	  • `dataPath.compressionEnabled=true`
	  • `compressionEnabled=true`
	• **Disable**:
	  • `dataPath.compressionEnabled=false`
	  • `compressionEnabled=false`

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Compression Enabled	
Setting	**Description**
Web Interface window	Compression Enabled 1. Click the **Compression Enabled** list box arrow and select **False** to disable compression of outgoing packets. 2. Click the **Update** button to save the change. **Note**: By default, the **Compression Enabled** is enabled (set to True). See the Data Path window (on page 368) for parameter location.
Default Setting	True
Options	• True • False
Description	When the Compression Enabled (on page 218) setting is enabled, the outgoing packets are analyzed and, if the data packet can be compressed, sent compressed to transmit fewer bits over the air. **Important!**: The compression ratio varies depending on the type of data being transmitted. **Example**: Text data is easily compressible, while video data is not. **FREEWAVE Recommends**: Enable Packet Compression on all ZumLink networks. **Notes** • When enabled, the **Packet Compression** setting increases latency by a maximum of 10msec. • When enabled, the **Packet Compression** setting ensures that the packet transmitted is no larger than the current packet size. • Net throughput may increase due to sending more data in each packet. • All radios have the ability to de-compress received packets regardless of their compression setting. • This setting does NOT need to match on all radios.

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17.3. FEC Rate

FEC Rate	
Setting	**Description**
CLI / Web Page	[Page=dataPath]

CLI Command	• **Enable**:
	  • `dataPath.fecRate=RATE_7_8`
	  • `fecRate=RATE_7_8`
	• **Disable**:
	  • `dataPath.fecRate=RATE_1_1`
	  • `fecRate=RATE_1_1`

Web Interface window	FEC Rate 1. Click the **FEC Rate** list box arrow and select the Forward Error Correction (FEC) rate. 2. Click the **Update** button to save the change. **Note**: See the Data Path window (on page 368) for parameter location.
Default Setting	RATE_1_1
Options	• RATE_1_1 • RATE_7_8

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FEC Rate	
Setting	**Description**
Description	The **dataPath.fecRate** parameter enables the Forward Error Correction (FEC) rate. **Note**: The FEC Rate (on page 220) increases the reliability of the data transferred over the air at the cost of some transmission throughput. **Notes** • The FEC setting MUST match on ALL radios in the network, to maintain over-the-air compatibility. • When enabled, this setting indicates that for every 7 bytes in, the radio sends 8 bytes out, with the 8th byte used for parity / error correction. • Reduces throughput by 13%. • Improves sensitivity by 3dB to maximize link range in noisy environments. • Adds redundant information to a data stream to detect packet errors and corrects them to avoid retransmission of the packet. • Adds resilience in noisy environments. • FEC reduces the maximum achievable throughput. • However, in noisy environments, net throughput may increase due to reduced errors and retries. **Caution**: When enabling FEC, start with the farthest Endpoints, then any Repeaters, then lastly the Gateway. As FEC is enabled on each radio, that radio is temporarily dropped off the network, until any downstream Repeaters and the Gateway also have FEC enabled, at which time all communication will resume. **FREEWAVE Recommends**: When viewing local diagnostics, if the Radio Bad CRC (on page 241) count is more than 15-20% of the total transmitted packets (the Radio LL Tx (on page 244) count), enabling the FEC Rate (on page 220) setting is beneficial.

17.4. MAC Table Entry Age Timeout

MAC Table Entry Age Timeout	
Setting	**Description**
CLI / Web Page	[Page=dataPath]

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MAC Table Entry Age Timeout	
Setting	**Description**
CLI Command	• `dataPath.MacTableEntryAgeTimeout=nnnn` • `MacTableEntryAgeTimeout=nnnn` **Note**: Where `nnnn` is the number of seconds.
Web Interface window	MAC Table Entry Age Timeout 1. In the **MAC Table Entry Age Timeout** text box, enter the number of seconds before an inactive entry in the MAC Table ages out and expires. 2. Click the **Update** button to save the change. **Note**: See the Data Path window (on page 368) for parameter location.
Default Setting	120
Options	• The minimum value is 30. • The maximum value is 86400.
Description	The **dataPath.MacTableEntryAgeTimeout** parameter designates the number of seconds before an inactive entry in the MAC Table ages out and expires. **FREEWAVE Recommends**: Set this timeout longer than the polling rate on the network. Entries do not use the new timeout value until they are updated when a packet transfers. **Note**: See Mac Table Show (on page 239) to view the MAC to **nodeId** mapping table. **Notes** • The radio network learns the MAC address of devices connected to particular radio Endpoints and stores them in a MAC table. • As traffic passes between the Endpoints, the entries in the MAC table are updated. • If packets have NOT been sent or received to a MAC address within the designated **dataPath.MacTableEntryAgeTimeout** period, the entry in the table is marked as expired. • Expired entries must be re-learned and generate some extra traffic on the network until the radio Endpoint associated with the MAC address is learned. • The timeout **does** impact the time it takes to learn the new path. • This value can be optimized with parallel Repeaters to allow for fail over. • Setting this value too small so normal traffic does not keep the MAC table entry from expiring may generate excess network traffic.

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17.5. OTA Max Fragment Size

OTA Max Fragment Size	
Setting	**Description**
CLI / Web Page	[Page=dataPath]
CLI Command	• `dataPath.otaMaxFragmentSize=nnnn` • `otaMaxFragmentSize=nnnn` **Note**: Where `nnnn` is the maximum fragment size.
Web Interface window	OTA Max Fragment Size 1. In the **OTA Max Fragment Size** text box, enter the maximum fragment size, in bytes, sent over the air. 2. Click the **Update** button to save the change. **Note**: See the Data Path window (on page 368) for parameter location.
Default Setting	1000
Options	• The minimum value is 64. • The maximum value is 1000.

Description	The **dataPath.otaMaxFragmentSize** setting designates the maximum fragment size, in bytes, sent over the air.
	Notes
	• This setting does NOT need to match on all radios.
	• A **smaller Max Fragment Size** may increase RF link reliability in highly noisy environments.
	  • A **smaller Max Fragment Size** may reduce data throughput.
	• A **larger Max Fragment Size** may increase data throughput.
	  • A **larger Max Fragment Size** may reduce RF link reliability in noisy environments.

17.6. Route Min Signal Margin Thresh

Route Min Signal Margin Thresh	
Setting	**Description**
CLI / Web Page	[Page=dataPath]
CLI Command	• `dataPath.routeMinSignalMarginThresh=nnnn` • `routeMinSignalMarginThresh=nnnn` **Note**: Where `nnnn` is the minimum signal margin in dB.

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Route Min Signal Margin Thresh	
Setting	**Description**
Web Interface window	Route Min Signal Margin Thresh 1. In the **Route Min Signal Margin Thresh** text box, enter the minimum threshold signal margin in dB. 2. Click the **Update** button to save the change. **Note**: See the Data Path window (on page 368) for parameter location.
Default Setting	• 10
Options	• The minimum value is -5. • The maximum value is 60.
Description	The **dataPath.routeMinSignalMarginThresh** parameter designates the minimum (threshold) signal margin, in dB, the next hop **must be** considered part of the packet route. **FREEWAVE Recommends**: This value should be at least 4 dB lower than the reported link margin to the next hop. **Example**: If the best-reported link margin for the next hop is 20 dB, this number should be set to 16 or less. This prevents the traffic from choosing an alternative route with lower margin. **Notes** • When Repeaters are enabled, the packets take the path through the radio network with the minimum number of hops. • By increasing the threshold value, the possible routes can be reduced to allow a particular routing path to be preferred.

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18. Date Parameters

Note: See the Date window (on page 370).

DC App StartTime (on page 226)
DC App Uptime (on page 226)
Time (on page 227)
Time String (on page 227)
Up Time (on page 228)
Up Time String (on page 229)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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18.1. DC App StartTime

Important!: Time zones **do not** apply to the Z9-P2 or Z9-PE2.

DC App StartTime	
Setting	**Description**
CLI / Web Page	[Page=date]
CLI Command	• `date.dcAppStartTime` • `dcAppStartTime`
Web Interface window	DC App Start Time **Note**: This parameter is read-only in the Web Interface. See the Date window (on page 370) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **date.dcAppStartTime** parameter reports the time stamp of when the main app started. **Note**: This is a Read-only parameter.

18.2. DC App Uptime

Important!: Time zones **do not** apply to the Z9-P2 or Z9-PE2.

DC App Uptime	
Setting	**Description**
CLI / Web Page	[Page=date]
CLI Command	• `date.dcAppUptime` • `dcAppUptime`
Web Interface window	DC App Uptime **Note**: This parameter is read-only in the Web Interface. See the Date window (on page 370) for parameter location.
Default Setting	N/A
Options	N/A

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DC App Uptime	
Setting	**Description**
Description	The **date.dcAppUptime** parameter reports the number of Days, Hours, Minutes, and Seconds since the main app started. **Note**: This is a Read-only parameter.

18.3. Time

Important!: Time zones **do not** apply to the Z9-P2 or Z9-PE2.

Time	
Setting	**Description**
CLI / Web Page	[Page=date]
CLI Command	• `date.time` • `time`
Web Interface window	Time **Note**: This parameter is read-only in the Web Interface. See the Date window (on page 370) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **date.time** parameter reports the current time in Unix time stamp format. **Note**: This is a Read-only parameter.

18.4. Time String

Important!: Time zones **do not** apply to the Z9-P2 or Z9-PE2.

Time String	
Setting	**Description**
CLI / Web Page	[Page=date]
CLI Command	`date.timeString=MM/DD/YYYY HH.MM.SS`

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Time String	
Setting	**Description**
Web Interface window	Time String **Note**: This parameter is read-only in the Web Interface. See the Date window (on page 370) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **date.timeString** parameter designates the time ONLY if the NTP Reference (on page 283) is set to **REFCLK_LOCALCLOCK**. **Important!**: If the Z9-P2 or Z9-PE2 loses power, the time must be manually reset.

18.5. Up Time

Important!: Time zones **do not** apply to the Z9-P2 or Z9-PE2.

Up Time	
Setting	**Description**
CLI / Web Page	[Page=date]
CLI Command	• `date.upTime` • `upTime`
Web Interface window	Up Time **Note**: This parameter is read-only in the Web Interface. See the Date window (on page 370) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **date.upTime** parameter reports the number of seconds since the Z9-P2 or Z9-PE2 restarted. **Note**: This is a Read-only parameter.

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18.6. Up Time String

Important!: Time zones **do not** apply to the Z9-P2 or Z9-PE2.

Up Time String	
Setting	**Description**
CLI / Web Page	[Page=date]
CLI Command	• `date.upTimeString` • `upTimeString` **Example**: A return of **Uptime 5 Days 01:36:41** means the unit has been up for 5 days, 1 hour, 36 minutes, and 41 seconds.
Web Interface window	Up Time String **Note**: This parameter is read-only in the Web Interface. See the Date window (on page 370) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **date.upTimeString** parameter reports the amount of time in Days, Hours, Minutes, and Seconds the Z9-P2 or Z9-PE2 has been powered on without a reboot. **Note**: This is a Read-only parameter.

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19. Encryption Parameters

Note: See the Encryption window (on page 372).

Active Key (on page 231)
Encryption Mode (on page 232)
Key1 to Key 16 (on page 233)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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19.1. Active Key

Caution: Encryption settings **MUST match** on ALL radios in the network to maintain over-the-air compatibility.
When enabling Encryption, start with the farthest Endpoints, then any Repeaters, then lastly the Gateway.
As Encryption is enabled on each radio, that radio temporarily drops off the network, until any downstream Repeaters and the Gateway also have Encryption enabled, at which time all communication will resume.

Active Key	
Setting	**Description**
CLI / Web Page	[Page=encryption]

CLI Command	• `encryption.activeKey=Off`
	  • `activeKey=Off`
	• `encryption.activeKey=Key1 to Key16`
	  • `activeKey=Key1 to Key16`
	Example: `encryption.activeKey=Key10`.

Web Interface window	Active Key 1. Verify the designated Key1 to Key 16 (on page 233) is set at either a 128- or 256-bit hexadecimal. 2. Click the **Active Key** list box arrow and select the designated active key. 3. Click the **Update** button to save the change. **Note**: See the Encryption window (on page 372) for parameter location.
Default Setting	Off
Options	• Off • Key1 to Key16
Description	The **encryption.activeKey** parameter designates the key used for encryption and decryption. **Important!**: Assigning the **activeKey** to a key that is NOT set will **NOT** allow communication across the link. Keys **MUST BE** set before they can become active keys.

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19.2. Encryption Mode

Caution: Encryption settings **MUST match** on ALL radios in the network to maintain over-the-air compatibility.
When enabling Encryption, start with the farthest Endpoints, then any Repeaters, then lastly the Gateway.
As Encryption is enabled on each radio, that radio temporarily drops off the network, until any downstream Repeaters and the Gateway also have Encryption enabled, at which time all communication will resume.

Encryption Mode	
Setting	**Description**
CLI / Web Page	[Page=encryption]

CLI Command	• **AES Counter Mode**:
	  • `encryption.encryptionMode=AES_CTR`
	  • `encryptionMode=AES_CTR`
	• **AES Counter Mode with MIC** (Message Integrity Check):
	  • `encryption.encryptionMode=AES_CCM`
	  • `encryptionMode=AES_CCM`

Web Interface window	Encryption Mode 1. Click the **Encryption Mode** list box arrow and select the designated encryption mode. 2. Click the **Update** button to save the change. **Note**: See the Encryption window (on page 372) for parameter location.
Default Setting	AES_CTR
Options	• AES_CCM • AES_CTR
Description	The **encryption.encryptionMode** parameter designates the encryption mode. **Important!**: Use of encryption may affect latency and user throughput.

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19.3. Key1 to Key 16

Caution: Encryption settings **MUST match** on ALL radios in the network to maintain over-the-air compatibility.
When enabling Encryption, start with the farthest Endpoints, then any Repeaters, then lastly the Gateway.
As Encryption is enabled on each radio, that radio temporarily drops off the network, until any downstream Repeaters and the Gateway also have Encryption enabled, at which time all communication will resume.

Key1 to Key16 (Get Key)	
Setting	**Description**
CLI / Web Page	[Page=encryption]
CLI Command	• `encryption.Key1=Key1 to Key16` • `Key1=Key1 to Key16` **Example**: `encryption.getKey=key8`.
Web Interface window	Get Key 1. In the **KeyX** text box, enter either the 128- or 256-bit key in 16 or 32 hexadecimal format respectively. Enter **Clear** to erase a previously enter key. 2. Click the **Update** button to save the change. **Note**: Where X is the designated key number. See the Encryption window (on page 372) for parameter location.
Default Setting	Key has not been set.
Options	Key1 to Key16
Description	The **encryption.Key1** parameter designates whether the specified key is a 128- or 256-bit key. **Example**: 128 bit key: Key1=1234567890abcdef1234567890abcdef **Example**: 256 bit key: Key2=1234567890abcdef1234567890abcdef1234567890abcdef1234567890abcdef

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20. IO Ex Com Parameters

Note: This parameter is read-only.

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21. Local Diagnostics Parameters

Note: See the Local Diagnostics window (on page 381).

Signal Level (on page 236)
Signal Margin (on page 236)
CNT Bad BCC (on page 237)
CNT Bad Sync (on page 237)
CNT ETX (on page 237)
CNT STX (on page 237)
Get Stats (on page 237)
Interface Bytes Rx (on page 238)
Interface Bytes Tx (on page 238)
Interface Data Rx (on page 238)
Interface Data Tx (on page 238)
Mac Table Clear (on page 238)
Mac Table Show (on page 239)
Monitored Node (on page 239)
Noise Level (on page 240)
Radio Ack Tx (on page 241)
Radio Bad Ack Rx (on page 241)
Radio Bad CRC (on page 241)
Radio Bad Sync (on page 242)
Radio Contention Drop (on page 243)
Radio LL Rx (on page 243)
Radio LL Tx (on page 244)
Radio No Ack Tx (on page 244)
Radio Reliable Rx (on page 244)
Radio Reliable Tx (on page 244)
Radio Rexmit (on page 245)
Radio Rx (on page 245)
Radio Sending Drop (on page 245)
Radio Timed Out (on page 245)
Radio Too Long (on page 245)
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Radio Tx (on page 246)
Resets Detected (on page 246)
Resets Sent (on page 246)
Reset Stats (on page 246)
Rx Success (on page 247)
Show Channel Diags (on page 247)
Show Node Diags (on page 248)
Supply Voltage (on page 248)
Timestamp (on page 249)
Tx Availability (on page 249)
Tx Success (on page 250)
VSWR (Signal Level) (on page 250)

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21.1. Signal Level

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

signalLevel	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.signalLevel` • `signalLevel`
Web Interface window	Signal Level **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	0 (zero)
Options	N/A
Description	The **localDiagnostics.signalLevel** command reports the signal level of the Z9-P2 or Z9-PE2, in dBm, of the last received packet. **Note**: This setting shows -128.00 if no packet has been received since the stats were cleared.

21.2. Signal Margin

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

signalMargin	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.signalMargin` • `signalMargin`
Web Interface window	Signal Margin **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.

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signalMargin	
Setting	**Description**
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.signalMargin** command reports the amount of signal margin, in dB, the last received packet experienced. **Note**: The signal margin is the difference between the signal level and either the receive sensitivity or the noise level, whichever is higher, for the configured RF data rate.

21.3. CNT Bad BCC

Important!: FreeWave internal use only.

21.4. CNT Bad Sync

Important!: FreeWave internal use only.

21.5. CNT ETX

Important!: FreeWave internal use only.

21.6. CNT STX

Important!: FreeWave internal use only.

21.7. Get Stats

Get Stats	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.getStats` • `getStats`
Web Interface window	**Note**: This parameter is only available in the CLI window.

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Get Stats	
Setting	**Description**
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.getStats** command reports the local diagnostics from the connected Z9-P2 or Z9-PE2 immediately. **Important!**: A refresh of the **localDiagnostics** page is required to see the updates.

21.8. Interface Bytes Rx

Important!: FreeWave internal use only.

21.9. Interface Bytes Tx

Important!: FreeWave internal use only.

21.10. Interface Data Rx

Important!: FreeWave internal use only.

21.11. Interface Data Tx

Important!: FreeWave internal use only.

21.12. Mac Table Clear

Mac Table Clear	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]

CLI Command	• `localDiagnostics.MacTableClear=Now`
	  • `localDiagnostics.MacTableClear=`
	• `MacTableClear=Now`
	  • `MacTableClear=`

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Mac Table Clear	
Setting	**Description**
Web Interface window	**Note**: This parameter is only available in the CLI window.
Default Setting	N/A
Options	Now
Description	The **localDiagnostics.MacTableClear** command clears the MAC to the Node ID (on page 297) mapping table and forces routes to be relearned.

21.13. Mac Table Show

MacTableShow	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.MacTableShow` • `MacTableShow`
Web Interface window	**Note**: This parameter is only available in the CLI window.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.MacTableShow** command reports the MAC addresses of the devices connected to the Z9-P2 or Z9-PE2 in a Node ID (on page 297) table format.

21.14. Monitored Node

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Monitored Node	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.monitoredNode=<Node ID here>` • `monitoredNode=<Node ID here>`

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Monitored Node	
Setting	**Description**
Web Interface window	Monitored Node 1. In the **Monitored Node** text box, enter the Node ID (on page 297) to monitor. 2. Click the **Update** button to save the change. **Note**: See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.monitoredNode** parameter designates the Node ID (on page 297) to monitor the signal level. Use the Show Node Diags (on page 248) to view the received signal level (RSSI) of this node.

21.15. Noise Level

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Noise Level	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.noiseLevel` • `noiseLevel`
Web Interface window	Noise Level **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	0.000000
Options	N/A
Description	The **localDiagnostics.noiseLevel** command reports the amount of link noise measured in dB before the last packet was transmitted.

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21.16. Radio Ack Tx

Important!: FreeWave internal use only.

21.17. Radio Bad Ack Rx

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Radio Bad Ack Rx	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RadioBadAckRx` • `RadioBadAckRx`
Web Interface window	Radio Bad Ack RX **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.RadioBadAckRx** command reports the number of received ACKs missed in unicast transmissions.

21.18. Radio Bad CRC

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Radio Bad CRC	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RadioBadCRC` • `RadioBadCRC`

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Radio Bad CRC	
Setting	**Description**
Web Interface window	Radio Bad CRC **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.RadioBadCRC** command reports the number of radio packets received with data corruption. **FREEWAVE Recommends**: When viewing local diagnostics, if the Radio Bad CRC (on page 241) count is more than 15-20% of the total transmitted packets (the Radio LL Tx (on page 244) count), enabling the FEC Rate (on page 220) setting is beneficial.

21.19. Radio Bad Sync

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Radio Bad Sync	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RadioBadSync` • `RadioBadSync`
Web Interface window	Radio Bad Sync **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.RadioBadSync** command reports the number of times beacons were lost and the Endpoint needed to re-synchronize with the Gateway when **`radiosettings.radioHoppingMode=Hopping_On`**.

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21.20. Radio Contention Drop

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Radio Contention Drop	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RadioContentionDrop` • `RadioContentionDrop`
Web Interface window	Radio Contention Drop **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.RadioContentionDrop** command reports the number of times a transmission was backed-off due to contention on the RF channel.

21.21. Radio LL Rx

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Radio LL Rx	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RadioLLRx` • `RadioLLRx`
Web Interface window	Radio LL RX **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.RadioLLRx** command reports the number of packets received over the air without data corruption.

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21.22. Radio LL Tx

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Radio LL Tx	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RadioLLTx` • `RadioLLTx`
Web Interface window	Radio LL TX **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.RadioLLTx** command reports the number of packets transmitted over the air. **FREEWAVE Recommends**: When viewing local diagnostics, if the Radio Bad CRC (on page 241) count is more than 15-20% of the total transmitted packets (the Radio LL Tx (on page 244) count), enabling the FEC Rate (on page 220) setting is beneficial.

21.23. Radio No Ack Tx

Important!: FreeWave internal use only.

21.24. Radio Reliable Rx

Important!: FreeWave internal use only.

21.25. Radio Reliable Tx

Important!: FreeWave internal use only.

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21.26. Radio Rexmit

Important!: FreeWave internal use only.

21.27. Radio Rx

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Radio Rx	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RadioRx` • `RadioRx`
Web Interface window	Radio RX **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.RadioRx** command reports the number of data packets correctly received over the wireless RF link for this Endpoint.

21.28. Radio Sending Drop

Important!: FreeWave internal use only.

21.29. Radio Timed Out

Important!: FreeWave internal use only.

21.30. Radio Too Long

Important!: FreeWave internal use only.

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21.31. Radio Too Short

Important!: FreeWave internal use only.

21.32. Radio Tx

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Radio Tx	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RadioTx` • `RadioTx`
Web Interface window	Radio TX **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.RadioTx** command reports the number of data packets scheduled to be transmitted.

21.33. Resets Detected

Important!: FreeWave internal use only.

21.34. Resets Sent

Important!: FreeWave internal use only.

21.35. Reset Stats

Reset Stats	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]

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Reset Stats	
Setting	**Description**
CLI Command	• `localDiagnostics.resetStats=Now` • `localDiagnostics.resetStats=` • `resetStats=Now` • `resetStats=`
Web Interface window	**Note**: This parameter is only available in the CLI window.
Default Setting	N/A
Options	Now
Description	The **localDiagnostics.resetStats** command resets the local diagnostics counters.

21.36. Rx Success

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Rx Success	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.RxSuccess` • `RxSuccess`
Web Interface window	Rx Success **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	100
Options	N/A
Description	The **localDiagnostics.RxSuccess** command reports the percentage of packets correctly received for this Endpoint.

21.37. Show Channel Diags

Show Channel Diags	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]

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Show Channel Diags	
Setting	**Description**
CLI Command	• `localDiagnostics.showChannelDiags` • `showChannelDiags`
Web Interface window	**Note**: This parameter is only available in the CLI window.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.showChannelDiags** command reports the received signal level (RSSI) and Node ID (on page 297) of the last packet received on the displayed frequencies.

21.38. Show Node Diags

showNodeDiags	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.showNodeDiags` • `showNodeDiags`
Web Interface window	**Note**: This parameter is only available in the CLI window.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.showNodeDiags** command reports the channel frequency and signal level for the node selected by the Monitored Node (on page 239) parameter.

21.39. Supply Voltage

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Supply Voltage	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]

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Supply Voltage	
Setting	**Description**
CLI Command	• `localDiagnostics.SupplyVoltage` • `SupplyVoltage`
Web Interface window	Supply Voltage **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.SupplyVoltage** command reports the supply voltage to the Z9-P2 or Z9-PE2 in units of voltage (V).

21.40. Timestamp

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Timestamp	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.timestamp` • `timestamp`
Web Interface window	Timestamp **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **localDiagnostics.timestamp** command reports the time the Diagnostics Information was collected by the device.

21.41. Tx Availability

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

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Tx Availability	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.TxAvailability` • `TxAvailability`
Web Interface window	Tx Availability **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	100
Options	N/A
Description	The **localDiagnostics.TxAvailability** command reports the percentage of packets that were transmitted without back-off.

21.42. Tx Success

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

Tx Success	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.TxSuccess` • `TxSuccess`
Web Interface window	Tx Success **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	100
Options	N/A
Description	The **localDiagnostics.TxSuccess** command reports the percentage of packets that were transmitted with a successful ACK received.

21.43. VSWR (Signal Level)

Important!: Most of the **localDiagnostics** parameters are read-only.
The information reported is dependent upon the connected Z9-P2 or Z9-PE2.

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VSWR (Signal Level)	
Setting	**Description**
CLI / Web Page	[Page=localDiagnostics]
CLI Command	• `localDiagnostics.VSWR` • `VSWR`
Web Interface window	Signal Level **Note**: This parameter is read-only in the Web Interface. See the Local Diagnostics window (on page 381) for parameter location.
Default Setting	0 (zero)
Options	N/A

Description	The **localDiagnostics.VSWR** command reports the value proportional to the VSWR (Voltage Standing Wave Ratio) measured from the last packet transmitted.
	• For the antenna port, the value can range from:
	  • 1 to 2 for an excellent match
	  • 2 to 10 for a good match
	  • 11 to 99 - user discretion
	  • > 100 for a poor match
	Notes
	• VSWR is less accurate at higher power levels (>20 dBm).
	• The reported VSWR is a value proportional to the VSWR. It is closer to VSWR at lower powers, but at higher power levels, it still increases with reflected power.
	• VSWR **may not** function on Z9-P2 or Z9-PE2 models manufactured prior to September, 2018. If the Z9-P2 or Z9-PE2 always reports a VSWR value of 0 (zero), VSWR is **not** supported.
	• The VSWR is instantaneous, not averaged. Each measurement can produce a different value; units that do support VSWR will occasionally report 0 (zero) due to an invalid measurement.
	FREEWAVE Recommends: Investigate cable and antenna at higher VSWR levels.

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22. Modbus Parameters

Note: See the Modbus window (on page 383).

Modbus Device ID (on page 253)
Modbus RTU Over TCP (on page 254)
Modbus TCP (on page 255)
Modbus Layout (on page 253)
Read (on page 255)
Read Coils (on page 256)
Write (on page 257)
Write Coils (on page 258)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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22.1. Modbus Device ID

Modbus Device ID	
Setting	**Description**
CLI / Web Page	[Page=modbus]
CLI Command	• `modbus.modbusDeviceId=nnn` • `modbusDeviceId=nnn` **Note**: Where `nnn` designates the user-defined Modbus device ID.
Web Interface window	Modbus Device ID 1. In the **Modbus Device ID** text box, enter a user-defined Modbus device ID. 2. Click the **Update** button to save the change. **Note**: See the Modbus window (on page 383) for parameter location.
Default Setting	1
Options	1 to 247
Description	The **modbus.modbusDeviceId** parameter designates the Modbus device ID the local device responds to during a Modbus TCP (on page 255) request over the network or a Modbus RTU Over TCP (on page 254) request coming in via COM1 or COM2.

22.2. Modbus Layout

Modbus Layout	
Setting	**Description**
CLI / Web Page	[Page=modbus]
CLI Command	• `modbus.modbusLayout` • `modbusLayout`
Web Interface window	Modbus Layout **Note**: This parameter is visible and read-only in the Web Interface selected from the **System Info** menu. See the Modbus window (on page 383) for parameter location.
Default Setting	N/A
Options	N/A

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Modbus Layout	
Setting	**Description**

Description	The **modbus.modbusLayout** parameter reports the Modbus map for the local device.
	Example
	`>modbusLayout`
	`radioSettings.radioMode type:uint32_t Protocol address:31001 Number registers:2 Modbus FC:4 Address:1000`
	`radioSettings.rfDataRate type:uint32_t Protocol address:31003 Number registers:2 Modbus FC:4 Address:1002`
	`radioSettings.radioMaxRepeaters type:uint32_t Protocol address:31005 Number registers:2 Modbus FC:4 Address:1004`
	`….`
	`rfStats.DownRateAvg2 type:double Protocol address:32121 Number registers:4 Modbus FC:4 Address:2120`
	`RESULT:0:OK`
	`>`

22.3. Modbus RTU Over TCP

Modbus RTU Over TCP	
Setting	**Description**
CLI / Web Page	[Page=modbus]
CLI Command	• `modbus.modbusRtuOverTcp=nnnn` • `modbusRtuOverTcp=nnnn` **Note**: Where `nnnn` designates the TCP port used for the Modbus RTU over TCP requests.
Web Interface window	Modbus RTU Over TCP 1. In the **Modbus Rtu Over TCP** text box, enter the TCP port used for the Modbus RTU over TCP requests. 2. Click the **Update** button to save the change. **Note**: See the Modbus window (on page 383) for parameter location.
Default Setting	5021
Options	0 (zero) to 65535

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Modbus RTU Over TCP	
Setting	**Description**
Description	The **modbus.modbusRtuOverTcp** parameter designates the TCP port used for the Modbus RTU over TCP requests. **Note**: Set to 0 (zero) to disable Modbus RTU over TCP requests.

22.4. Modbus TCP

Modbus TCP	
Setting	**Description**
CLI / Web Page	[Page=modbus]
CLI Command	• `modbus.modbusTcp=nnnn` • `modbusTcp=nnnn` **Note**: Where `nnnn` designates the TCP port used for the Modbus TCP requests.
Web Interface window	Modbus TCP 1. In the **Modbus TCP** text box, enter the TCP port used for the Modbus TCP requests. 2. Click the **Update** button to save the change. **Note**: See the Modbus window (on page 383) for parameter location.
Default Setting	502
Options	0 (zero) to 65535
Description	The **modbus.modbusTcp** parameter designates the TCP port used for the Modbus TCP requests. **Note**: Set to 0 (zero) to disable Modbus TCP. **Important!**: A reboot is required when changing the **modbus.modbusTcp** value for the change to take effect.

22.5. Read

read	
Setting	**Description**
CLI / Web Page	[Page=modbus]

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read	
Setting	**Description**
CLI Command	• modbus.read • read
Web Interface window	Read **Note**: This parameter is read-only in the Web Interface. See the Modbus window (on page 383) for parameter location.
Default Setting	N/A
Options	Bool, Byte, FloatABCD, FloatBADC, FloatCDAB, FloatDCBA, IntABCD, IntBADC, IntCDAB, LongABCD, LongBADC, LongCDAB, LongDCBA, Raw, Unsigned, IntDCBA, Signed

Description	The **modbus.read** parameter creates a Modbus request from the CLI.
	Example
	`>read --srcId=1 --srcAddress=1000 --srcFc=FC4 --type=longABCD --numElements=4`
	`Id:1 Fc:4 Address: 1000 Type: LongABCD Value: 0`
	`Id:1 Fc:4 Address: 1002 Type: LongABCD Value: 4000000`
	`Id:1 Fc:4 Address: 1004 Type: LongABCD Value: 0`
	`Id:1 Fc:4 Address: 1006 Type: LongABCD Value: 1`
	`RESULT:0:OK`
	`>`

22.6. Read Coils

Read Coils	
Setting	**Description**
CLI / Web Page	[Page=modbus]
CLI Command	• modbus.readCoils • readCoils

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Read Coils	
Setting	**Description**
Web Interface window	Read Coils **Note**: This parameter is read-only in the Web Interface. See the Modbus window (on page 383) for parameter location.
Default Setting	N/A
Options	N/A

Description	The **modbus.readCoils** parameter creates a Modbus request to read coils from the CLI.
	Example
	`>readCoils --srcId=1 --srcAddress=100 --srcFc=FC1 --numElements=4`
	`Id:1 Fc:1 Address: 100 Value: 1`
	`Id:1 Fc:1 Address: 101 Value: 1`
	`Id:1 Fc:1 Address: 102 Value: 1`
	`Id:1 Fc:1 Address: 103 Value: 1`
	`RESULT:0:OK`

22.7. Write

Write	
Setting	**Description**
CLI / Web Page	[Page=modbus]
CLI Command	• `modbus.write` • `write`
Web Interface window	Write **Note**: This parameter is read-only in the Web Interface. See the Modbus window (on page 383) for parameter location.
Default Setting	N/A

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Write	
Setting	**Description**
Options	Bool, Byte, FloatABCD, FloatBADC, FloatCDAB, FloatDCBA, IntABCD, IntBADC, IntCDAB, LongABCD, LongBADC, LongCDAB, LongDCBA, Raw, Unsigned, IntDCBA, Signed

Description	The **modbus.write** parameter creates a Modbus write request from the CLI to write to a holding register.
	Example
	`>write --srcId=1 --srcAddress=100 --type=intabcd --value=1024`
	`RESULT:0:OK`

22.8. Write Coils

Write Coils	
Setting	**Description**
CLI / Web Page	[Page=modbus]
CLI Command	• `modbus.writeCoils` • `writeCoils`
Web Interface window	Write Coils **Note**: This parameter is read-only in the Web Interface. See the Modbus window (on page 383) for parameter location.
Default Setting	N/A
Options	N/A

Description	The **modbus.writeCoils** parameter creates a Modbus write request from the CLI to write to the coils.
	Example
	`>writeCoils --srcId=1 --srcAddress=100 --value=0x55 --numElements=4`
	`RESULT:0:OK`

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22.9. Modbus Use Cases

The Modbus feature allows for radio diagnostics and radio settings to be read via Modbus. Settings are read only.

The three methods of connecting to the radio are:

- Modbus TCP (on page 259),
- Modbus RTU over TCP (on page 259), and
- Modbus RTU using COM1 (on page 260)
  or
  Modbus RTU using COM2 (on page 260) serial ports.

COM1 or COM2 can be configured for Modbus pass thru.

This will take any request that comes in through any one of the three methods and convert it to a serial Modbus RTU request. This request is sent out the configured serial port to a serial Modbus device.

This allows the Z9-P2 or Z9-PE2 to act as a Modbus TCP to serial Modbus gateway.

22.9.1. Connecting to a Device via Modbus

Modbus TCP

1. On the Z9-P2 or Z9-PE2, connect to port 502.
2. Use the Modbus TCP protocol.
3. In the CLI, enter **`modbus.modbusTcp=nnnn`** to change the port.

   Note: Where `nnnn` designates the TCP port used for the Modbus TCP requests.
   Set to 0 (zero) to disable Modbus TCP.
   See Modbus TCP (on page 255) for additional information.

Modbus RTU over TCP

1. On the Z9-P2 or Z9-PE2, connect to port 5021.
2. Use the Modbus RTU protocol.
3. In the CLI, enter **`modbus.modbusRtuOverTcp=nnnn`** to change the port.

   Note: Where `nnnn` designates the TCP port used for the Modbus RTU over TCP requests.
   Set to 0 (zero) to disable Modbus RTU over TCP requests.
   See Modbus RTU Over TCP (on page 254) for additional information.

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Modbus RTU using COM1

1. Connect the device to the COM1 serial port.
2. Configure the COM port Baudrate (on page 199) and other settings to match the serial Modbus RTU device.
3. Change the COM1 Handler (on page 204) to `Com1.handler=ModbusRTU`.
4. Send in Modbus requests via COM1.

Modbus RTU using COM2

1. Connect the device to the COM2 serial port.
2. Configure the COM port Baudrate (on page 199) and other settings to match the serial Modbus RTU device.
3. Change the COM1 Handler (on page 204) to `Com2.handler=ModbusRTU`.
4. Send in Modbus requests via COM2.

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22.10. Reading Local Diagnostics and Radio Settings using Modbus

Note: See Modbus Device ID (on page 253) for additional information.

The local device ID is set using **`modbus.modbusDeviceId=nnnn`**.

22.10.1. Reading from an External Modbus RTU Serial Device using COM1

1. Connect the device to the COM1 serial port.
2. Configure the COM port Baudrate (on page 199) and other settings to match the serial Modbus device.
3. Change the COM1 Handler (on page 204) to **`Com1.handler=ModbusPassthru`**.

Notes

- Incoming requests that are not for the local Z9-P2 or Z9-PE2 device or for IOEX are sent out COM1.
- Responses are returned out the port that the request came in on.
- The protocol is converted from Modbus TCP to Modbus RTU and back where necessary.

22.10.2. Reading from the External Modbus RTU Serial Device using COM2

1. Connect the device to the COM2 serial port.
2. Configure the COM port Baudrate (on page 199) and other settings to match the serial Modbus device.
3. Change the COM2 Handler (on page 204) to **`Com2.handler=ModbusPassthru`**.

Notes

- Incoming requests that are not for the local Z9-P2 or Z9-PE2 device or for IOEX are sent out COM2.
- Responses are returned out the port that the request came in on.
- The protocol is converted from Modbus TCP to Modbus RTU and back where necessary.

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23. Network Parameters

Note: See the Network window (on page 385).

Arp Filter Enabled (on page 263)
Gateway (on page 263)
IP Address (on page 264)
MAC Address (on page 264)
MTU (on page 265)
Nameserver Address 1 (on page 266)
Nameserver Address 2 (on page 267)
Netmask (on page 267)
Netmask Filter Enabled (on page 268)
STP Enabled (on page 269)
Txqueuelen (on page 270)
VLAN MGMT (on page 271)
VLAN Tag Port 1 (on page 271)
VLAN Tag Port 2 (on page 273)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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23.1. Arp Filter Enabled

Arp Filter Enabled	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• Enable the parameter: `network.arpFilterEnabled=True` • Disable the parameter: `network.arpFilterEnabled=False`
Web Interface window	Arp Filter Enabled 1. Click the **Arp Filter Enabled** list box arrow and select **True** to enable the parameter. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	False
Options	• True • False
Description	The **network.arpFilterEnabled** setting enables ARP filter in the bridge firewall. This allows only ARP communication that is in the Netmask (on page 267) parameter to enter the radio network.

23.2. Gateway

Gateway	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.gateway=nnn.nnn.nnn.nnn` • `gateway=nnn.nnn.nnn.nnn` **Important!**: Where `nnn.nnn.nnn.nnn` is the Gateway IP address for the network.
Web Interface window	Gateway 1. In the **Gateway** text box, enter the Gateway IP address for the network. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	192.168.111.1
Options	N/A

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Gateway	
Setting	**Description**
Description	The **network.gateway** parameter designates the Gateway IP address for the network. **Important!**: The use of a Gateway here is **NOT** related to the `radioSettings.radioMode=Gateway` or `radioSettings.radioMode=Endpoint`.

23.3. IP Address

IP Address	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.ip_address=nnn.nnn.nnn.nnn` • `ip_address=nnn.nnn.nnn.nnn` **Important!**: Where `nnn.nnn.nnn.nnn` is the IP Address assigned to each Z9-P2 or Z9-PE2.
Web Interface window	IP Address 1. In the **IP Address** text box, enter the IP address of the Z9-P2 or Z9-PE2 assigned by the IT department for the network. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	192.168.111.100
Options	N/A
Description	The **network.ip_address** parameter designates the IP address of the Z9-P2 or Z9-PE2.

23.4. MAC Address

MAC Address	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.mac_address` • `mac_address`

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MAC Address	
Setting	**Description**
Web Interface window	MAC Address **Note**: This parameter is read-only in the Web Interface. See the Network window (on page 385) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **network.mac_address** command reports the MAC Address of the Z9-P2 or Z9-PE2. **Important!**: This parameter is read-only and is unique for each radio. **Notes about the MAC Address Table** • 1024 apps and programs are allowed to talk directly to the Z9-P2 or Z9-PE2. • 4096 entries are allowed for the Z9-P2 or Z9-PE2 links. • If 4096 is exceeded, old entries are deleted but they can be re-learned.

23.5. MTU

MTU	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.mtu=nnnn` • `mtu=nnnn` **Note**: Where `nnnn` is the maximum transmission unit.
Web Interface window	MTU 1. In the **MTU** text box, enter the maximum transmission unit. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	1500
Options	• The minimum value is 100. • The maximum value is 65521.

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MTU	
Setting	**Description**
Description	The **network.mtu** parameter designates the maximum transmission unit (MTU) frame size for the Z9-P2 or Z9-PE2. **Notes** • The MTU size only effects communications that originate or terminate on this device, such as the web services or the Terminal Servers. • All other traffic passing through the radio network is affected by this setting. **Important!**: The value MUST BE increased to support jumbo size frames that exceed the normal 1500 byte MTU.

23.6. Nameserver Address 1

Nameserver Address 1	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.nameserver_address1=nnn.nnn.nnn.nnn` • `nameserver_address1=nnn.nnn.nnn.nnn` **Note**: Where `nnn.nnn.nnn.nnn` is a user-defined DNS IP address.
Web Interface window	Nameserver Address 1 1. Optional: In the **Nameserver Address 1** text box, enter a user-defined DNS IP address. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	8.8.8.8 **Note**: This is a Google Public DNS.
Options	User-defined DNS IP address.
Description	The **network.nameserver_address1** parameter designates the DNS for name-to-address resolution.

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23.7. Nameserver Address 2

Nameserver Address 2	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.nameserver_address2=nnn.nnn.nnn.nnn.` • `nameserver_address2=nnn.nnn.nnn.nnn` **Note**: Where `nnn.nnn.nnn.nnn` is a user-defined DNS IP address.
Web Interface window	Nameserver Address 2 1. Optional: In the **Nameserver Address 2** text box, enter a user-defined DNS IP address.. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	8.8.4.4 **Note**: This is a Google Public DNS.
Options	User-defined DNS IP address.
Description	The **network.nameserver_address2** parameter designates the DNS for name-to-address resolution.

23.8. Netmask

Netmask	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.netmask=nnn.nnn.nnn.nnn` • `netmask=nnn.nnn.nnn.nnn` **Note**: Where `nnn.nnn.nnn.nnn` is the Netmask of the Z9-P2 or Z9-PE2.
Web Interface window	Netmask 1. In the **Netmask** text box, enter the Netmask of the Z9-P2 or Z9-PE2. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.

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Netmask	
Setting	**Description**
Default Setting	255.255.255.0
Options	N/A
Description	The **network.netmask** parameter designates the Netmask of the Z9-P2 or Z9-PE2.

23.9. Netmask Filter Enabled

Netmask Filter Enabled	
Setting	**Description**
CLI / Web Page	[Page=network]

CLI Command	• **Enable**:
	  • `network.netmaskFilterEnabled=true`
	  • `netmaskFilterEnabled=true`
	• **Disable**:
	  • `network.netmaskFilterEnabled=false`
	  • `netmaskFilterEnabled=false`

Web Interface window	Netmask Filter Enabled 1. Click the **Netmask Filter Enabled** list box arrow and select **True** to enable the bridge firewall and restrict network communication to current IPv4 subnet. 2. Click the **Update** button to save the change. **Note**: By default, the **Netmask Filter Enabled** is enabled (set to False). See the Network window (on page 385) for parameter location.
Default Setting	False
Options	• True • False

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Netmask Filter Enabled	
Setting	**Description**
Description	The **network.netmaskFilterEnabled** enables a bridge firewall to restrict network communication to the current IPv4 subnet. **Notes** • Allows ONLY IPv4, TCP, UDP, ICMP (ping), and ARP communication that is in the **network.netmask** parameter subnet to enter into the radio network. • VLAN tagged packets are filtered out because the radio is not considered on the VLAN and therefore VLAN packets cannot be on the same subnet. • Enabling **Netmask Filter** can prevent non-radio Ethernet traffic from adversely affecting the performance and capacity of the radio network. **Important!**: ZumLink acts as a layer 2 switch. ALL Ethernet and Multicast packets are passed when IP Netmask Filter is NOT enabled.

23.10. STP Enabled

STP Enabled	
Setting	**Description**
CLI / Web Page	[Page=network]

CLI Command	• **Enable**:
	  • `network.stpEnabled=true`
	  • `stpEnabled=true`
	• **Disable**:
	  • `network.stpEnabled=false`
	  • `stpEnabled=false`

Web Interface window	STP Enabled 1. Click the **STP Enabled** list box arrow and select **True** to enable the Spanning Tree Protocol. 2. Click the **Update** button to save the change. **Note**: By default, the **STP Enabled** is NOT enabled (set to False). See the Network window (on page 385) for parameter location.
Default Setting	False
Options	• True • False
Description	The **network.stpEnabled** setting enables the Spanning Tree Protocol.

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23.11. Txqueuelen

Txqueuelen	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.txqueuelen=nnnn` • `txqueuelen=nnnn` **Note**: Where `nnnn` is the maximum number of packets to hold in the transmit queue.
Web Interface window	Txqueuelen 1. In the **Txqueuelen** text box, enter the maximum number of packets to hold in the transmit queue. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	25
Options	• The minimum value is 1. • The maximum value is 1000.
Description	The **network.txqueuelen** parameter designates the maximum number of packets that can be buffered before they are rejected by the radio. **Notes** • The radio is still trying to send packets as soon as it receives them. • If the queue size is too small in an Ethernet network with a high rate of small packets, then packets could be lost. • **Increasing TX Queue Length** may increase throughput if there is a lot of network chatter that causes packets to be lost at the network layer. • **Increasing TX Queue Length** can increase latency if the packets are arriving at the Ethernet interface at an average rate that is above the capacity of the radio link. **Example**: `network.txqueuelen=750` allows 750 Ethernet packets buffered in the transmit queue.

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23.12. VLAN MGMT

VLAN MGMT	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.vlanMgmt=nnnn` • `vlanMgmt=nnnn` **Note**: Where `nnnn` designates the Management VLAN ID for the Z9-P2 or Z9-PE2.
Web Interface window	VLAN MGMT 1. In the **Vlan MGMT** text box, enter the Management VLAN ID. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	0 (zero)
Options	0 (zero) to 4094
Description	The **network.vlanMgmt** parameter designates the Management VLAN ID for the Z9-P2 or Z9-PE2. • If the **network.vlanMgmt** is set, users can only access the device from the same VLAN ID. • If the VLAN Tag Port 1 (on page 271) or VLAN Tag Port 2 (on page 273) are set on an Ethernet port, that port cannot be used to access the **network.vlanMgmt**. **Important!**: **network.vlanMgmt** must be different from any of the **network.vlanTag** IDs. **Note**: Set to 0 (zero) to disable Management VLAN.

23.13. VLAN Tag Port 1

VLAN Tag Port 1	
Setting	**Description**
CLI / Web Page	[Page=network]

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VLAN Tag Port 1	
Setting	**Description**
CLI Command	• `network.vlanTagPort1=nnnn` • `vlanTagPort1=nnnn` **Note**: Where `nnnn` designates the VLAN Tag ID.
Web Interface window	VLAN Tag Port 1 1. In the **Vlan Tag Port 1** and/or **Vlan Tag Port 2** text boxes, enter the VLAN ID for the designated port. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	0 (zero)
Options	0 (zero) to 4094

Description	The **network.vlanTagPort1** parameter:
	• removes the VLAN ID for traffic transmitted from the Z9-P2 or Z9-PE2 to VLAN-incapable equipment and
	• adds a VLAN ID for traffic received on the Z9-P2 or Z9-PE2.
	Notes
	• Set to 0 (zero) to disable VLAN tagging for the designated Ethernet port and allow VLAN tags to pass unchanged through the Z9-P2 or Z9-PE2.
	• The VLAN Tag ID is set on the Z9-P2 or Z9-PE2 designated Ethernet port.
	• **Egress Traffic**
	  • Egress traffic tagged with the VLAN ID has the tag stripped and sent out the designated Ethernet port.
	  • Egress traffic with 802.11ad double tags will have one tag stripped and sent out the designated Ethernet port.
	• **Ingress Traffic**
	  • Ingress traffic to the designated Ethernet port has the VLAN tag with that ID added.
	  • Ingress traffic that is already tagged can have an additional tag added (802.11ad double tag).
	• **vlanTagPort1** and **vlanTagPort2** can have the same VLAN Tag ID.

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23.14. VLAN Tag Port 2

VLAN Tag Port 2	
Setting	**Description**
CLI / Web Page	[Page=network]
CLI Command	• `network.vlanTagPort2=nnnn` • `vlanTagPort2=nnnn` **Note**: Where `nnnn` designates the VLAN Tag ID.
Web Interface window	VLAN Tag Port 2 1. In the **Vlan Tag Port 1** and/or **Vlan Tag Port 2** text boxes, enter the VLAN ID for the designated port. 2. Click the **Update** button to save the change. **Note**: See the Network window (on page 385) for parameter location.
Default Setting	0 (zero)
Options	0 (zero) to 4094

Description	The **network.vlanTagPort2** parameter:
	• removes the VLAN ID for traffic transmitted from the Z9-P2 or Z9-PE2 to VLAN-incapable equipment and
	• adds a VLAN ID for traffic received on the Z9-P2 or Z9-PE2.
	Notes
	• Set to 0 (zero) to disable VLAN tagging for the designated Ethernet port and allow VLAN tags to pass unchanged through the Z9-P2 or Z9-PE2.
	• The VLAN Tag ID is set on the Z9-P2 or Z9-PE2 designated Ethernet port.
	• **Egress Traffic**
	  • Egress traffic tagged with the VLAN ID has the tag stripped and sent out the designated Ethernet port.
	  • Egress traffic with 802.11ad double tags will have one tag stripped and sent out the designated Ethernet port.
	• **Ingress Traffic**
	  • Ingress traffic to the designated Ethernet port has the VLAN tag with that ID added.
	  • Ingress traffic that is already tagged can have an additional tag added (802.11ad double tag).
	• **vlanTagPort1** and **vlanTagPort2** can have the same VLAN Tag ID.

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24. Network StatsParameters

Note: See the Network Stats window (on page 392).

RX Bytes (on page 275)
RX Dropped (on page 275)
RX Errors (on page 276)
RX Packets (on page 276)
TX Bytes (on page 277)
TX Dropped (on page 277)
TX Errors (on page 278)
TX Packets (on page 278)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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24.1. RX Bytes

RX Bytes	
Setting	**Description**
CLI / Web Page	[Page=networkStats]
CLI Command	• `networkStats.rx_bytes` • `rx_bytes`
Web Interface window	RX Bytes **Note**: This parameter is read-only in the Web Interface. See the Network Stats window (on page 392) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **networkStats.rx_bytes** command reports the number of bytes received from the radio network. **Note**: This is a Read-only parameter.

24.2. RX Dropped

RX Dropped	
Setting	**Description**
CLI / Web Page	[Page=networkStats]
CLI Command	• `networkStats.rx_dropped` • `rx_dropped`
Web Interface window	RX Dropped **Note**: This parameter is read-only in the Web Interface. See the Network Stats window (on page 392) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **networkStats.rx_dropped** command reports the number of Ethernet packets received from the radio network that were dropped at the Ethernet interface. **Note**: This is a Read-only parameter.

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24.3. RX Errors

RX Errors	
Setting	**Description**
CLI / Web Page	[Page=networkStats]
CLI Command	• networkStats.rx_errors • rx_errors
Web Interface window	RX Errors **Note**: This parameter is read-only in the Web Interface. See the Network Stats window (on page 392) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **networkStats.rx_errors** command reports the number of Ethernet packets received from the radio network that had Ethernet errors. **Note**: This is a Read-only parameter.

24.4. RX Packets

RX Packets	
Setting	**Description**
CLI / Web Page	[Page=networkStats]
CLI Command	• networkStats.rx_packets • rx_packets
Web Interface window	RX Packets **Note**: This parameter is read-only in the Web Interface. See the Network Stats window (on page 392) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **networkStats.rx_packets** command reports the number of Ethernet packets received from the radio network. **Note**: This is a Read-only parameter.

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24.5. TX Bytes

TX Bytes	
Setting	**Description**
CLI / Web Page	[Page=networkStats]
CLI Command	• `networkStats.tx_bytes` • `tx_bytes`
Web Interface window	TX Bytes **Note**: This parameter is read-only in the Web Interface. See the Network Stats window (on page 392) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **networkStats.tx_bytes** command reports the number of bytes of Ethernet packets received from the Ethernet port and sent over the radio network. **Note**: This is a Read-only parameter.

24.6. TX Dropped

TX Dropped	
Setting	**Description**
CLI / Web Page	[Page=networkStats]
CLI Command	• `networkStats.tx_dropped` • `tx_dropped`
Web Interface window	TX Dropped **Note**: This parameter is read-only in the Web Interface. See the Network Stats window (on page 392) for parameter location.
Default Setting	N/A
Options	N/A

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TX Dropped	
Setting	**Description**
Description	The **networkStats.tx_dropped** command reports the number of Ethernet packets received from the Ethernet port but dropped because the transmit queue is full. **Note**: An increase of this counter may indicate that increasing the Txqueuelen (on page 270) parameter may improve overall network performance. **Note**: This is a Read-only parameter.

24.7. TX Errors

TX Errors	
Setting	**Description**
CLI / Web Page	[Page=networkStats]
CLI Command	• networkStats.tx_errors • tx_errors
Web Interface window	TX Errors **Note**: This parameter is read-only in the Web Interface. See the Network Stats window (on page 392) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **networkStats.tx_errors** command reports the number of Ethernet packets received from the Ethernet port that were in error. **Note**: This is a Read-only parameter.

24.8. TX Packets

TX Packets	
Setting	**Description**
CLI / Web Page	[Page=networkStats]
CLI Command	• networkStats.tx_packets • tx_packets

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TX Packets	
Setting	**Description**
Web Interface window	TX Packets **Note**: This parameter is read-only in the Web Interface. See the Network Stats window (on page 392) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **networkStats.tx_packets** command reports the number of Ethernet packets received from the Ethernet port and sent over the radio network. **Note**: This is a Read-only parameter.

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25. NTP Parameters

Note: See the NTP window (on page 394).

NTP Address (1 to 5) (on page 281)
NTP Date (on page 282)
NTP Reference (on page 283)
NTP Restart (on page 284)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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25.1. NTP Address (1 to 5)

NTP Address (1 to 5)	
Setting	**Description**
CLI / Web Page	[Page=ntp]
CLI Command	• `ntp.ntp_address1=nnn.nnn.nnn.nnn` • `ntp.ntp_address2=nnn.nnn.nnn.nnn` • `ntp.ntp_address3=nnn.nnn.nnn.nnn` • `ntp.ntp_address4=nnn.nnn.nnn.nnn` • `ntp.ntp_address5=nnn.nnn.nnn.nnn` **Note**: Where `nnn.nnn.nnn.nnn` is the IP address of the servers used for synchronizing time.
Web Interface window	NTP Address 1 NTP Address 2 NTP Address 3 NTP Address 4 NTP Address 5 1. In the **NTP Address 2 to 5** text boxes, enter the IP address of the servers used for synchronizing time. 2. Click the **Update** button to save the change. **Note**: By default, the **NTP Address 1** is time.nist.gov. See the NTP window (on page 394) for parameter location.
Default Setting	• **ntp_address1**: time.nist.gov • **ntp_address2-5**: 0.0.0.0
Options	N/A

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NTP Address (1 to 5)	
Setting	**Description**
Description	The **ntp.ntp_address1-5** parameter designates the IP address of the server used for synchronizing time. **Notes** • This can be a server such as **time.nist.gov**, **time1.google.com** or it can be the IP address of another radio in the network. • A maximum of five NTP servers are allowed. • The fields in the NTP Parameters (on page 280) parameters are **not** validated by the system. • Use `0.0.0.0` to skip a specific server. **Example**: Enter `ntp.ntp_address2=0.0.0.0` to skip a second server, if it's available. A common use is to have all of the Endpoints and Repeaters use the IP address of the Gateway radio then the entire network will stay synchronized to the Gateway time.

25.2. NTP Date

NTP Date	
Setting	**Description**
CLI / Web Page	[Page=ntp]
CLI Command	• `ntp.ntpDate=now` • `ntpDate=now`
Web Interface window	NTP Date 1. In the **NTP Date** text box, enter **Now** to synchronize the local clock with the time from the NTP servers specified in the NTP Address (1 to 5) (on page 281) settings. 2. Click the **Update** button to save the change. **Note**: See the NTP window (on page 394) for parameter location.
Default Setting	N/A
Options	Now

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NTP Date	
Setting	**Description**
Description	The **ntp.ntpDate** parameter sets the local time from other NTP servers on the network. • The server with the best clock, as defined by the NTP protocol, is used. • The fields in the NTP Parameters (on page 280) parameters are **not** validated by the system.

25.3. NTP Reference

NTP Reference	
Setting	**Description**
CLI / Web Page	[Page=ntp]

CLI Command	• `ntp.ntpReference=NETWORK_TIME_SERVER`
	  • The reference is from other systems on the network.
	• `ntp.ntpReference=REFCLK_LOCALCLOCK`
	  • The reference is generated by the local clock.

Web Interface window	NTP Reference 1. Click the **NTP Reference** list box arrow and select either **NETWORK_TIME_SERVER** or **REFCLK_LOCALCLOCK**. 2. Click the **Update** button to save the change. **Note**: See the NTP window (on page 394) for parameter location.
Default Setting	NETWORK_TIME_SERVER
Options	• NETWORK_TIME_SERVER • REFCLK_LOCALCLOCK
Description	The **ntp.ntpReference** parameter designates the time correction from either a local clock or over the network clock reference for NTP. **Notes** • NTP is always running. • **NETWORK_TIME_SERVER**: The clock designation is from a network clock. • **REFCLK_LOCALCLOCK**: The clock designation is from the local clock. • If no server address is set in NTP Address (1 to 5) (on page 281), the reference is to the **REFCLK_LOCALCLOCK**. • If any NTP Address (1 to 5) is valid then, at startup and whenever NTP restarts, the system clock is set from the NTP servers over the network. • The fields in the NTP Parameters (on page 280) parameters are **not** validated by the system.

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25.4. NTP Restart

NTP Restart	
Setting	**Description**
CLI / Web Page	[Page=ntp]
CLI Command	• `ntp.ntpRestart=now` • `ntpRestart=now`
Web Interface window	NTP Restart **Note**: This parameter is read-only in the Web Interface. See the NTP window (on page 394) for parameter location.
Default Setting	N/A
Options	Now
Description	The **ntp.ntpRestart** parameter restarts the NTP system. • If any NTP Address (1 to 5) (on page 281) is valid, then the system clock is set from the NTP servers over the network at the time the command is run. • The fields in the NTP Parameters (on page 280) parameters are **not** validated by the system.

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26. Radio Settings Parameters

Note: See the Radio Settings window - Endpoint (on page 396).

Beacon Burst Count (on page 286)
Beacon Interval (on page 287)
Frequency Key (on page 288)
Frequency Masks (on page 290)
LNA Bypass (on page 294)
Max Link Distance in Miles (on page 295)
Network ID (on page 296)
Node ID (on page 297)
Radio Frequency (on page 298)
Radio Hopping Mode (on page 299)
Radio Max Repeaters (on page 302)
Radio Mode (on page 304)
Radio Repeater Slot (on page 305)
RF Data Rate (on page 307)
TX Power (on page 309)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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26.1. Beacon Burst Count

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Beacon Burst Count	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]
CLI Command	• `radioSettings.beaconBurstCount=n` • `beaconBurstCount=n` **Note**: Where `n` is any number between 1 and 7.
Web Interface window	Beacon Burst Count 1. In the **Beacon Burst Count** text box, enter the number of consecutive beacons to send per Beacon Interval time. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	3
Options	Any number between 1 and 7.
Description	The **radioSettings.beaconBurstCount** setting designates the number of consecutive beacons to send per Beacon Interval time. **Notes** • The **radioSettings.beaconBurstCount** is set only on the Gateway device. • The Endpoint radios obtain this value from a Gateway with the same **networkId** via the beacon frame. • This setting is **only** used when **`radiosettings.radioHoppingMode=Hopping_On`**. • **Increasing** the number of beacons may improve RF link reliability in noisy environments. • **Decreasing** the number of beacons may improve throughput in environments where interference is minimal. **FREEWAVE Recommends**: Set the Beacon Burst Count (on page 286) to 2 or more for optimal throughput when Repeaters are used and the RF environment is noisy. This increases the number of beacons sent in a beacon interval.

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26.2. Beacon Interval

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Beacon Interval	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]

CLI Command	• `radioSettings.beaconInterval=TWENTY_FIVE_MS`
	  • `beaconInterval=TWENTY_FIVE_MS`
	• `radioSettings.beaconInterval=FIFTY_MS`
	  • `beaconInterval=FIFTY_MS`
	• `radioSettings.beaconInterval=ONE_HUNDRED_MS`
	  • `beaconInterval=ONE_HUNDRED_MS`
	• `radioSettings.beaconInterval=TWO_HUNDRED_MS`
	  • `beaconInterval=TWO_HUNDRED_MS`
	• `radioSettings.beaconInterval=FOUR_HUNDRED_MS`
	  • `beaconInterval=FOUR_HUNDRED_MS`

Web Interface window	Beacon Interval 1. Click the **Beacon Interval** list box arrow and select how often a Gateway radio sends out a beacon packet and changes to the next radio frequency in the hopping pattern. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	ONE_HUNDRED_MS
Options	• TWENTY_FIVE_MS • FIFTY_MS • ONE_HUNDRED_MS • TWO_HUNDRED_MS • FOUR_HUNDRED_MS

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Beacon Interval	
Setting	**Description**
Description	The **radioSettings.beaconInterval** controls how often a Gateway radio sends out a beacon packet and changes to the next radio frequency in the hopping pattern. **Notes** • The **radioSettings.beaconInterval** is set only on the Gateway device. • The Endpoint radios obtain this value from a Gateway with the same **networkId** via the beacon frame. • This setting is **only** used when `radiosettings.radioHoppingMode=Hopping_On`. • A **shorter Beacon Interval** may improve the RF link reliability in noisy environments. Tip A **longer Beacon Interval** may improve throughput in environments where interference is minimal.

26.3. Frequency Key

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Frequency Key	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]

CLI Command	• `radioSettings.frequencyKey=Key0`
	  • `frequencyKey=Key0`
	• `radioSettings.frequencyKey=Key1 to Key16`
	  • `frequencyKey=Key1 to Key16`

Web Interface window	Frequency Key 1. Click the **Frequency Key** list box arrow and select the Key number used as an index to select a hopping table. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	Key0 (zero)

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Frequency Key	
Setting	**Description**
Options	• Key0 (zero) • Key1 to Key16 **Valid frequencyKey Values**

Data Rate of 115.2K	
Frequency Key Values	**Description**
Key0 to Key14	Select classic hop tables.
Key15	Select standard randomized hop table.
Key16	Select sequential hop table in reverse order of center frequencies.

All Other Data Rates	
Frequency Key Values	**Description**
Key0	Select standard randomized hop table.
Key1	Select sequential hop table in reverse order of center frequencies.

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Frequency Key	
Setting	**Description**

Description	The **radioSettings.frequencyKey** setting designates the Key number used as an index to select a hopping table.
	Notes
	• Use a unique **Frequency Key** setting to use different hop patterns for each ZumLink network.
	• This setting is **only** used when `radiosettings.radioHoppingMode=Hopping_On`.
	  • The number of available frequency keys is based on the number of hopping sequences in the hop table.
	• An invalid frequency key setting is determined by being outside of the specified range.
	  • If an invalid frequency key setting is found, the **radioSettings.frequencyKey** is NOT changed.
	  • A frequency key setting is also invalid if the frequency key setting is larger than the number of hopping tables configured for a specific RF Data Rate (on page 307).
	  • In this instance, the **radioSettings.frequencyKey** is set to Key0 (zero).
	Important!: The Endpoint radios obtain this value from a Gateway with the same Network ID (on page 296) via the beacon frame.
	After communications are established, any change of this value are picked up by the Endpoints.
	
	When using different hop patterns on each network, interference caused by neighboring **ZumLink** networks can be minimized.

26.4. Frequency Masks

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Frequency Masks	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]

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Frequency Masks	
Setting	**Description**
CLI Command	• `radioSettings.frequencyMasks=nnnn` • `frequencyMasks=nnnn` **Note**: Where `nnnn` is the specified format of the frequency range to mask shown in: A. Single Channel Format, B. Range of Channels Format, or C. Combination of Channels Format. **Important!**: Hop table frequency masking masks the channels that fall within the range plus or minus one-half (½) the channel bandwidth.
Web Interface window	Frequency Masks 1. In the **Frequency Masks** text box, enter the exact specified format of the frequency range to mask. 2. Click the **Update** button to save the change. 3. Wait a few seconds the for the radio to process the command. 4. Refresh the radio Web Interface and review the **Frequency Masks** text box to verify the mask was accepted. 5. If the frequency mask setting is NOT what was requested, click the **Radio Settings Helpers** menu. Figure 204 **Figure 204: Radio Settings Helpers menu** 6. In the Radio Settings Helpers window (on page 404), review the Frequency Masks Errors (on page 312) to determine the error that exists in the frequency mask string. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	Blank

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Frequency Masks	
Setting	**Description**
Options	**Caution**: ONLY A comma MUST separate the values - NOT a comma with a space. **Use this information in examples A to C:** • xxx is a value between 902-927 MHz. • yyyy is a value between .0000-.9999 MHz. **A. Single Channel Format** • A single entry masks the specified frequency plus the bandwidth on each side of the center frequency as a function of the **rfDataRate**. • `frequencyMasks=xxx.yyyy,xxx.yyyy,xxx.yyyy` **B. Range of Channels Format** **Important!**: If a radio channel intersects with the mask limits, it will be masked and not used. • `frequencyMasks=xxx.yyyy-xxx.yyyy,xxx.yyyy-xxx.yyyy` **C. Combination of Channels Format** • `frequencyMasks=xxx.yyyy-xxx.yyyy,xxx.yyyy`

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Frequency Masks	
Setting	**Description**

Description	The **radioSettings.frequencyMasks** setting designates specific frequencies or a set of frequencies in the hopping pattern to remove from usage.
	
	Caution: **radioSettings.frequencyMasks** entries MUST BE less than 128 bytes.
	
	Notes
	• This setting is **only** used when `radiosettings.radioHoppingMode=Hopping_On`.
	• All radios in the network **MUST** use the same value for this parameter.
	• When **Frequency Masks** is enabled, interference fixed at certain frequencies within the spectrum can be avoided by the transmitter.
	• Least significant zeros are NOT required.
	  • .9, .09, .009 are valid entries as well as .9000, .0900, .0090.
	• The **radioSettings.frequencyMasks** parameter needs to be re-entered when moving between RF Data Rate (on page 307).
	
	Type `frequencyMasks=` and press <Enter> to clear all **Frequency Mask** entries.
	
	Important!: Special rules must be applied for the 115.2 and 250 kbps data rates to enforce regulatory rules.
	
	Notes for 115.2 and 250 kbps Rates for Regulatory Compliance
	For 115.2 kbps:
	• If the number of hopping channels contained in the hop table is > 50, TX Power (on page 309) can be set to values up to and including 30 dBm.
	  • **radioSettings.txPower** is NOT automatically changed.
	• If the number of hopping channels contained in the hop table is < 50, all masking is removed and all of the channels contained in the hop table are re-enabled.
	• **radioSettings.txPower** is NOT automatically changed.
	
	For 250 kbps:
	• If the number of hopping channels contained in the hop table is > 50, TX Power (on page 309) can be set to values up to and including 30 dBm.
	  • **radioSettings.txPower** is NOT automatically changed.
	• If the number of hopping channels contained in the hop table is >= 25, but < 50, **radioSettings.txPower** can be set to values up to and including 24 dBm.
	  • **radioSettings.txPower** is automatically reduced to 24 dBm.

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Frequency Masks	
Setting	**Description**
	• If the number of hopping channels contained in the hop table is < 25, all masking is removed and all of the channels contained in the hop table are re-enabled. • **radioSettings.txPower** is NOT automatically changed.

26.5. LNA Bypass

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

LNA Bypass	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]

CLI Command	• **Enable LNA**:
	  • `radioSettings.lnaBypass=0`
	  • `lnaBypass=0`
	• **Bypass LNA**:
	  • `radioSettings.lnaBypass=1`
	  • `lnaBypass=1`

Web Interface window	LNA Bypass 1. In the **LNA Bypass** text box, enter **1** to bypass the Low Noise Amplifier (LNA) and reduce the radio module receive signal by 10dB. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	0 (zero)
Options	• 0 • 1
Description	When set to **1**, the **radioSettings.lnaBypass** parameter bypasses the Low Noise Amplifier (LNA) and reduces the radio module receive signal by 10 dB. It can be useful to bypass the LNA if there is a presence of strong signals in band and packet reception is not good.

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26.6. Max Link Distance in Miles

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Max Link Distance in Miles	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]
CLI Command	• `radioSettings.maxLinkDistanceinMiles=nnn` • `maxLinkDistanceinMiles=nnn` **Note**: Where `nnn` is the maximum one-way distance (in miles) between any nodes in the network.
Web Interface window	Max Link Distance in Miles 1. In the **Max Link Distance in Miles** text box, enter the maximum one-way distance (in miles) used to set the maximum expected propagation delay between any Endpoints in the network. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	20 miles
Options	• The minimum value is miles. • The maximum value is 120 miles.
Description	The **radioSettings.maxLinkDistanceinMiles** parameter designates the maximum one-way distance (in miles) used to set the maximum expected propagation delay between any Endpoints in the network. **Notes** • If the parameter is set too small, then packets are retransmitted unnecessarily and could significantly reduce throughput. • If the parameter is set larger than the maximum propagation delay, it will take longer than needed to retransmit lost packets. **FREEWAVE Recommends**: Set a slightly larger number than needed. All Endpoints in the network that communicate with each other should use the same distance value.

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26.7. Network ID

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Network ID	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]
CLI Command	• `radioSettings.networkId=nnnn` • `networkId=nnnn` **Note**: Where `nnnn` is the network identifier which subdivides traffic on radio units.
Web Interface window	Network ID 1. In the **Network ID** text box, enter the network identifier that subdivides traffic on radio units. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	51966
Options	• The minimum value is 2. • The maximum value is 65535.
Description	The **radioSettings.networkId** parameter designates the network identifier which subdivides traffic on radio units. **Notes** • Radio units can **only** communicate with other units that have the same **radioSettings.networkId** setting. **Important!**: If radios are on the same frequency, they still receive data from radios of a different **networkId**, but the data is dropped.

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26.8. Node ID

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Node ID	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]
CLI Command	• `radioSettings.nodeId=nnnn` • `nodeId=nnnn` **Note**: Where `nnnn` is a user-designated nodeId instead of the auto-generated nodeId.
Web Interface window	Node ID 1. In the **Node ID** text box, enter a user-designated **nodeId** instead of the auto-generated **nodeId**. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	Predetermined by the Z9-P2 or Z9-PE2, this is an auto-generated, unique number from 2 through 65533.
Options	N/A
Description	The **radioSettings.nodeId** parameter designates the unique ID of the device. **Notes** • Each radio with the same **networkId** **must have** a UNIQUE **nodeId**. • Otherwise, two or more nodes will unicast an acknowledgment that may collide. • The Gateway or Gateway-Repeater device **ALWAYS** has a **nodeId** of value 1. It cannot be changed.

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26.9. Radio Frequency

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Radio Frequency	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]
CLI Command	• `radioSettings.radioFrequency=nnn.nnnn` • `radioFrequency=nnn.nnnn` **Note**: Where `nnn.nnnn` is the operating center frequency.
Web Interface window	Radio Frequency 1. In the **Radio Frequency** text box, enter the operating center frequency. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	915.0000 for the Standard Hop Set - 900 MHz Channels (on page 431)
Options	**Valid Ranges**

Data Rate	MHz Range
4 Mbps	904.5504 - 925.7472
1.5 Mbps (Beta)	903.2562 - 925.8354
1 Mbps	903.0528 - 927.0144
500 kbps	902.7072 - 927.3600
250 kbps	902.5344 - 927.4176
115.2 kbps	902.4768 - 927.5904

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Radio Frequency	
Setting	**Description**
Description	The **radioSettings.radioFrequency** parameter designates the operating center frequency in MHz. **Notes** • All radios in the network **MUST** use the same value for this parameter. • This setting is **only** used when `radiosettings.radioHoppingMode=Hopping_Off`. • The range of this parameter is dependent on the RF Data Rate (on page 307) setting. • The frequency interval is 100 Hz. • The minimum value increases and the maximum value decreases as the **radioSettings.rfDataRate** increases. • The increase in channel bandwidth affects these ranges. • If the **radioSettings.radioFrequency** parameter is set too close to the band edge for the current **radioSettings.rfDataRate**, the radio module rejects the setting. • A minimum of 3 hopping channels are supported when **radioSettings.rfDataRate** =`RATE_4M`, `RATE_1M`, and `RATE_500K`. **FREEWAVE Recommends**: Use a single **radioSettings.radioFrequency** if `radiosettings.radioHoppingMode=Hopping_Off`. **Important!**: A few seconds are needed to apply the change; allow some time prior to reading back this value. Tip: Read back this value after setting it to determine if it was accepted by the Z9-P2 or Z9-PE2.

26.10. Radio Hopping Mode

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Radio Hopping Mode	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]

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Radio Hopping Mode	
Setting	**Description**

CLI Command	• **Enable**:
	  • `radiosettings.radioHoppingMode=Hopping_On`
	  • `radioHoppingMode=Hopping_On`
	• **Disable**:
	  • `radiosettings.radioHoppingMode=Hopping_Off`
	  • `radioHoppingMode=Hopping_Off`

Web Interface window	Radio Hopping Mode 1. Click the **Radio Hopping Mode** list box arrow and select **Off** to disable frequency hopping. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	Hopping_On
Options	• Hopping_Off • Hopping_On

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Radio Hopping Mode	
Setting	**Description**

Description	The **radioSettings.radioHoppingMode** parameter enables frequency hopping.
	Notes
	• All radios in the network **MUST** use the same value for this parameter.
	• For **rfDataRate** values of 115.2 and 250 kbps, the **radioSettings.radioHoppingMode** is forced **On** and CANNOT be set to `radiosettings.radioHoppingMode=Hopping_Off`.
	• For **rfDataRate** values of 500 kbps, 1 Mbps, and 4 Mbps, the choice of the selected hopping mode is based on network frequency planning and channel conditions.
	• A Gateway **is required** when the `radiosettings.radioHoppingMode=Hopping_On`.
	• A Gateway **is NOT required** when the `radiosettings.radioHoppingMode=Hopping_Off`.
	Important!: Special rules must be applied for the 115.2 and 250 kbps data rates to enforce regulatory rules.
	Notes for 115.2 and 250 kbps Rates for Regulatory Compliance
	For 115.2 kbps:
	• If the number of hopping channels contained in the hop table is > 50, TX Power (on page 309) can be set to values up to and including 30 dBm.
	  • **radioSettings.txPower** is NOT automatically changed.
	• If the number of hopping channels contained in the hop table is < 50, all masking is removed and all of the channels contained in the hop table are re-enabled.
	• **radioSettings.txPower** is NOT automatically changed.
	For 250 kbps:
	• If the number of hopping channels contained in the hop table is > 50, TX Power (on page 309) can be set to values up to and including 30 dBm.
	  • **radioSettings.txPower** is NOT automatically changed.
	• If the number of hopping channels contained in the hop table is >= 25, but < 50, **radioSettings.txPower** can be set to values up to and including 24 dBm.
	  • **radioSettings.txPower** is automatically reduced to 24 dBm.
	• If the number of hopping channels contained in the hop table is < 25, all masking is removed and all of the channels contained in the hop table are re-enabled.
	  • **radioSettings.txPower** is NOT automatically changed.

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26.11. Radio Max Repeaters

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Radio Max Repeaters	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]
CLI Command	• `radioSettings.radioMaxRepeaters=n` • `radioMaxRepeaters=n` **Note**: Where `n` is the number of Repeater slots in the network.
Web Interface window	Radio Max Repeaters 1. In the **Radio Max Repeaters** text box, enter the number of Repeater slots in the network. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	0 (zero)
Options	• 0 (zero) • 1 • 2 • 3

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Radio Max Repeaters	
Setting	**Description**

Description	The **radioSettings.radioMaxRepeaters** parameter designates the maximum Repeater slots in the network when the `radiosettings.radioHoppingMode=Hopping_On`.
	Notes
	• The Endpoint radios obtain this value from a Gateway with the same **networkId** via the beacon frame.
	• The **radioSettings.radioMaxRepeaters** is set on the network Gateway device and the Gateway beacon carries this information.
	• If `radioSettings.radioMaxRepeaters=0`:
	  • Set the value to `0 (zero)` when there are no Endpoint-Repeaters or when `radiosettings.radioHoppingMode=Hopping_Off`.
	• If `radioSettings.radioMaxRepeaters=n`:
	  • If the network has one Repeater, set this to `1`.
	  • If the network has two Repeaters, set this to `2`.
	  • If the network has three or more Repeaters, set this to `3`.
	  • Set the value to match the number of overlapping Repeaters, with a maximum of 3.
	  • Set the value to the **maximum number** of repeater slots used in the network when Endpoint-Repeaters are present in the network and when the `radiosettings.radioHoppingMode=Hopping_On`.
	Note: Setting this value too high adds unnecessary latency to the network.
	Communication Method
	The Z9-P2 or Z9-PE2 use Listen Before Talk (LBT) and Carrier Sense Multiple Access (CSMA). There are no assigned slots. The radios transmit when the channel is clear.
	• The Gateway broadcasts packets to all Endpoints and Endpoint-Repeaters within range.
	• The Endpoints unicast packets back to the Gateway or downstream Endpoint-Repeaters.
	• The Gateway acknowledges the Endpoint or Endpoint-Repeater packets.
	FreeWave's traditional protocol has a Gateway Time Slot and an Endpoint Time Slot within a frame.
	• The Gateway transmits in its slot and listens in the Endpoint slot.
	• The Endpoint transmits its slot and listens in the Gateway slot.

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26.12. Radio Mode

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Radio Mode	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]

CLI Command	• `radioSettings.radioMode=Gateway`
	  • `radioMode=Gateway`
	• `radioSettings.radioMode=Endpoint`
	  • `radioMode=Endpoint`
	• `radioSettings.radioMode=Gateway_Repeater`
	  • `radioMode=Gateway_Repeater`
	• `radioSettings.radioMode=Endpoint_Repeater`
	  • `radioMode=Endpoint_Repeater`

Web Interface window	Radio Mode 1. Click the **Radio Mode** list box arrow and select the device type to designate the Z9-P2 or Z9-PE2 as. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	Endpoint
Options	• Endpoint • Endpoint-Repeater • Gateway • Gateway-Repeater

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Radio Mode	
Setting	**Description**

Description	The **radioSettings.radioMode** parameter designates the device type.
	Notes
	• Each network can have only ONE Gateway or Gateway-Repeater device.
	  • See Repeaters (on page 171) for additional information.
	• The remaining devices MUST BE configured as Endpoints or Endpoint-Repeaters.
	• The Gateway or Gateway-Repeater device **ALWAYS** has a **nodeId** of value 1. It cannot be changed.
	• The Endpoint or Endpoint-Repeater **nodeId** values are 2 through 65535.
	• A Gateway **is required** when the `radiosettings.radioHoppingMode=Hopping_On`.
	• A Gateway **is NOT required** when the `radiosettings.radioHoppingMode=Hopping_Off`.
	• The Gateway-Repeater repeats packets.
	• The Endpoint-Repeater has a unique **nodeId** and repeats packets and master beacons.
	  • See Repeaters (on page 171) for additional information.

26.13. Radio Repeater Slot

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

Radio Repeater Slot	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]
CLI Command	• `radioSettings.radioRepeaterSlot=n` • `radioRepeaterSlot=n` **Note**: Where `n` is the Repeater slot.

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Radio Repeater Slot	
Setting	**Description**
Web Interface window	Radio Repeater Slot 1. In the **Radio Repeater Slot** text box, enter which repeater slot the Endpoint-Repeater uses. 2. Click the **Update** button to save the change. **Note**: The **Radio Repeater Slot** parameter is only visible when the Z9-P2 or Z9-PE2 is designated as an Endpoint-Repeater. See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	1
Options	• 1 • 2 • 3
Description	The **radioSettings.radioRepeaterSlot** parameter designates which repeater slot, up to the Radio Max Repeaters setting, the Endpoint-Repeater uses. **Important!**: This setting is only available when `radioSettings.radioMode=Endpoint_Repeater`. **Notes** • The **radioSettings.radioRepeaterSlot** is set on the Endpoint-Repeater device when `radiosettings.radioHoppingMode=Hopping_On`. • This setting does NOT apply when `radiosettings.radioHoppingMode=Hopping_Off`. • Repeater slots **must be** unique for Repeaters that are in communication range so the beacons do not collide. • Endpoint-Repeaters can share a slot number when they do not overlap and form longer repeater chains. • The number of entered Repeater slots cannot be larger than the numbered entered in the Radio Max Repeaters (on page 302) setting.

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26.14. RF Data Rate

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

RF Data Rate	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]

CLI Command	• `radioSettings.rfDataRate=RATE_4M`
	  • `rfDataRate=RATE_4M`
	• `radioSettings.rfDataRate=RATE_1M`
	  • `rfDataRate=RATE_1M`
	• `radioSettings.rfDataRate=RATE_1.5M_BETA_FEATURE`
	  • `rfDataRate=RATE_1.5M_BETA_FEATURE`
	• `radioSettings.rfDataRate=RATE_500K`
	  • `rfDataRate=RATE_500K`
	• `radioSettings.rfDataRate=RATE_250K`
	  • `rfDataRate=RATE_250K`
	• `radioSettings.rfDataRate=RATE_115.2K`
	  • `rfDataRate=RATE_115.2K`

Web Interface window	RF Data Rate 1. Click the **RF Data Rate** list box arrow and select the RF link data rate in bits per second. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	RATE_500K
Options	• RATE_4M (4 Mbps mode) • RATE_1M (1 Mbps mode) • RATE_1.5M_BETA_FEATURE • RATE_500K (500 kbps mode) • RATE_250K (250 kbps mode) • RATE_115.2K (115.2 kbps mode)

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RF Data Rate	
Setting	**Description**

Description	The **radioSettings.rfDataRate** parameter designates the RF link data rate in bits per second.
	Notes
	• All radios in the network **MUST** use the same value for this parameter.
	• A higher RF link data rate provides more throughput but at the expense of link distance or fade margin.
	• When changing from lower data rates to higher ones (e.g., `rfDataRate=RATE_115.2K` to `rfDataRate=RATE_1M`), the Radio Frequency (on page 298) may be set back to the default if the frequency would have been out of band.
	• When selecting data rates of either `rfDataRate=RATE_115.2K` or `rfDataRate=RATE_250K`, **radioSettings.radioHoppingMode** is automatically forced to `radiosettings.radioHoppingMode=Hopping_On` and **cannot** be turned off.
	• For all other data rates, the **radioSettings.radioHoppingMode** remains at its current setting.
	Important!: Special rules must be applied for the 115.2 and 250 kbps data rates to enforce regulatory rules.
	Notes for 115.2 and 250 kbps Rates for Regulatory Compliance
	For 115.2 kbps:
	• If the number of hopping channels contained in the hop table is > 50, TX Power (on page 309) can be set to values up to and including 30 dBm.
	  • **radioSettings.txPower** is NOT automatically changed.
	• If the number of hopping channels contained in the hop table is < 50, all masking is removed and all of the channels contained in the hop table are re-enabled.
	• **radioSettings.txPower** is NOT automatically changed.
	For 250 kbps:
	• If the number of hopping channels contained in the hop table is > 50, TX Power (on page 309) can be set to values up to and including 30 dBm.
	  • **radioSettings.txPower** is NOT automatically changed.
	• If the number of hopping channels contained in the hop table is >= 25, but < 50, **radioSettings.txPower** can be set to values up to and including 24 dBm.
	  • **radioSettings.txPower** is automatically reduced to 24 dBm.
	• If the number of hopping channels contained in the hop table is < 25, all masking is removed and all of the channels contained in the hop table are re-enabled.

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RF Data Rate	
Setting	**Description**
	• **radioSettings.txPower** is NOT automatically changed. **FREEWAVE Recommends**: Use a single **radioSettings.radioFrequency** if `radiosettings.radioHoppingMode=Hopping_Off`. **Caution**: The `RATE_1.5M_BETA_FEATURE` data rate is a Beta feature NOT recommended for production deployment.

26.15. TX Power

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

TX Power	
Setting	**Description**
CLI / Web Page	[Page=radioSettings]
CLI Command	• `radioSettings.txPower=nn` • `txPower=nn` **Note**: Where `nn` is the RF output transmit power. **Important!**: Entering a decimal value changes the **txpower** to 0 (zero). **FREEWAVE Recommends**: Use whole numbers only.
Web Interface window	TX Power 1. Click the **Tx Power** list box arrow and select the dB RF output transmit power level for the Z9-P2 or Z9-PE2. 2. Click the **Update** button to save the change. **Note**: See the Radio Settings window - Endpoint (on page 396) for parameter location.
Default Setting	• 30

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TX Power	
Setting	**Description**
Options	• The minimum value is 10. • The maximum value is 30.
Description	The **radioSettings.txPower** setting designates the dB RF output transmit power for the Z9-P2 or Z9-PE2. **Notes** • Output power is limited to maximum of 30dBm or 1 Watt. • Use a higher power to increase link margin. • Use a lower transmit power to reduce interference when multiple radio links are in close proximity. • The maximum **radioSettings.txPower** can be limited if the `radiosettings.radioHoppingMode=Hopping_On`. • See Frequency Masks (on page 290) for additional details. Entering **txpower=0** or **radiosettings.txpower=0** changes the output power to the minimum or 10 dB.

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27. Radio Settings Helpers Parameters

Note: See the Radio Settings Helpers window (on page 404).

- Frequency Masks Errors (on page 312)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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27.1. Frequency Masks Errors

Frequency Masks Errors	
Setting	**Description**
CLI / Web Page	[Page=radioSettingsHelpers]
CLI Command	• `radioSettingsHelpers.frequencyMasksErrors` • `radioSettingsHelpers`
Web Interface window	Frequency Masks Errors **Note**: This parameter is read-only in the Web Interface. See the Radio Settings Helpers window (on page 404) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **radioSettingsHelpers.frequencyMasksErrors** command reports the results of any errors in the Frequency Masks (on page 290). **Note**: This is a Read-only parameter.

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28. Runtime Environment Parameters

Note: See the Runtime Environment window (on page 406).

Rte Installed by Apps Version (on page 314)
Rte Reset (on page 314)
Rte Template Version (on page 315)
Rte Version (on page 316)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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28.1. Rte Installed by Apps Version

Rte Installed by Apps Version	
Setting	**Description**
CLI / Web Page	[Page=runtimeEnvironment]
CLI Command	• `runtimeEnvironment.rteInstalledByAppsVersion` • `rteInstalledByAppsVersion`
Web Interface window	Rte Installed by Apps Version **Note**: This parameter is read-only in the Web Interface. See the Runtime Environment window (on page 406) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **runtimeEnvironment.rteInstalledByAppsVersion** parameter reports the version number of the firmware used to install the runtime developer environment. **Important!**: The firmware that installed the runtime developer environment may have a different version than the developer environment itself. **Note**: This is a Read-only parameter.

28.2. Rte Reset

Rte Reset	
Setting	**Description**
CLI / Web Page	[Page=runtimeEnvironment]

CLI Command	• `runtimeEnvironment.rteReset=Cancel`
	  • `rteReset=Cancel`
	• `runtimeEnvironment.rteReset=Hard`
	  • `rteReset=Hard`
	• `runtimeEnvironment.rteReset=Now`
	  • `rteReset=Now`

Web Interface window	Rte Reset **Note**: This parameter is read-only in the Web Interface. See the Runtime Environment window (on page 406) for parameter location.

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Rte Reset	
Setting	**Description**
Default Setting	N/A
Options	• Cancel • Hard • Now

Description	The **runtimeEnvironment.rteReset** parameter designates the update or reset of the runtime application environment.
	Notes
	• `runtimeEnvironment.rteReset=Cancel` is used to REMOVE the `rteReset=Hard` command BEFORE the next boot of the Z9-P2 or Z9-PE2.
	• `runtimeEnvironment.rteReset=Hard` completely resets the file system of the runtime application environment to match the latest installed developer user package.
	  • This will stage the development runtimeEnvironment to be applied on the next reboot.
	  • The runtime application environment reset takes place at the time of next boot.
	Warning! ALL User-generated content and settings in Z9-P2 or Z9-PE2 ARE DELETED after the next reboot!
	• `runtimeEnvironment.rteReset=Now`
	  • This reboots the Z9-P2 or Z9-PE2 and copies the Linux application environment into the runtime location.
	This will take several minutes to complete.
	The larger the **IQ Application Environment**, the longer the time needed.

28.3. Rte Template Version

Rte Template Version	
Setting	**Description**
CLI / Web Page	[Page=runtimeEnvironment]
CLI Command	• `runtimeEnvironment.rteTemplateVersion` • `rteTemplateVersion`
Web Interface window	Rte Template Version **Note**: This parameter is read-only in the Web Interface. See the Runtime Environment window (on page 406) for parameter location.

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Rte Template Version	
Setting	**Description**
Default Setting	N/A
Options	N/A
Description	The **runtimeEnvironment.rteTemplateVersion** parameter reports the version number for the IQ environment template. This is the IQ environment applied when executing the **rteReset=hard** command. **Note**: See Rte Reset (on page 314) for additional information. This is a Read-only parameter.

28.4. Rte Version

Rte Version	
Setting	**Description**
CLI / Web Page	[Page=runtimeEnvironment]
CLI Command	• runtimeEnvironment.rteVersion • rteVersion
Web Interface window	Rte Version **Note**: This parameter is read-only in the Web Interface. See the Runtime Environment window (on page 406) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **runtimeEnvironment.rteVersion** parameter reports the version number for the active IQ environment **Note**: If this setting is blank, the application environment has not been initialized. This is a Read-only parameter.

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29. Security Parameters

Note: See the Security window (on page 408).

Enable Ethernet Login (on page 318)
Ethernet PTP Interface (on page 318)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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29.1. Enable Ethernet Login

Enable Ethernet Login	
Setting	**Description**
CLI / Web Page	[Page=security]

CLI Command	• **Enable**:
	  • `security.enableEthernetLogin=true`
	  • `enableEthernetLogin=true`
	• **Disable**:
	  • `security.enableEthernetLogin=false`
	  • `enableEthernetLogin=false`

Web Interface window	Enable Ethernet Login 1. Click the **Enable Ethernet Login** list box arrow and select **False** to disable SSH logins. 2. Click the **Update** button to save the change. **Note**: By default, the **Enable Ethernet Login** is enabled (set to True). See the Security window (on page 408) for parameter location.
Default Setting	True
Options	• True • False
Description	The **security.enableEthernetLogin** parameter enables SSH logins. • When **Disabled**, the device no longer responds to SSH connection requests. • This parameter also disables any SSH-based services, such as SCP. **Important!**: This parameter does NOT affect website logins. This parameter **requires** a reboot to apply the changes, either by executing the **`config.reset=now`** CLI command or power cycling the Z9-P2 or Z9-PE2. See Reset (on page 214) for additional information.

29.2. Ethernet PTP Interface

Ethernet PTP Interface	
Setting	**Description**
CLI / Web Page	[Page=security]

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Ethernet PTP Interface	
Setting	**Description**

CLI Command	• **Enable**:
	  • `security.enablePtpInterface=true`
	  • `enablePtpInterface=true`
	• **Disable**:
	  • `security.enablePtpInterface=false`
	  • `enablePtpInterface=false`

Web Interface window	Ethernet PTP Interface 1. Click the **Ethernet PTP Interface** list box arrow and select **False** to disable the PTP (drag-and-drop) interface. 2. Click the **Update** button to save the change. **Note**: By default, the **Ethernet PTP Interface** is enabled (set to True). See the Security window (on page 408) for parameter location.
Default Setting	True
Options	• True • False
Description	The **security.enablePtpInterface** parameter enables the PTP (drag-and-drop) interface. When **Disabled**, the Z9-P2 or Z9-PE2 no longer appears in **Windows® File Explorer** as _____<serialnumber> when connected to a computer using the Micro-USB cable. **Note**: Where _____ is the name of the Z9-P2 or Z9-PE2. **Important!**: The **security.enablePtpInterface** setting does NOT disable serial connections through the Micro-USB cable. This parameter **requires** a reboot to apply the changes, either by executing the **`config.reset=now`** CLI command or power cycling the Z9-P2 or Z9-PE2. See Reset (on page 214) for additional information.

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30. Services Parameters

Note: See the Services window (on page 410).

Time Out CLI (on page 321)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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30.1. Time Out CLI

Time Out CLI	
Setting	**Description**
CLI / Web Page	[Page=services]
CLI Command	• `services.timeOutCli=nnnn` • `timeOutCli=nnnn` **Note**: Where `nnnn` is the number of seconds of idle time.
Web Interface window	Time Out CLI 1. In the **Time Out CLI** text box, enter the number of seconds of idle time before the CLI connection is closed. 2. Click the **Update** button to save the change. **Note**: See the Services window (on page 410) for parameter location.
Default Setting	900
Options	**FREEWAVE Recommends**: Enter any number between 60 and 3600.
Description	The **services.timeOutCli** parameter designates the number of seconds of idle time before the CLI connection is closed. **Warning!** DO NOT enter 0 (zero). 0 disables the timeout.

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31. SNMP Parameters

Note: See the SNMP window (on page 412).

RO Community Name (on page 323)
RW Community Name (on page 323)
SNMP User (on page 324)
V1 Enabled (on page 325)
V2C Enabled (on page 326)
V3 Enabled (on page 327)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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31.1. RO Community Name

RO Community Name	
Setting	**Description**
CLI / Web Page	[Page=SNMP]
CLI Command	• `snmp.roCommunityName=enter_unique_name_here` • `roCommunityName=enter_unique_name_here` **Note**: Where `enter_unique_name_here` is a user-designated name.
Web Interface window	RO Community Name 1. In the **RO Community Name** text box, enter the user-designated name for SNMP V1/V2C Read-only access. 2. Click the **Update** button to save the change. **Note**: See the SNMP window (on page 412) for parameter location.
Default Setting	public
Options	Maximum of 31 characters.
Description	The **snmp.roCommunityName** parameter designates the user-defined name for SNMP V1/V2C read-only access. **Important!**: Special characters are allowed EXCEPT # but they **may not** be compatible with 3rd-party SNMP managers.

31.2. RW Community Name

RW Community Name	
Setting	**Description**
CLI / Web Page	[Page=SNMP]
CLI Command	• `snmp.rwCommunityName=enter_unique_name_here` • `rwCommunityName=enter_unique_name_here` **Note**: Where `enter_unique_name_here` is a user-designated name.

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RW Community Name	
Setting	**Description**
Web Interface window	RW Community Name 1. In the **RW Community Name** text box, enter the user-designated name for SNMP V1/V2C Read-Write access. 2. Click the **Update** button to save the change. **Note**: See the SNMP window (on page 412) for parameter location.
Default Setting	private
Options	Maximum of 31 characters.
Description	The **snmp.rwCommunityName** parameter designates the user-defined name for SNMP V1/V2C read-write access. **Important!**: Special characters are allowed EXCEPT # but they **may not** be compatible with 3rd-party SNMP managers.

31.3. SNMP User

SNMP User	
Setting	**Description**
CLI / Web Page	[Page=SNMP]

CLI Command	• **Add User****:
	  • `snmpUser=add <username>`
	Example: `snmpUser=add <username> <ReadOnly or ReadWrite> <MD5 or SHA> <Authentication Passphrase> <AES or DES> <Encryption Passphrase>`
	• **Modify User****:
	  • `snmpUser=modify <username>`
	Example: `snmpUser modify <username> <ReadOnly or ReadWrite> <MD5 or SHA> <Authentication Passphrase> <AES or DES> <Encryption Passphrase>`
	• **Remove User**:
	  • `snmpUser=remove <username>`
	• **View All Users**:
	  • `snmpUser=show`

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SNMP User	
Setting	**Description**
Web Interface window	SNMP User **Note**: This parameter is read-only in the Web Interface. See the SNMP window (on page 412) for parameter location.
Default Setting	Blank
Options	• Add User • Modify User • Remove User • View All Users **Note**: ****Add** or **Modify** access authorization options are: • <AES> <Encryption Passphrase> • <DES> <Encryption Passphrase> • <MD5> <Authentication Passphrase> • <ReadOnly> • <ReadWrite> • <SHA> <Authentication Passphrase>
Description	The **snmp.snmpUser** parameter manages the SNMP V3 users. **Example**: `snmpUser=add <username> <AES> <Encryption Passphrase>`. `snmpUser=modify <username> <ReadWrite>` **Important!**: The Passphrase requires a minimum of 8 characters.

31.4. V1 Enabled

V1 Enabled	
Setting	**Description**
CLI / Web Page	[Page=SNMP]

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V1 Enabled	
Setting	**Description**

CLI Command	• **Enable SNMP V1**:
	  • `snmp.v1Enabled=true`
	  • `v1Enabled=true`
	• **Disable SNMP V1**:
	  • `snmp.v1Enabled=false`
	  • `v1Enabled=false`

Web Interface window	V1 Enabled 1. Click the **V1 Enabled** list box arrow and select **True** to enable SNMP V1. 2. Click the **Update** button to save the change. **Note**: See the SNMP window (on page 412) for parameter location.
Default Setting	False
Options	False
Description	The **snmp.v1Enabled** parameter enables SNMP V1. **Important!**: For security, the protocol **SNMP v1** is read-only.

31.5. V2C Enabled

V2C Enabled	
Setting	**Description**
CLI / Web Page	[Page=SNMP]

CLI Command	• **Enable SNMP V2C**:
	  • `snmp.v2cEnabled=true`
	  • `v2cEnabled=true`
	• **Disable SNMP V2C**:
	  • `snmp.v2cEnabled=false`
	  • `v2cEnabled=false`

Web Interface window	V2C Enabled 1. Click the **V2C Enabled** list box arrow and select **True** to enable SNMP V2C. 2. Click the **Update** button to save the change. **Note**: By default, the **v2c Enabled** is NOT enabled (set to False). See the SNMP window (on page 412) for parameter location.

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V2C Enabled	
Setting	**Description**
Default Setting	False
Options	• True • False
Description	The **snmp.v2cEnabled** parameter enables SNMP V2C.

31.6. V3 Enabled

V3 Enabled	
Setting	**Description**
CLI / Web Page	[Page=SNMP]

CLI Command	• **Enable SNMP V3**:
	  • `snmp.v3Enabled=true`
	  • `v3Enabled=true`
	• **Disable SNMP V3**:
	  • `snmp.v3Enabled=false`
	  • `v3Enabled=false`

Web Interface window	V3 Enabled 1. Click the **V3 Enabled** list box arrow and select **True** to enable SNMP V3. 2. Click the **Update** button to save the change. **Note**: By default, the **v3 Enabled** is NOT enabled (set to False). See the SNMP window (on page 412) for parameter location.
Default Setting	False
Options	• True • False
Description	The **snmp.v3Enabled** parameter enables SNMP V3.

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32. System Parameters

Important!: The [Page=system] parameters are only available in the CLI window.
See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.

dump (on page 329)
dumpFormat (on page 329)
dumpPage (on page 330)
dumpTag (on page 331)
filter (on page 331)
help (on page 331)
login (on page 332)
logout (on page 332)
pages (on page 333)
password (on page 333)
passwordRestoreDefaults (on page 334)
showLayout (on page 334)
tags (on page 335)
whoami (on page 335)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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32.1. dump

dump	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	• system.dump • dump
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A
Description	The **system.dump** command reports all of the device configuration and status values using the format specified in dumpFormat (on page 329). **Note**: This is a Read-only parameter.

32.2. dumpFormat

dumpFormat	
Setting	**Description**
CLI / Web Page	[Page=system]

CLI Command	• system.dumpFormat=Full
	  • dumpFormat=Full
	• system.dumpFormat=Json
	  • dumpFormat=Json
	• system.dumpFormat=Result
	  • dumpFormat=Result
	• system.dumpFormat=Short
	  • dumpFormat=Short
	• system.dumpFormat=Verbose
	  • dumpFormat=Verbose

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dumpFormat	
Setting	**Description**
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	Short
Options	N/A

Description	The **system.dumpFormat** parameter designates the format of the output of commands and setting changes.
	Notes
	• **dumpFormat=Full** - Shows each setting with its fully-qualified name and value (**page.setting=value**).
	• **dumpFormat=Json** - Shows the output results in JavaScript Object Notation (Json).
	• **dumpFormat=Result** - This setting is identical to **dumpFormat=Full**.
	• **dumpFormat=Short** - Shows the page name in a header row, then each setting indented with its value.
	• **dumpFormat=Verbose** This setting shows:
	  • The fully-quailifed name and value (the same as the **dumpFormat=Full**).
	  • The header row (the same as the **dumpFormat=Short**).

32.3. dumpPage

dumpPage	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	• `system.dumpPage=enter_page_name_here` • `dumpPage=enter_page_name_here` **Note**: Where `enter_page_name_here` is a CLI page.
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A

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dumpPage	
Setting	**Description**
Description	The **system.dumpPage** command reports all device configuration and status values for the specified page, using the format specified in dumpFormat (on page 329). **Example**: Enter `dumpPage=SNMP` to show the SNMP settings. **Note**: This is a Read-only parameter.

32.4. dumpTag

Important!: FreeWave internal use only.

32.5. filter

Important!: FreeWave internal use only.

32.6. help

help	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	• `system.help` • `help` • `help <parameter>` • to see help for a specific parameter
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A

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help	
Setting	**Description**
Description	The **system.help** command lists the **help.txt** file. **Important!**: Help information is only available for active parameters. **Example**: If the **ZumLink** is designated as a Gateway, the Help information for **radioSettings.nodeId** is NOT provided since the **nodeId** parameter cannot be changed.

32.7. login

password	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	`system.login=[username],[password]`
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A
Description	The **system.login** command logs the user into the Z9-P2 or Z9-PE2.

32.8. logout

logout	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	• `system.logout` • `logout`
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A

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logout	
Setting	**Description**
Options	N/A
Description	The **logout** command logs out of the CLI session.

32.9. pages

pages	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	• `system.pages` • `pages`
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A
Description	The **system.pages** command lists all of the pages of settings and commands in the Z9-P2 or Z9-PE2.

32.10. password

password	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	`system.password=[oldpassword],[newpassword],[newpassword]`
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A

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password	
Setting	**Description**
Description	The **system.password** parameter designates the password. **Important!**: Must be logged in to the Z9-P2 or Z9-PE2. **Example**: `system.password=admin,12345,12345`. **Note**: An error message appears when there is an error in typing the new password command.

32.11. passwordRestoreDefaults

passwordRestoreDefaults	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	• `system.passwordRestoreDefaults` • `passwordRestoreDefaults`
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	Now

Description	The **system.passwordRestoreDefaults** command resets both the **admin** and **devuser** account passwords to factory defaults.
	• After executing this command, the Z9-P2 or Z9-PE2 must be rebooted by either:
	  • executing the `reset now` command (see Reset (on page 214)) or
	  • power-cycling the Z9-P2 or Z9-PE2.

32.12. showLayout

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32.13. tags

Important!: FreeWave internal use only.

32.14. whoami

whoami	
Setting	**Description**
CLI / Web Page	[Page=system]
CLI Command	• `system.whoami` • `whoami`
Web Interface window	**Important!**: The [Page=system] parameters are only available in the CLI window. See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
Default Setting	N/A
Options	N/A
Description	The **system.whoami** command reports the user currently logged in. **Note**: This is a Read-only parameter.

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33. System Info Parameters

Note: See the System Info window (on page 414).

Device Configuration (on page 337)
Device Firmware Version (on page 337)
Device ID (on page 338)
Device Model (on page 338)
Device Name (on page 339)
Hop Table Version (on page 339)
Layout Hash (on page 340)
Licenses (on page 340)
Model Code (on page 341)
Radio Firmware Version (on page 341)
Radio Model (on page 342)
Radio Model Code (on page 342)
Radio Serial Number (on page 343)
Reset Info (on page 343)
Rte Template Version (on page 344)
Rte Version (on page 344)
Serial Number (on page 345)
Theme Version (on page 345)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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33.1. Device Configuration

Device Configuration	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.deviceConfiguration` • `deviceConfiguration`
Web Interface window	Device Configuration **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.deviceConfiguration** command reports the device configuration of the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

33.2. Device Firmware Version

Device Firmware Version	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.deviceFirmwareVersion` • `deviceFirmwareVersion`
Web Interface window	Device Firmware Version **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.deviceFirmwareVersion** command reports the device firmware version of the Z9-P2 or Z9-PE2. **Note**: For the **IQ Application Environment**, see Verify Activation. **Note**: This is a Read-only parameter.

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33.3. Device ID

Device ID	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.deviceId=nnnn` • `deviceId` **Note**: Where `nnnn` is a user-designated device ID.
Web Interface window	Device ID **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	1
Options	N/A
Description	The **systemInfo.deviceId** parameter designates the Device Identifier selected for the Z9-P2 or Z9-PE2.

33.4. Device Model

Device Model	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.deviceModel` • `deviceModel`
Web Interface window	Device Model **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.deviceModel** command reports the device model. **Note**: This is a Read-only parameter.

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33.5. Device Name

Device Name	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.deviceName=nnnn` • `deviceName=nnnn` **Note**: Where `nnnn` is the user-defined name for the Z9-P2 or Z9-PE2.
Web Interface window	Device Name 1. In the **Device Name** text box, enter the user-defined name for the Z9-P2 or Z9-PE2. 2. Click the **Update** button to save the change. **Note**: See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.deviceName** parameter designates the user-defined name for the Z9-P2 or Z9-PE2.

33.6. Hop Table Version

Hop Table Version	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.hopTableVersion` • `hopTableVersion`
Web Interface window	Hop Table Version **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.hopTableVersion** command reports the radio Hop Table Version of the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

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33.7. Layout Hash

Layout Hash	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.layoutHash` • `layoutHash`
Web Interface window	Layout Hash **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.layoutHash** command reports the Unique Layout Identifier. **Note**: This is a Read-only parameter.

33.8. Licenses

Licenses	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.licenses` • `licenses`
Web Interface window	Licenses **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	None
Options	N/A
Description	The **systemInfo.licenses** command reports all of the license information. **Note**: For the **IQ Application Environment**, see Verify Activation. **Note**: This is a Read-only parameter.

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33.9. Model Code

Model Code	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.modelCode` • `modelCode`
Web Interface window	Model Code **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.modelCode** command reports the model code of the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

33.10. Radio Firmware Version

Radio Firmware Version	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.radioFirmwareVersion` • `radioFirmwareVersion`
Web Interface window	Radio Firmware Version **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.radioFirmwareVersion** command reports the radio firmware version of the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

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33.11. Radio Model

Radio Model	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.radioModel` • `radioModel`
Web Interface window	Radio Model **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	AMT0100AA
Options	N/A
Description	The **systemInfo.radioModel** command reports the radio model of the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

33.12. Radio Model Code

Radio Model Code	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.radioModelCode` • `radioModelCode`
Web Interface window	Radio Model Code **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.radioModelCode** command reports the radio model code of the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

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33.13. Radio Serial Number

Radio Serial Number	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.radioSerialNumber` • `radioSerialNumber`
Web Interface window	Radio Serial Number **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.radioSerialNumber** command reports the radio serial number of the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

33.14. Reset Info

Reset Info	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.resetInfo` • `resetInfo`
Web Interface window	Reset Info **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.resetInfo** parameter commands the radio to reset the information.

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33.15. Rte Template Version

Rte Template Version	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systeminfo.rteTemplateVersion` • `rteTemplateVersion`
Web Interface window	Rte Template Version **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systeminfo.rteTemplateVersion** command reports the version number for the IQ environment template. **Notes** • This is the IQ environment applied when executing the **`rteReset=hard`** command. • See Rte Reset (on page 314) for additional information. • For the **IQ Application Environment**, see Verify Activation. • This is a Read-only parameter.

33.16. Rte Version

Rte Version	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systeminfo.rteVersion` • `rteVersion`
Web Interface window	Rte Version **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A

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Rte Version	
Setting	**Description**
Description	The **systeminfo.rteVersion** command reports the version number for the active IQ environment. **Note**: If this setting is blank, the application environment has not been initialized. For the **IQ Application Environment**, see Verify Activation. **Note**: This is a Read-only parameter.

33.17. Serial Number

Serial Number	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.serialNumber` • `serialNumber`
Web Interface window	Serial Number **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	The **systemInfo.serialNumber** command reports the serial number of the Z9-P2 or Z9-PE2. **Note**: This is a Read-only parameter.

33.18. Theme Version

Theme Version	
Setting	**Description**
CLI / Web Page	[Page=systemInfo]
CLI Command	• `systemInfo.themeVersion` • `themeVersion`

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Theme Version	
Setting	**Description**
Web Interface window	Theme Version **Note**: This parameter is read-only in the Web Interface. See the System Info window (on page 414) for parameter location.
Default Setting	N/A
Options	N/A
Description	**Note**: FreeWave internal use only. This is a Read-only parameter.

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34. Terminal Server Relay Parameters

Note: See the Terminal Server Relay window (on page 416).

Remote Termserv IP Address (on page 348)
Termserv Relay Mapping (on page 348)

The parameter syntax is: page.parameter=value.
Parameters with unique names can be specified as parameter=value.

Note: In the CLI, if the "=" sign is appended to the parameter, it is an implied change to that parameter.
If a value is NOT included after the "=", the value becomes a null, space, or 0 (zero) **depending on the parameter**.

Example: Entering **frequencyKey** returns the current value of **frequencyKey**.
Entering **frequencyKey=** is an implied change to **frequencyKey**.
If a value is NOT included, it changes **frequencyKey** to 0 (zero).

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34.1. Remote Termserv IP Address

Remote Termserv IP Address	
Setting	**Description**
CLI / Web Page	[Page=TerminalServerRelay]
CLI Command	• `TerminalServerRelay.remote_termserv_ip_address=nnn.nnn.nnn.nnn` • `remote_termserv_ip_address=nnn.nnn.nnn.nnn` **Note**: Where `nnn.nnn.nnn.nnn` is the IP address for the remote terminal server.
Web Interface window	Remote Termserv IP Address 1. In the **Remote Termserv IP Address** text box, enter the IP address for the remote terminal server. 2. Click the **Update** button to save the change. 3. Restart the Z9-P2 or Z9-PE2 for the changes to be implemented. **Note**: See the Terminal Server Relay window (on page 416) for parameter location.
Default Setting	0.0.0.0
Options	N/A
Description	• The **TerminalServerRelay.remote_termserv_ip_address=** parameter designates the IP address of the remote terminal server. • The **`TerminalServerRelay.remote_termserv_ip_address=nnn.nnn.nnn.nnn`** changes the IP address of the remote terminal server.

34.2. Termserv Relay Mapping

Termserv Relay Mapping	
Setting	**Description**
CLI / Web Page	[Page=TerminalServerRelay]

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Termserv Relay Mapping	
Setting	**Description**

CLI Command	• TerminalServerRelay.termserv_relay_mapping=TERMSERV_RELAY_DISABLED
	  • termserv_relay_mapping=TERMSERV_RELAY_DISABLED
	• TerminalServerRelay.termserv_relay_mapping=LOCAL_BOTH_COM_TO_REMOTE_BOTH_COM
	  • termserv_relay_mapping=LOCAL_BOTH_COM_TO_REMOTE_BOTH_COM
	• TerminalServerRelay.termserv_relay_mapping=LOCAL_COM1_TO_REMOTE_COM1
	  • termserv_relay_mapping=LOCAL_COM1_TO_REMOTE_COM1
	• TerminalServerRelay.termserv_relay_mapping=LOCAL_COM2_TO_REMOTE_COM2
	  • termserv_relay_mapping=LOCAL_COM2_TO_REMOTE_COM2
	• TerminalServerRelay.termserv_relay_mapping=LOCAL_BOTH_COM_TO_REMOTE_COM1
	  • termserv_relay_mapping=LOCAL_BOTH_COM_TO_REMOTE_COM1
	• TerminalServerRelay.termserv_relay_mapping=LOCAL_BOTH_COM_TO_REMOTE_COM2
	  • termserv_relay_mapping=LOCAL_BOTH_COM_TO_REMOTE_COM2
	• TerminalServerRelay.termserv_relay_mapping=LOCAL_COM1_TO_REMOTE_BOTH_COM
	  • termserv_relay_mapping=LOCAL_COM1_TO_REMOTE_BOTH_COM
	• TerminalServerRelay.termserv_relay_mapping=LOCAL_COM2_TO_REMOTE_BOTH_COM
	  • termserv_relay_mapping=LOCAL_COM2_TO_REMOTE_BOTH_COM

Web Interface window	Termserv Relay Mapping 1. Click the **Termserv Relay Mapping** list box arrow and select a setting used for the transfer of a bi-directional byte stream between two serial device servers. 2. Click the **Update** button to save the change. 3. Restart the Z9-P2 or Z9-PE2 for the changes to be implemented. **Note**: See the Terminal Server Relay window (on page 416) for parameter location.
Default Setting	TERMSERV_RELAY_DISABLED

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Termserv Relay Mapping	
Setting	**Description**

Options	• TERMSERV_RELAY_DISABLED
	  • Data forwarding between local and remote COM ports is disabled.
	• LOCAL_BOTH_COM_TO_REMOTE_BOTH_COM (on page 355).
	  • Data is forwarded between the local COM1 and remote COM1 ports.
	  • Data is forwarded between the local COM2 and remote COM2 ports.
	• LOCAL_COM1_TO_REMOTE_COM1 (on page 356).
	  • Data is forwarded between the local COM1 and remote COM1 ports.
	• LOCAL_COM2_TO_REMOTE_COM2 (on page 357).
	  • Data is forwarded between the local COM2 and remote COM2 ports.
	• LOCAL_BOTH_COM_TO_REMOTE_COM1 (on page 358).
	  • Data is forwarded between the local COM1 and remote COM1 ports.
	  • Data is forwarded between the local COM2 and remote COM1 ports.
	• LOCAL_BOTH_COM_TO_REMOTE_COM2 (on page 359).
	  • Data is forwarded between the local COM1 and remote COM2 ports.
	  • Data is forwarded between the local COM2 and remote COM2 ports.
	• LOCAL_COM1_TO_REMOTE_BOTH_COM (on page 360).
	  • Data is forwarded between the local COM1 and remote COM1 ports.
	  • Data is forwarded between the local COM1 and remote COM2 ports.
	• LOCAL_COM2_TO_REMOTE_BOTH_COM (on page 361).
	  • Data is forwarded between the local COM2 and remote COM1 ports.
	  • Data is forwarded between the local COM2 and remote COM2 ports.

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Termserv Relay Mapping	
Setting	**Description**
Description	The **TerminalServerRelay.termserv_relay_mapping** parameter is used to transfer a bi-directional byte stream between two serial device servers. **Important!**: If using Terminal Server Relay Parameters (on page 347),the TCP port numbers designated in the Terminal Server Port (on page 209) **MUST BE** be consistent across all involved radios. **FREEWAVE Recommends**: If using the Terminal Server Port parameter, keep the TCP port numbers as their defaults. **Notes** • The data relay is only supported between the terminal server on this Z9-P2 or Z9-PE2 radio and the terminal server on a separate Z9-P2 or Z9-PE2 radio in the same IP network. See Terminal Server Relay Examples (on page 352). • For the relay function to operate, COM1 must be assigned to port 5041 and and COM2 must be assigned to port 5042 on both the local and remote terminal servers. • The **TerminalServerRelay.termserv_relay_mapping** should only be enabled on one side of the connection. • When the Termserv Relay Mapping (on page 348) parameter is designated and the Flow Control (on page 203) parameter is set to `Hardware`, the COM port's flow control does not function.

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35. Terminal Server Relay Examples

- Connected Terminal Servers and Terminal Server Relay (on page 353)
- LOCAL_BOTH_COM_TO_REMOTE_BOTH_COM (on page 355)
- LOCAL_COM1_TO_REMOTE_COM1 (on page 356)
- LOCAL_COM2_TO_REMOTE_COM2 (on page 357)
- LOCAL_BOTH_COM_TO_REMOTE_COM1 (on page 358)
- LOCAL_BOTH_COM_TO_REMOTE_COM2 (on page 359)
- LOCAL_COM1_TO_REMOTE_BOTH_COM (on page 360)
- LOCAL_COM2_TO_REMOTE_BOTH_COM (on page 361)
- Example: Multicast (on page 362)

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35.1. Connected Terminal Servers and Terminal Server Relay

Figure 205 shows the Terminal Servers and the Terminal Server Relay (client) connected together through the Bridge.

Note: Figure 205 shows the **ZumLink Z9-PE** connections. They are the same for the Z9-P2 or Z9-PE2.

- The Bridge connects the Ethernet interface with the radio interface.
- The Terminal Servers are connected to the COM ports.
- From any network interface you can get to the Terminal Servers.

The Terminal Server Relay is designed to connect the local Terminal Servers (hence the COM ports) to any remote Terminal Server.

- This connection could be over the Ethernet or radio interface.
- It does not matter since it is a TCP connection.
- Each terminal server can have 20 concurrent TCP connections.
- Expects COM1 to be on port 5041 for both local and remote units.
- Expects COM2 to be on port 5042 for both local and remote units.

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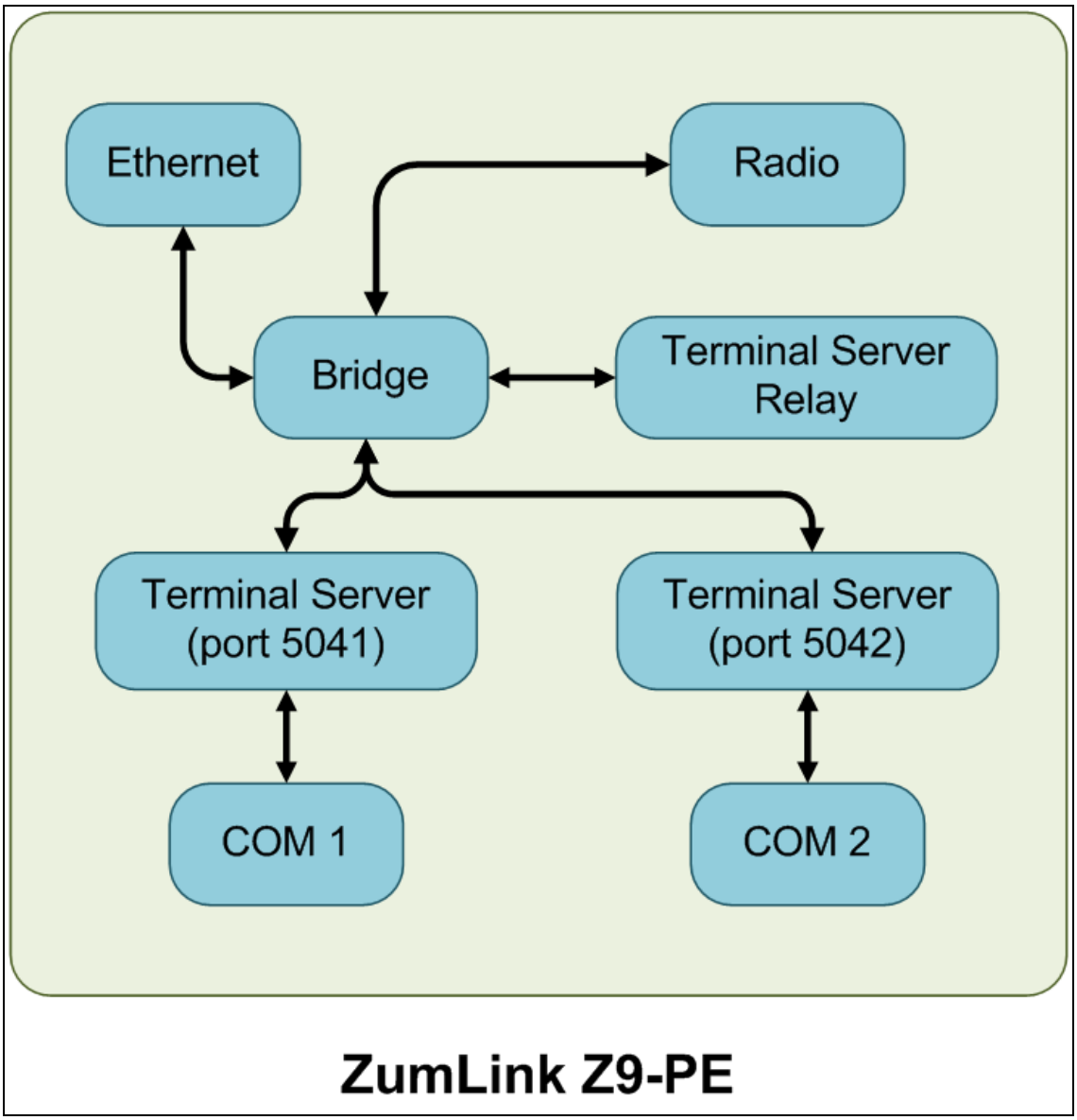

Figure 205: Terminal Servers and Terminal Server Relay (Client) Connected Together through the Bridge

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35.2. LOCAL_BOTH_COM_TO_REMOTE_BOTH_COM

Figure 206 illustrates the Terminal Server Relay command:
LOCAL_BOTH_COM_TO_REMOTE_BOTH_COM.

- Data is forwarded between the local COM1 and remote COM1 ports.
- Data is forwarded between the local COM2 and remote COM2 ports.

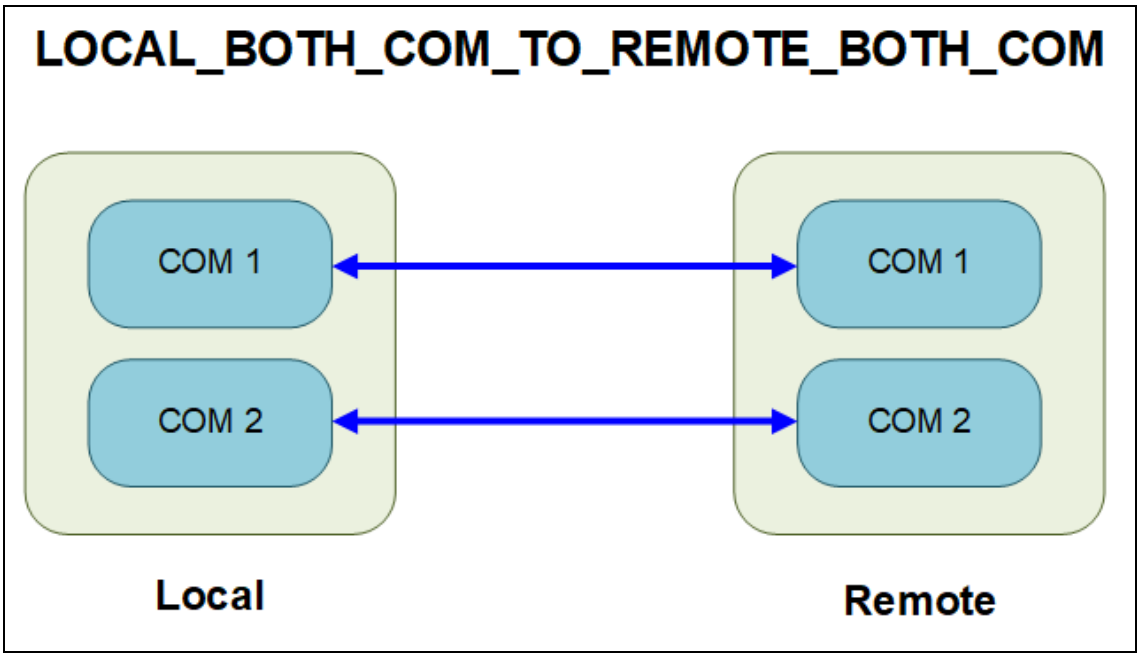

Figure 206: Terminal Server Relay command:
LOCAL_BOTH_COM_TO_REMOTE_BOTH_COM

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35.3. LOCAL_COM1_TO_REMOTE_COM1

Figure 207 illustrates the Terminal Server Relay command: **LOCAL_COM1_TO_REMOTE_COM1**.

- Data is forwarded between the local COM1 and remote COM1 ports.

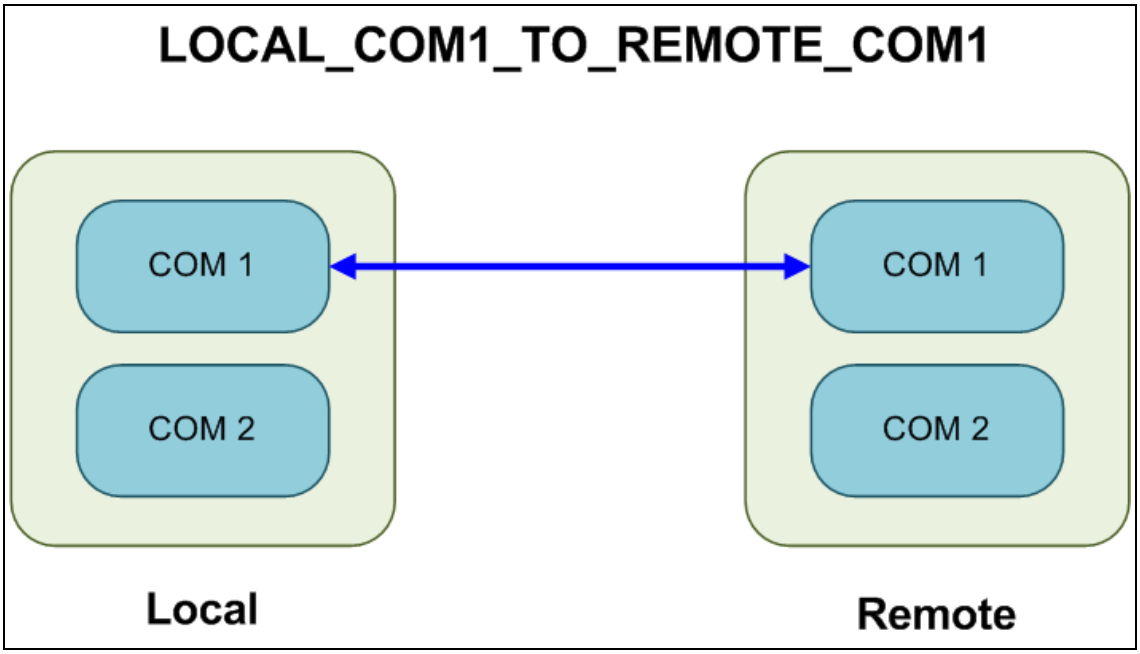

Figure 207: Terminal Server Relay command: LOCAL_COM1_TO_REMOTE_COM1

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35.4. LOCAL_COM2_TO_REMOTE_COM2

Figure 208 illustrates the Terminal Server Relay command: **LOCAL_COM2_TO_REMOTE_COM2**.

- Data is forwarded between the local COM2 and remote COM2 ports.

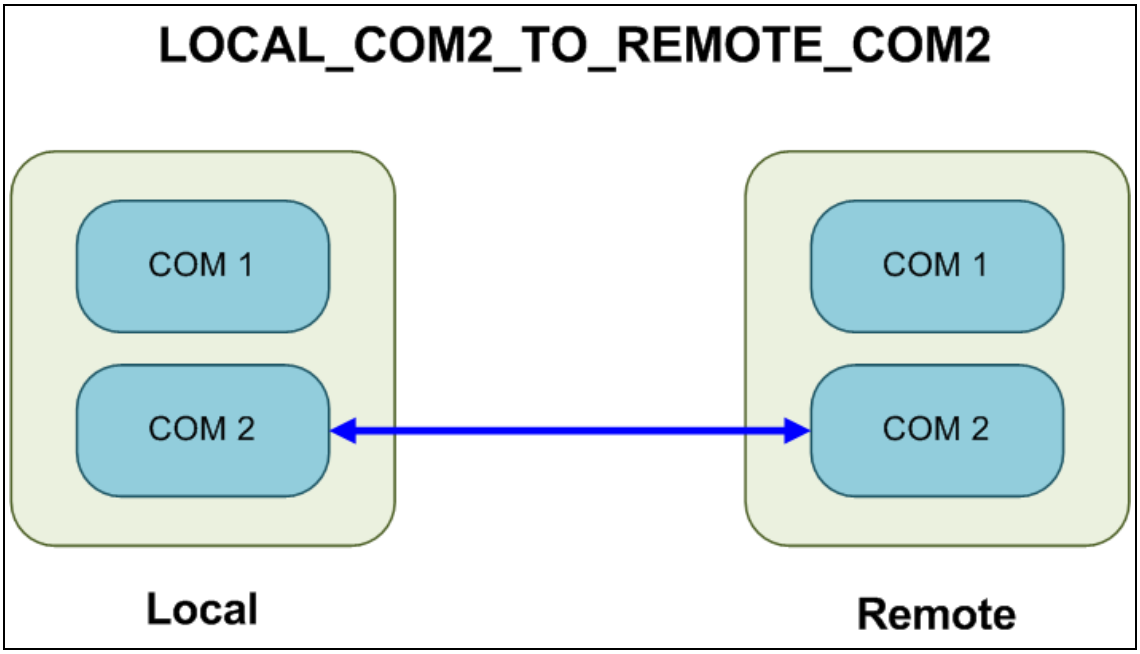

Figure 208: Terminal Server Relay command: LOCAL_COM2_TO_REMOTE_COM2

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35.5. LOCAL_BOTH_COM_TO_REMOTE_COM1

Figure 209 illustrates the Terminal Server Relay command: **LOCAL_BOTH_COM_TO_REMOTE_COM1**.

- Data is forwarded between the local COM1 and remote COM1 ports.
- Data is forwarded between the local COM2 and remote COM1 ports.

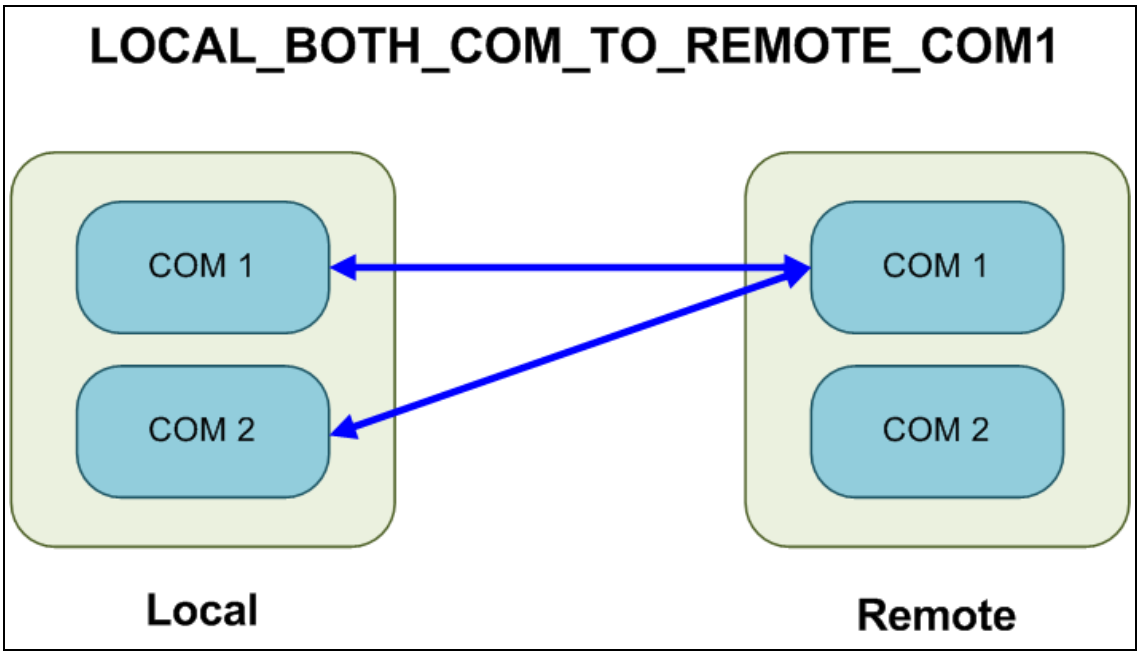

Figure 209: Terminal Server Relay command: LOCAL_BOTH_COM_TO_REMOTE_COM1

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35.6. LOCAL_BOTH_COM_TO_REMOTE_COM2

Figure 210 illustrates the Terminal Server Relay command: **LOCAL_BOTH_COM_TO_REMOTE_COM2**.

- Data is forwarded between the local COM1 and remote COM2 ports.
- Data is forwarded between the local COM2 and remote COM2 ports.

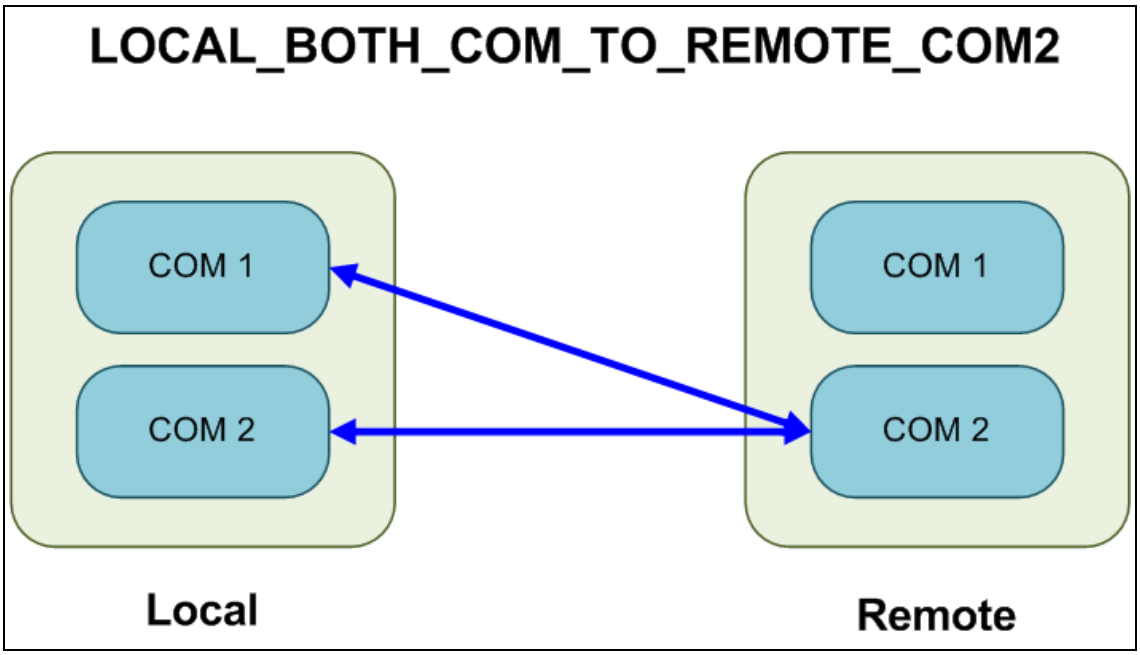

Figure 210: Terminal Server Relay command: LOCAL_BOTH_COM_TO_REMOTE_COM2

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35.7. LOCAL_COM1_TO_REMOTE_BOTH_COM

Figure 211 illustrates the Terminal Server Relay command: **LOCAL_COM1_TO_REMOTE_BOTH_COM**.

- Data is forwarded between the local COM1 and remote COM1 ports.
- Data is forwarded between the local COM1 and remote COM2 ports.

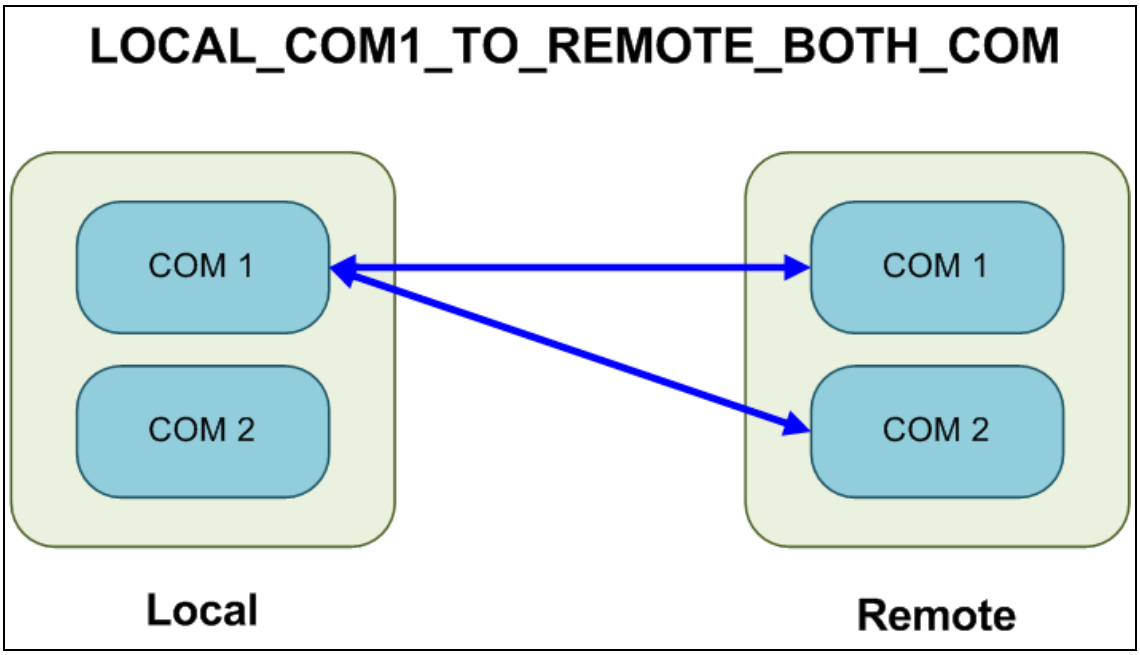

Figure 211: Terminal Server Relay command: LOCAL_COM1_TO_REMOTE_BOTH_COM

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35.8. LOCAL_COM2_TO_REMOTE_BOTH_COM

Figure 212 illustrates the Terminal Server Relay command: **LOCAL_COM2_TO_REMOTE_BOTH_COM**.

- Data is forwarded between the local COM2 and remote COM1 ports.
- Data is forwarded between the local COM2 and remote COM2 ports.

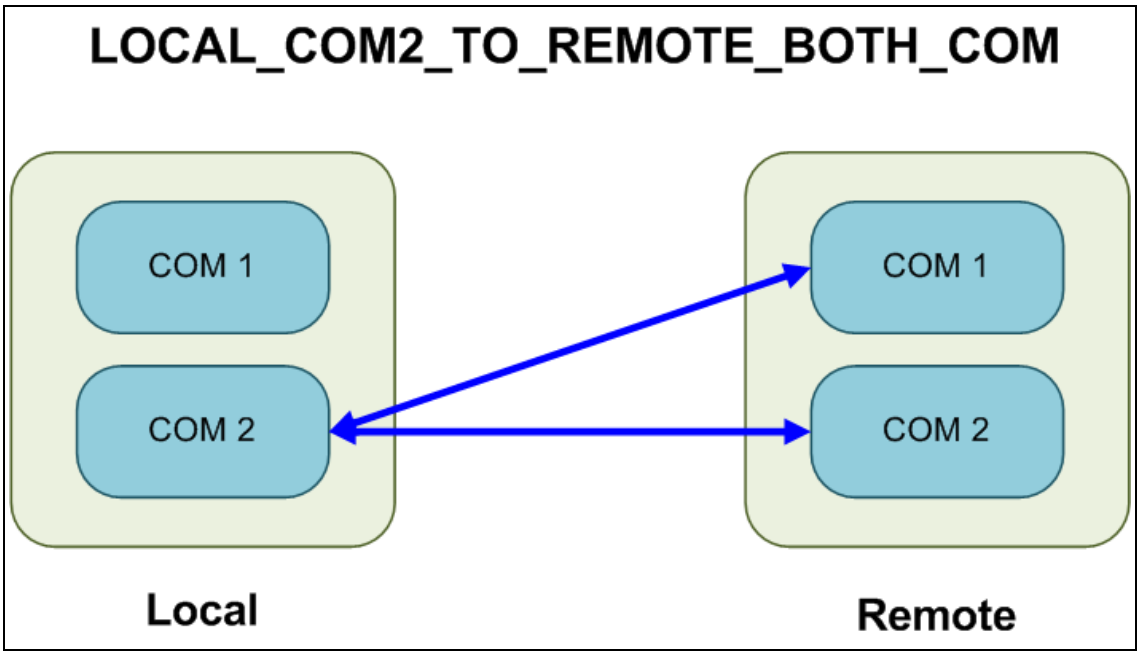

Figure 212: Terminal Server Relay command: LOCAL_COM2_TO_REMOTE_BOTH_COM

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35.9. Example: Multicast

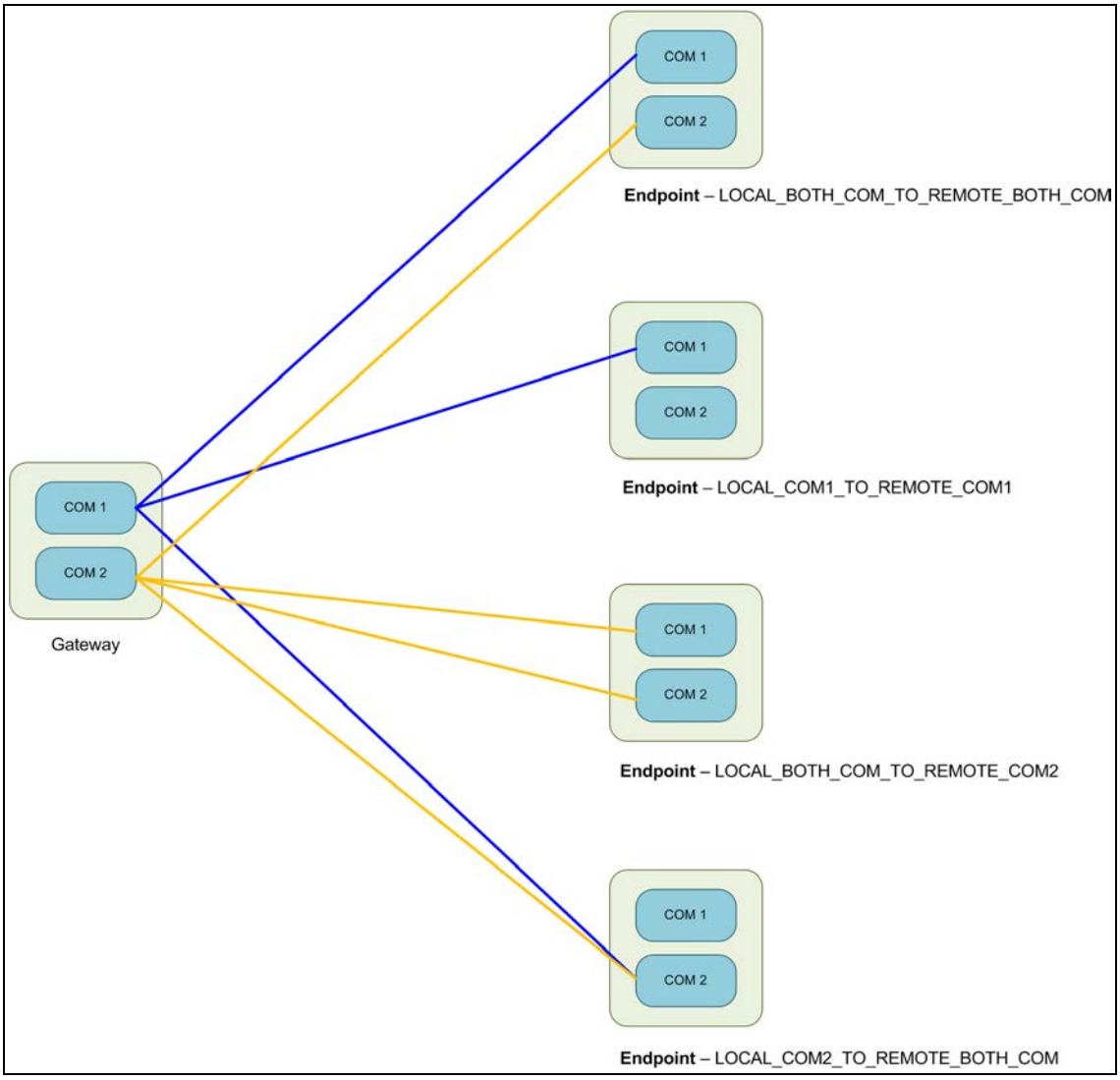

Figure 213: Example: Multicast

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36. Web Interface

The available windows are:

- COM window (on page 364)
- Config window (on page 366)
- Data Path window (on page 368)
- Date window (on page 370)
- Encryption window (on page 372)
- File Upload window (on page 374)
- Help window (on page 376)
- Home window (on page 378)
- Io Ex Com window (on page 379)
- Local Diagnostics window (on page 381)
- Modbus window (on page 383)
- Network window (on page 385)
- Network Diagnostics window (on page 387)
- Network Stats window (on page 392)
- NTP window (on page 394)
- Radio Settings window - Endpoint (on page 396)
- Radio Settings Helpers window (on page 404)
- Runtime Environment window (on page 406)
- Security window (on page 408)
- Services window (on page 410)
- SNMP window (on page 412)
- System Info window (on page 414)
- Terminal Server Relay window (on page 416)
- User Data - Drag and Drop window (on page 418)

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36.1. COM window

The **COM** windows are used to read and change information about the communication settings of the Z9-P2 or Z9-PE2.

> **Note**: See the COM Parameters (on page 198) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 214

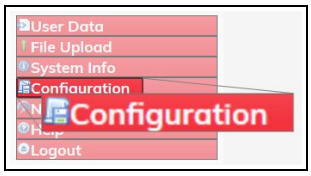

Figure 214: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

5. Click either the **COM1** or **COM2** tab to access their respective COM parameters. Figure 215 or Figure 216

   > **Note**: The parameters for **COM1** and **COM2** are the same except for the Terminal Server Port (on page 209) parameter setting.
   > See the COM Parameters (on page 198) for detailed information about the parameters.

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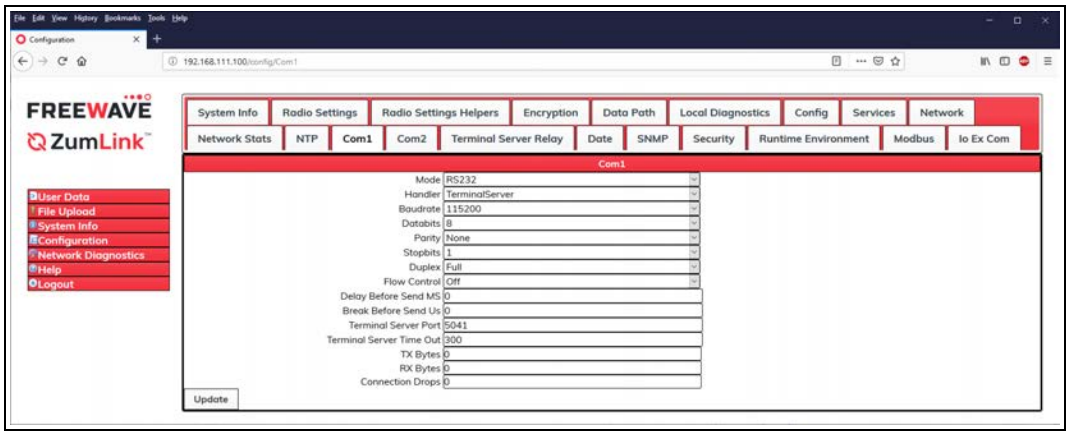

Figure 215: COM1 window

Figure 216: COM2 window

6. Optional: On the **Menu** list, click the **Configuration** link to Change the COM Parameters (on page 91).

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36.2. Config window

The **Config** window is used to reset the radio, restore factory defaults, view IQ license status.

> **Note**: See the Config Parameters (on page 212) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **System Info** link. Figure 217

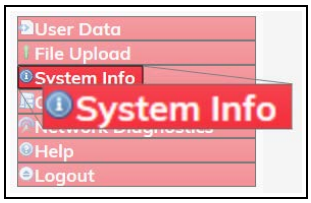

Figure 217: System Info link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Config** tab to access the **Config** parameters. Figure 218

   > **Important!**: The information in this window is read-only.
   > The parameters in this window can only be changed in the CLI.
   > See the Access the CLI and Change the IP Address and nodeId (on page 34) procedure for CLI access.
   > See the Config Parameters (on page 212) for detailed information about the parameters.

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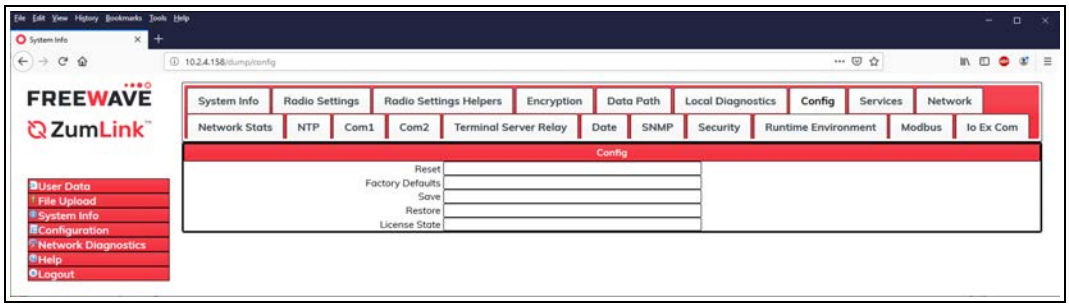

Figure 218: Config window

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36.3. Data Path window

The **Data Path** window is used to define more advanced data path features.

> **Note**: See the Data Path Parameters (on page 216) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 219

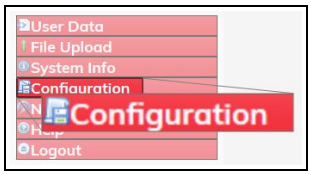

Figure 219: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Data Path** tab to access the **Data Path** parameters. Figure 220

   > **Note**: The information in this window is read-only.
   > See the Data Path Parameters (on page 216) for detailed information about the parameters.

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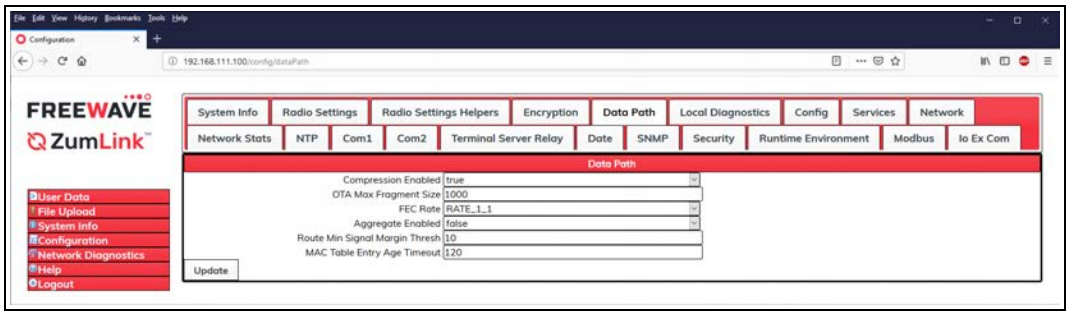

Figure 220: Data Path window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the Data Path Parameters (on page 94).

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36.4. Date window

The **Date** window is used to view the Z9-P2 or Z9-PE2 operation and application uptime.

> **Note**: See the Date Parameters (on page 225) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 221

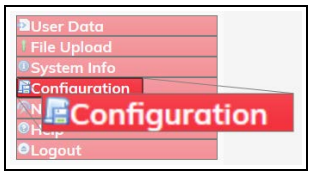

Figure 221: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Date** tab to access the **Date** parameters. Figure 222

   > **Note**: The information in this window is read-only.
   > See the Date Parameters (on page 225) for detailed information about the parameters.

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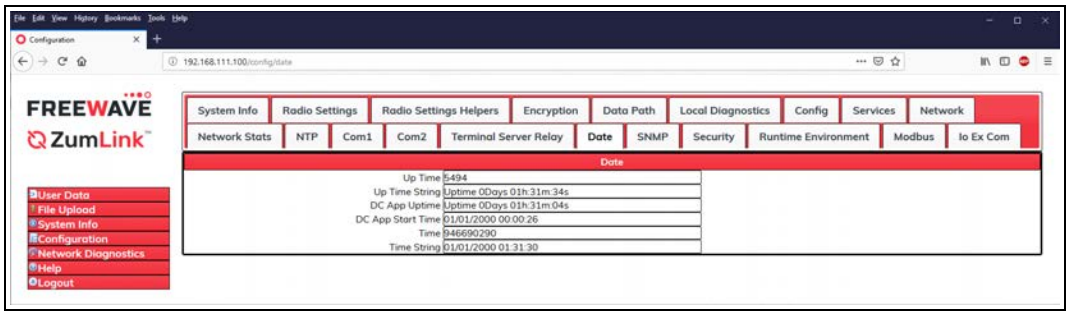

Figure 222: Date window

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36.5. Encryption window

The **Encryption** window is used to enable or disable encryption on the Z9-P2 or Z9-PE2.

Note: See the Encryption Parameters (on page 230) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 223

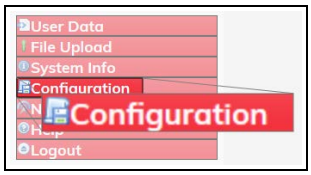

Figure 223: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Encryption** tab to access the **Encryption** parameters. Figure 224

   Note: See the Encryption Parameters (on page 230) for detailed information about the parameters.

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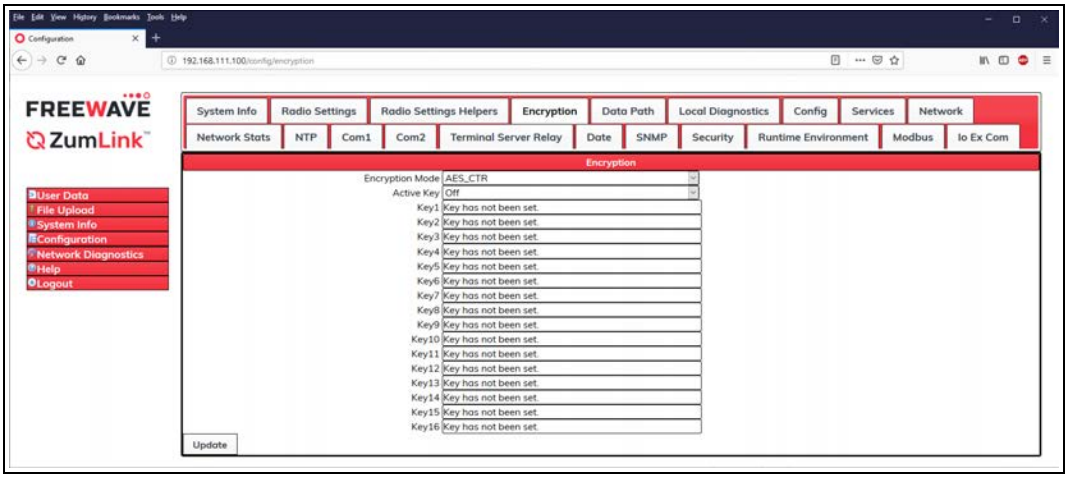

Figure 224: Encryption window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the Encryption Parameters (on page 96).

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36.6. File Upload window

The **File Upload** window is used to search for and upload these file types into the Z9-P2 or Z9-PE2:

Extension	File Type
.cfg; .cfg.txt	Configuration changes
.fcf; .fcf.txt	Radio module Firmware updates
.pkg; .pkg.txt	Interface board Firmware updates

Access and Window Description

Note: The images in this procedure are for **Windows**® 7 and/or **Windows**® 10 and **Firefox**®.

1. Verify the Setup the Computer IP Address Configuration procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **File Upload** link. Figure 225

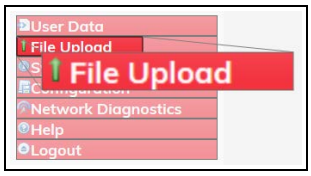

Figure 225: File Upload link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **File Upload** window opens. Figure 226

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

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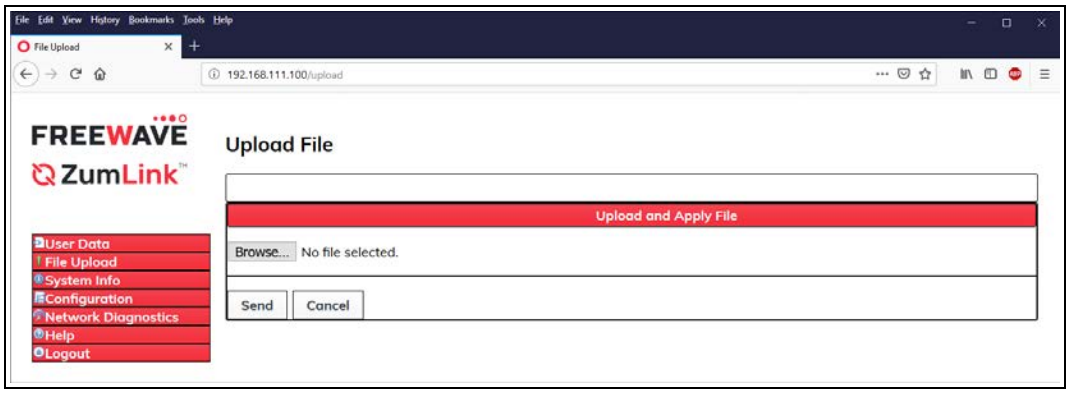

Figure 226: File Upload window

6. Optional: Complete the Firmware Update for the Z9-P2 or Z9-PE2.

File Upload window	
Control Title	**Control Description**
Browse button	Click to open the **Microsoft® File Upload** dialog box. **Note**: The **Browse** button title is dependent on the chosen browser.
Send button	Click to start the update process on the Z9-P2 or Z9-PE2.
Cancel button	Click to cancel the file transfer if already started or refresh the window and clear the selected file.

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36.7. Help window

The **Help** window is used to read information about the settings of the Z9-P2 or Z9-PE2.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Help** link. Figure 227

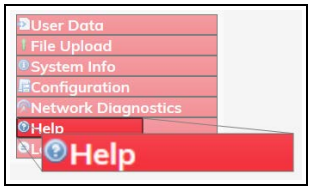

Figure 227: Help link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Login** dialog box closes and the **Help** window opens. Figure 228

   Note: The information in this window is read-only.

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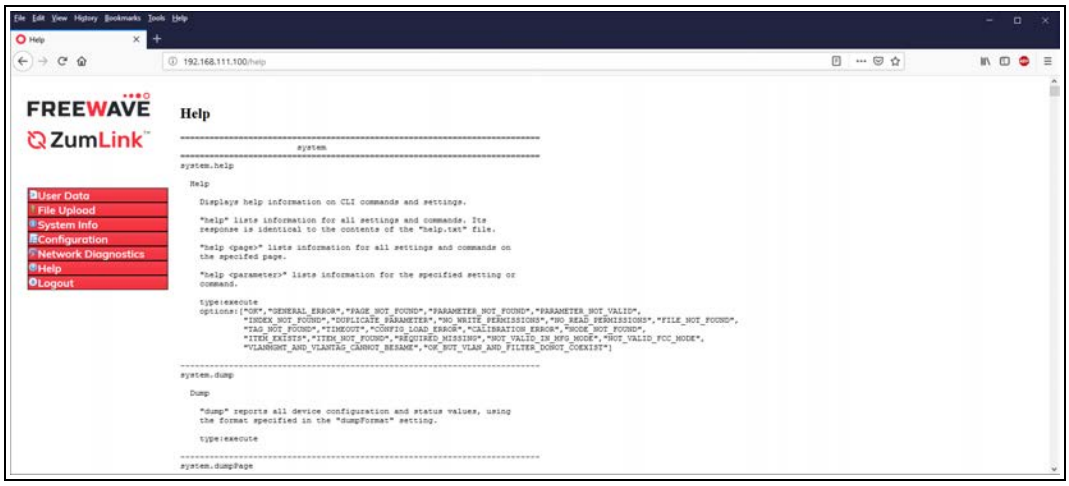

Figure 228: Help window

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36.8. Home window

The **Home** window is the default window that opens when the Web Interface is used.

It is used to:

- View basic System information of the connected Z9-P2 or Z9-PE2.
- Provide links to other windows of the Z9-P2 or Z9-PE2.

Access and Window Description

1. Open a web browser.
2. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Z9-P2 or Z9-PE2 **Home** window opens. Figure 229

Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
If the IP address was changed, enter that IP Address.
See the System Info Parameters (on page 336) for detailed information about the parameters.

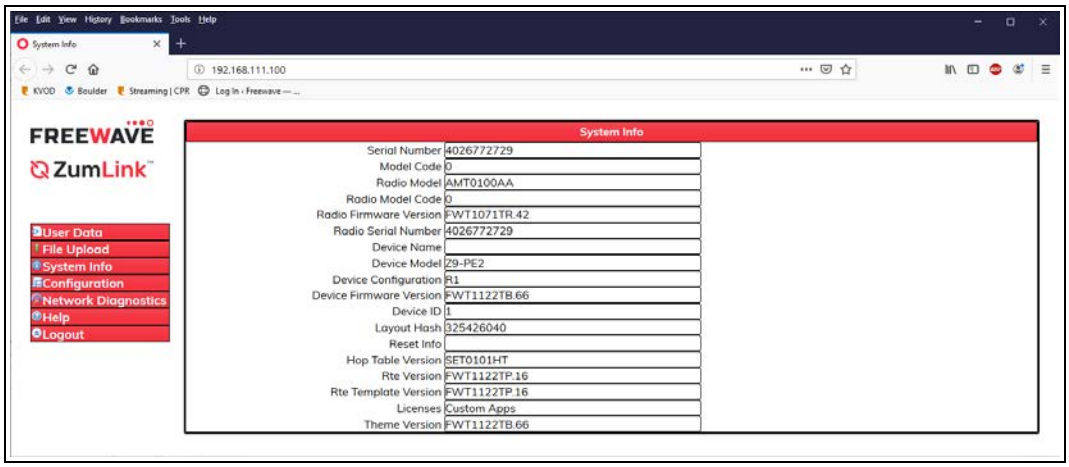

Figure 229: Home (System Info) window

Note: The information in this window is read-only.

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36.9. Io Ex Com window

The **ioExCom** window is used to designate the Modbus Device ID (on page 253) of the connected IOEX device that responds to during a Modbus TCP request over the network or a Modbus RTU request coming in via COM1 or COM2.

Note: See the IO Ex Com Parameters (on page 234) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 230

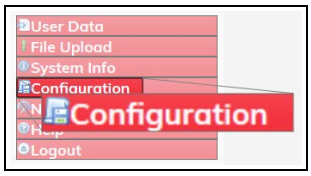

Figure 230: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Io Ex Com** tab to access the **Io Ex Com** parameters. Figure 231

   Note: See the IO Ex Com Parameters (on page 234) for detailed information about the parameters.

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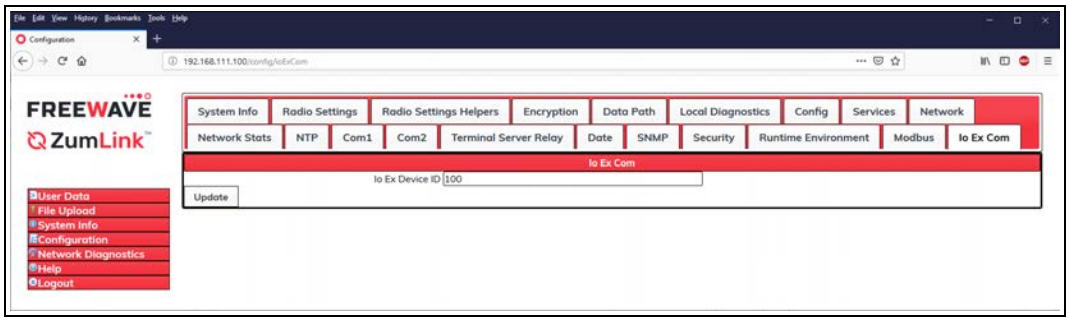

Figure 231: Io Ex Com window

Note: The information in this window is read-only.

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36.10. Local Diagnostics window

The **Local Diagnostics** window is used to view diagnostic info about the Z9-P2 or Z9-PE2.

> **Note**: See the Local Diagnostics Parameters (on page 235) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 232

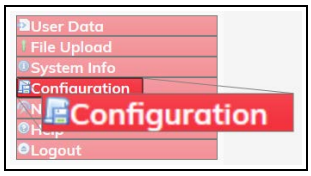

Figure 232: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Local Diagnostics** tab to access the **Local Diagnostics** parameters. Figure 233

   > **Note**: See the Local Diagnostics Parameters (on page 235) for detailed information about the parameters.

7. Optional: On the **Menu** list, click the **Configuration** link to Change the Local Diagnostics - Monitored Node (on page 99).

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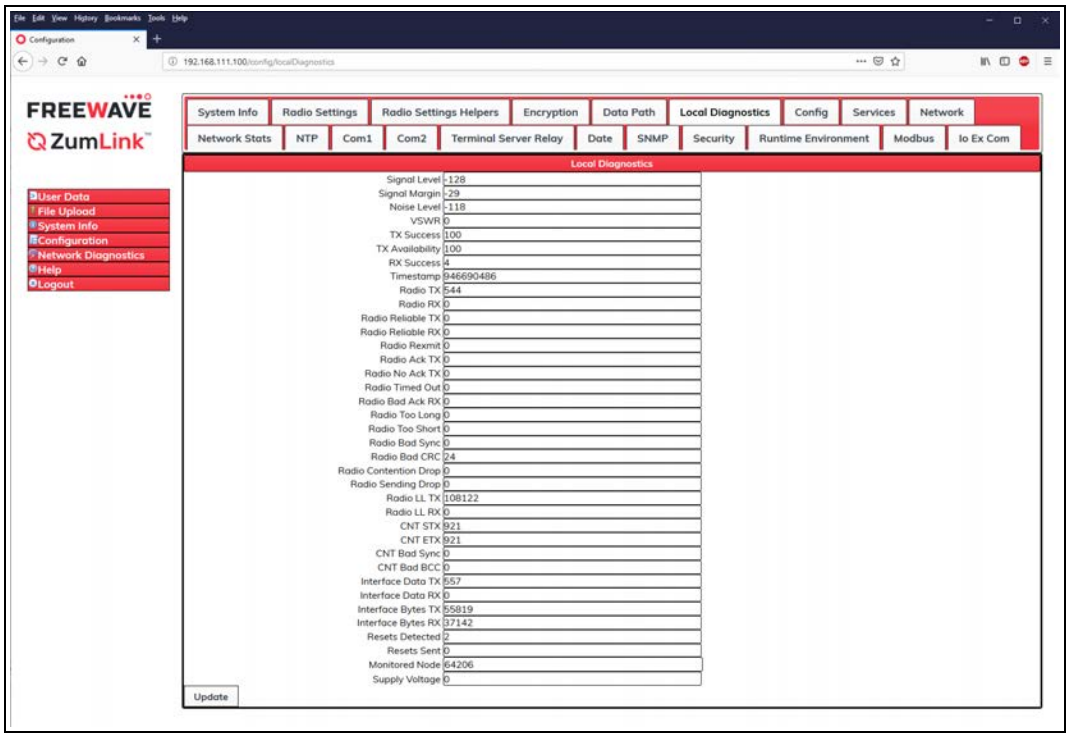

Figure 233: Local Diagnostics window

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36.11. Modbus window

The **Modbus** window is used to view Modbus information about the Z9-P2 or Z9-PE2.

Note: See the Modbus Parameters (on page 252) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 234

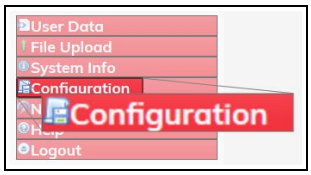

Figure 234: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Modbus** tab to access the **Modbus** parameters. Figure 235

   Note: See the Modbus Parameters (on page 252) for detailed information about the parameters.

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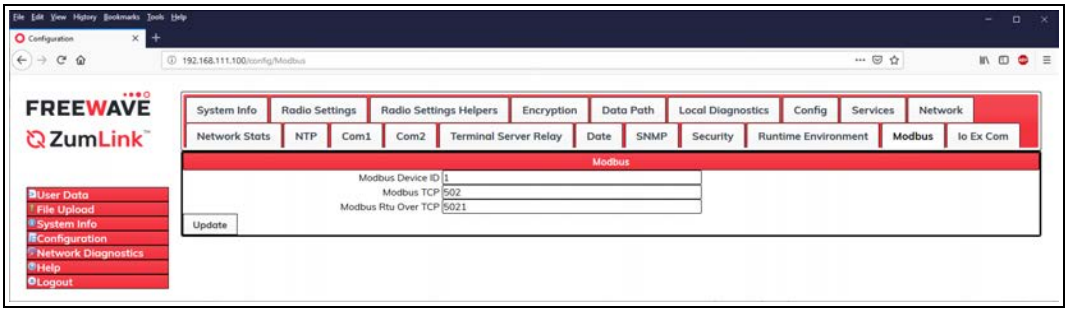

Figure 235: Modbus window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the Modbus Parameters (on page 101).
8. Optional:
   a. On the **Menu** list, click the **System Info** link.
   The System Info window (on page 414) opens.
   b. Click the **Modbus** tab.
   The **Modbus** window opens in Read-only mode to view the information for these parameters: 36.11
      - Modbus Layout (on page 253)
      - Read (on page 255)
      - Read Coils (on page 256)
      - Write (on page 257)
      - Write Coils (on page 258)

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36.12. Network window

The **Network** window is used to provide network information for the Z9-P2 or Z9-PE2.

> **Note**: See the Network Parameters (on page 262) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 236

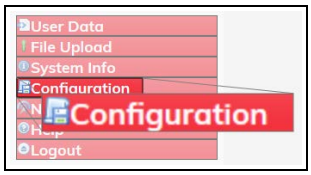

Figure 236: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Network** tab to access the **Network** parameters. Figure 237

   > **Note**: See the Network Parameters (on page 262) for detailed information about the parameters.

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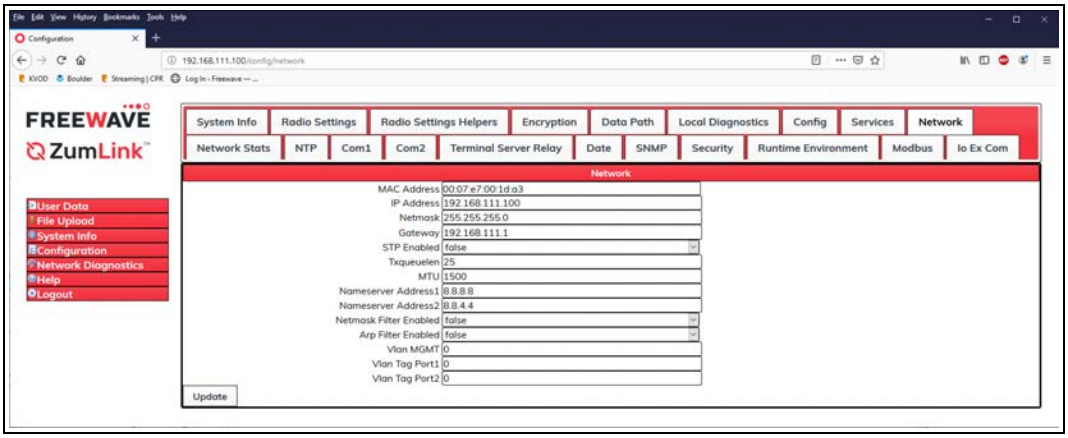

Figure 237: Network window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the Network Parameters (on page 103).

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36.13. Network Diagnostics window

The **Network Diagnostics** window is used to:

- Discover other Endpoints in the network.
- Show hops and their paths from the Gateway.
- Show the link quality (RSSI and Margin).
- Show neighbors.

Important!: A Gateway is required in the network to use this window.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Network Diagnostics** link.

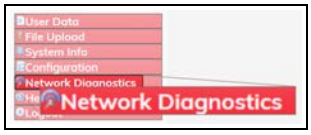

Figure 238: Network Diagnostics link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Network Diagnostics** window opens, scanning the network. Figure 239

   The diagram takes a few moments to render.

   The **Options** list box default selection is **Margin**.

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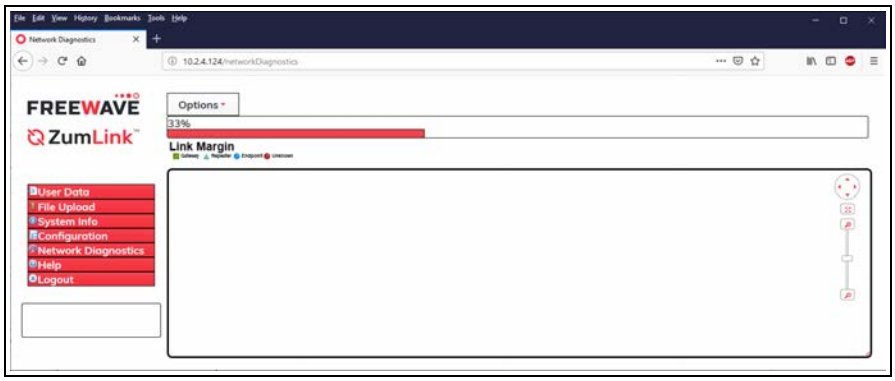

Figure 239: Network Diagnostics window - Scanning Network

The **Link Margin** connections appear in the **Network Diagram**.

Network Diagnostics window		
Control Area	**Control Title**	**Control Description**
Options list box		Click the **Options** list box arrow and select a connections diagram option.
Options list box	Show Big Graph	Select the **Show Big Graph** option to view the **Network Diagram** in a large format.
Options list box	Show Table	In the **Options** list box, select the **Show Table** option to view the radio connection table of the selected device below the **Network Diagram**. **Note**: See Show Table in the Network Diagnostics Window (on page 141) to view network and device information in a table format.
Options list box	Save Image	Select the **Save Image** option to open the **Save Image** dialog box. **Note**: See Save a Network Diagram Image (on page 137) to save the Network Diagram as a .PNG file.
Options list box	Gateway IP	Select the **Gateway IP** option to open the **Add Device IP** dialog box and add a Gateway IP address. **Note**: See Add a Gateway Device IP Address (on page 128) for additional information.

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Network Diagnostics window		
Control Area	**Control Title**	**Control Description**
Options list box	Clear Display	Click **Clear Display** to erase the network diagram in the window. **Note**: In the **Options** list box, click **Refresh Network Diagnostics** to show the network in the window.
Options list box	Save Network Diagnostics	Select the **Save Network Diagnostics** option to open the **Opening network_diag.json** dialog box. **Note**: See Save Network Diagnostics (on page 134) to save the current network performance reading for later review and to monitor network performance over time.
Options list box	Download Support Bundle	Select the **Download Support Bundle** option to open the **Opening support_bundle_nnn.zip** dialog box. **Note**: Where `nnn` is the selected device in the **Network Diagram**. Use the **Opening support_bundle_nnn.zip** dialog box to save the current network performance reading to send to FreeWave Technical Support for faster issue resolution.
Options list box	Refresh Network Diagnostics	Select the **Refresh Network Diagnostics** option to updated the current network performance reading.
Options list box	Clear All Stats	Select the **Clear All Stats** option to reset the Local Diagnostics Parameters (on page 235), Network StatsParameters (on page 274), and **Network Diagnostics**.
Options list box	Clear Stats	Select the **Clear Stats** option to clear **only** the local diagnostics. **Important!**: This does NOT clear the Network StatsParameters (on page 274) or **Network Diagnostics**.

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Network Diagnostics window		
Control Area	**Control Title**	**Control Description**
Options list box	Margin	Click the **Options** list box arrow and select the **Margin** option to show the **Link Margin** connections in the **Network Diagram**. **Note**: See the View the Network Diagnostics - Margin (on page 149) for a diagram example.
Options list box	RSSI	Click the **Options** list box arrow and select the **RSSI** option to show the **RSSI** connections in the **Network Diagram**. **Note**: See View the Network Diagnostics - RSSI (on page 154) for a diagram example.
Options list box	Tx Rate	Click the **Options** list box arrow and select the **Tx Rate** option to show the **Tx Rate** connections in the **Network Diagram**. **Note**: See View the Network Diagnostics - Tx Rate (on page 161) for a diagram example.
Options list box	Rx Rate	Click the **Options** list box arrow and select the **Rx Rate** option to show the **Rx Rate** connections in the **Network Diagram**. **Note**: See View the Network Diagnostics - Rx Rate (on page 159) for a diagram example.
Options list box	Margin with Neighbors	Click the **Options** list box arrow and select the **Margin with Neighbors** option to show the **Margin with Neighbors** connections in the **Network Diagram**. **Note**: See View the Network Diagnostics - Margin with Neighbors (on page 151) for a diagram example.
Options list box	RSSI with Neighbors	Click the **Options** list box arrow and select the **RSSI with Neighbors** option to show the **RSSI with Neighbors** connections in the **Network Diagram**. **Note**: See View the Network Diagnostics - RSSI with Neighbors (on page 156) for a diagram example.

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Network Diagnostics window		
Control Area	**Control Title**	**Control Description**
Options list box	Breadthfirst	Click the **Options** list box arrow and select the **Breadthfirst** option to show the **Breadthfirst** connections in the **Network Diagram**. **Note**: See the View the Network Diagnostics - Breadthfirst (on page 143) for a diagram example.
Options list box	Cose-bilkent	Click the **Options** list box arrow and select the **Cose-bilkent** option to show the **Cose-bilkent** connections in the **Network Diagram**. **Note**: See the View the Network Diagnostics - Cose-bilkent (on page 145) for a diagram example.
Options list box	Grid	Click the **Options** list box arrow and select the **Grid** option to show the **Grid** connections in the **Network Diagram**. **Note**: See the View the Network Diagnostics - Grid (on page 147) for a diagram example.
Options list box	Dagre	When **Dagre** is select, the network diagram shows possible loops in a complicated network. **Note**: By default, **Dagre** is selected.
Options list box	Paused	When **Paused** is selected, no updates or layout changes are made in the network diagram.
Options list box	Updating Layout	When **Updating Layout** is select, the node layouts are automatically set by the computer. **Note**: By default, Updating Layout is selected.

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36.14. Network Stats window

The **Network Stats** window is used to view received, dropped, or sent Ethernet packet information.

Note: See the Network StatsParameters (on page 274) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 240

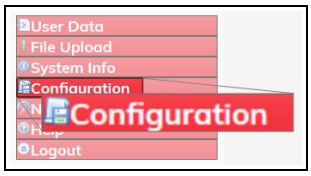

Figure 240: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Network Stats** tab to access the **Network Stats** parameters. Figure 241

   Note: The information in this window is read-only.
   See the Network StatsParameters (on page 274) for detailed information about the parameters.

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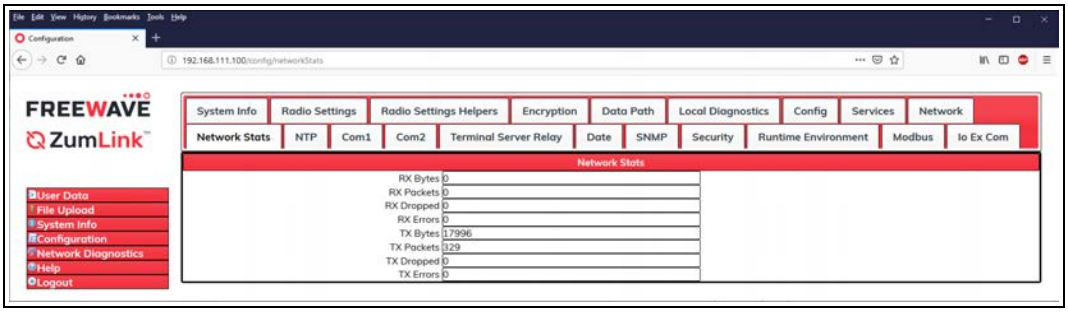

Figure 241: Network Stats window

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36.15. NTP window

The **NTP** window is used to designate the date and time used on the Z9-P2 or Z9-PE2.

Note: See the NTP Parameters (on page 280) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 242

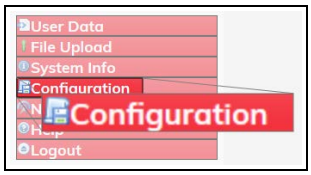

Figure 242: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **NTP** tab to access the **NTP** parameters. Figure 243

   Note: The information in this window is read-only.
   See the NTP Parameters (on page 280) for detailed information about the parameters.

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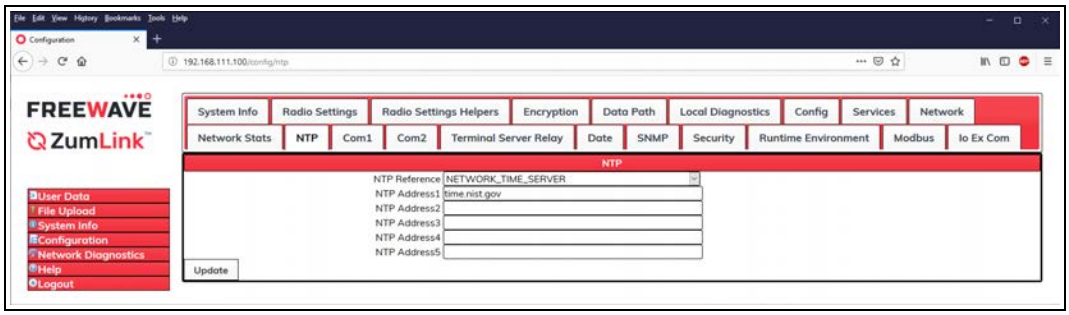

Figure 243: NTP window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the NTP Parameters (on page 105).

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36.16. Radio Settings window - Endpoint

The **Radio Settings** window is used to define the key parameters of an Endpoint Z9-P2 or Z9-PE2.

Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 244

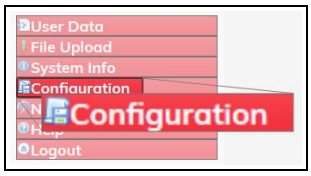

Figure 244: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Radio Settings** tab to access the **Radio Settings** parameters. Figure 245

   Note: By default, the Radio Mode (on page 304) parameter is set to **Endpoint**.
   See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

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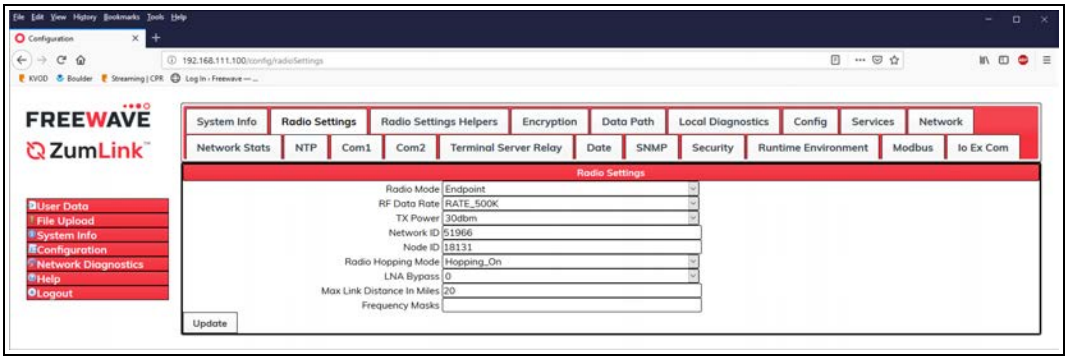

Figure 245: Radio Settings window - Endpoint

7. Optional: On the **Menu** list, click the **Configuration** link to Change the Radio Settings Parameters - Endpoint (on page 107).

> **Important!**: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

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36.16.1. Radio Settings window - Endpoint-Repeater

The **Radio Settings** window is used to define the key parameters of an Endpoint-Repeater Z9-P2 or Z9-PE2.

> **Note**: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 246

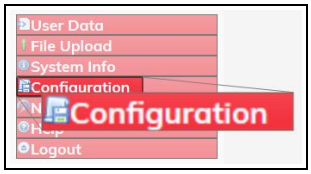

Figure 246: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Radio Settings** tab to access the **Radio Settings** parameters.

   > **Note**: By default, the Radio Mode (on page 304) parameter is set to **Endpoint**.
   > See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

7. Click the **Radio Mode** list box arrow and select **Endpoint_Repeater**. Figure 247

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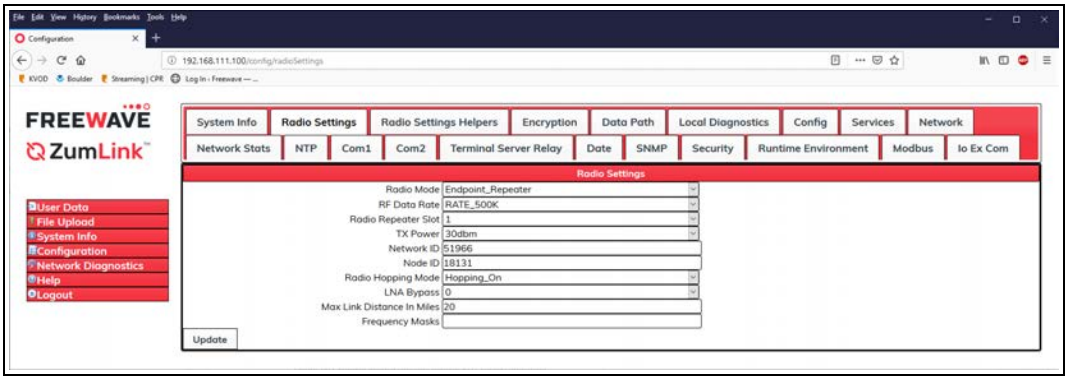

Figure 247: Radio Settings window - Endpoint_Repeater

8. Optional: On the **Menu** list, click the **Configuration** link to Change the Radio Settings Parameters - Endpoint-Repeater (on page 109).

> **Important!**: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

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36.16.2. Radio Settings window - Gateway

The **Radio Settings** window is used to define the key parameters of an Gateway Z9-P2 or Z9-PE2.

Note: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 248

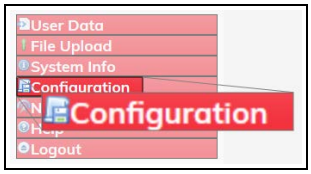

Figure 248: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Radio Settings** tab to access the **Radio Settings** parameters.

   Note: By default, the Radio Mode (on page 304) parameter is set to **Endpoint**.
   See the Radio Settings Parameters (on page 285) for detailed information about the parameters.
7. Click the **Radio Mode** list box arrow and select **Gateway**. Radio Settings window - Gateway (on page 401)

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Figure 249: Radio Settings window - Gateway

8. Optional: On the **Menu** list, click the **Configuration** link to Change the Radio Settings Parameters - Gateway (on page 111).

Important!: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

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36.16.3. Radio Settings window - Gateway-Repeater

The **Radio Settings** window is used to define the key parameters of an Gateway-Repeater Z9-P2 or Z9-PE2.

> **Note**: See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 250

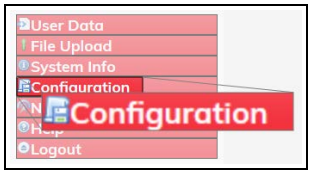

Figure 250: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Radio Settings** tab to access the **Radio Settings** parameters.

   > **Note**: By default, the Radio Mode (on page 304) parameter is set to **Endpoint**.
   > See the Radio Settings Parameters (on page 285) for detailed information about the parameters.

7. Click the **Radio Mode** list box arrow and select **Gateway_Repeater**. Figure 251

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Figure 251: Radio Settings window - Gateway_Repeater

8. Optional: On the **Menu** list, click the **Configuration** link to Change the Radio Settings Parameters - Gateway-Repeater (on page 114).

> **Important!**: Only Radio Settings Parameters (on page 285) that apply to the current Radio Mode (on page 304), RF Data Rate (on page 307), and Radio Hopping Mode (on page 299), and are visible in the CLI and the Web Interface and can be changed.

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36.17. Radio Settings Helpers window

The **Radio Settings Helpers** window is used to determine the error that exists in the frequency mask string.

> **Note**: This window is only available if the Radio Hopping Mode (on page 299) parameter is set to **Hopping_On**.
> See the Radio Settings Helpers Parameters (on page 311) for detailed information about the parameters.
> See Frequency Masks (on page 290) for usage.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 252

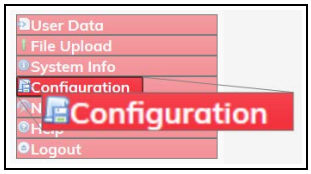

Figure 252: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Radio Settings Helpers** tab to access the **Radio Settings Helpers** parameter. Figure 253

   > **Note**: The information in this window is read-only.
   > See the Radio Settings Helpers Parameters (on page 311) for detailed information about the parameters.
   > See Frequency Masks (on page 290) for usage.

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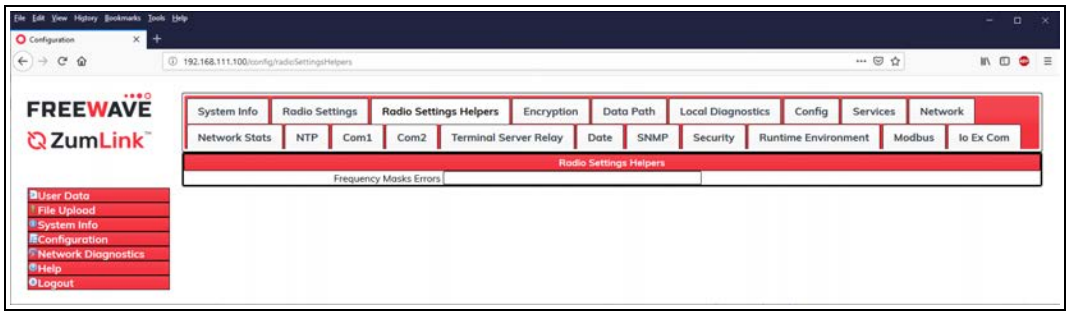

Figure 253: Radio Settings Helpers window

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36.18. Runtime Environment window

The **Runtime Environment** window is used to provide information specific to the Linux Runtime Environment.

Note: See the Runtime Environment Parameters (on page 313) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 254

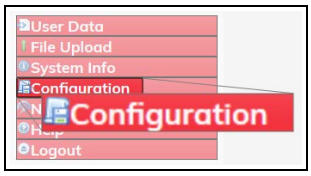

Figure 254: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Runtime Environment** tab to access The **Runtime Environment** parameters. Figure 255

   Note: The information in this window is read-only.
   See the Runtime Environment Parameters (on page 313) for detailed information about the parameters.

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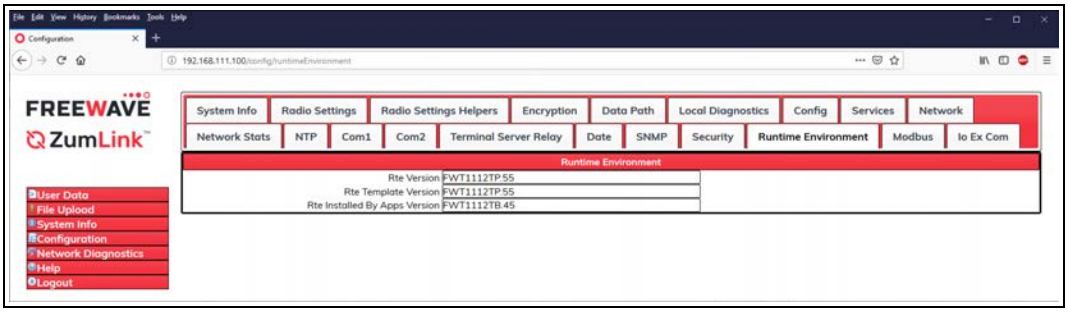

Figure 255: Runtime Environment window

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36.19. Security window

The **Security** window is used to enable or disable the drag-n-drop interface and SSH access.

> **Note**: See the Security Parameters (on page 317) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 256

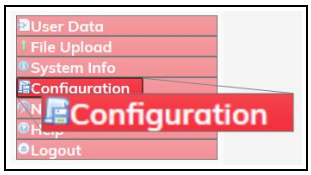

Figure 256: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

5. Click the **Security** tab to access the **Security** parameters. Figure 257

   > **Note**: See the Security Parameters (on page 317) for detailed information about the parameters.

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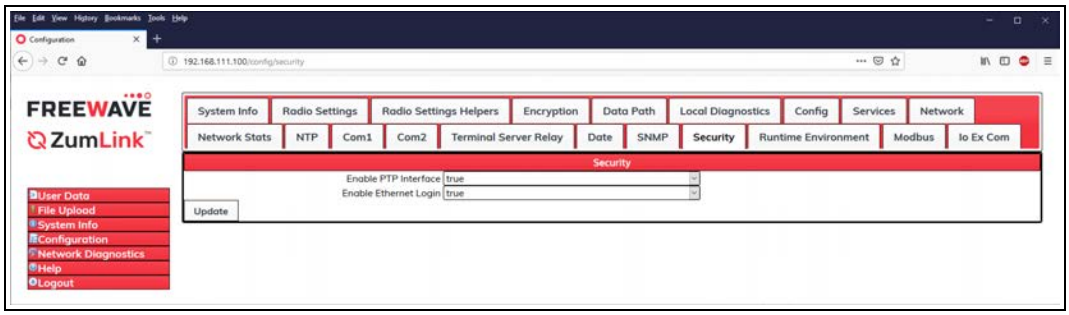

Figure 257: Security window

6. Optional: On the **Menu** list, click the **Configuration** link to Change the Security Parameters (on page 117).

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36.20. Services window

The **Services** window is used to enter the number of seconds of idle time before the CLI connection is closed.

Note: See the Services Parameters (on page 320) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.
4. On the **Menu** list, click the **Configuration** link. Figure 258

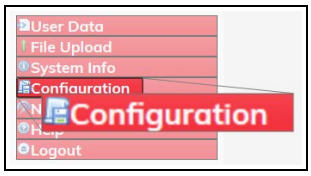

Figure 258: Configuration link

   The **Authentication Required** (Login) dialog box opens.
5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.
6. Click the **Services** tab to access the **Services** parameters. Figure 259

   Note: See the Services Parameters (on page 320) for detailed information about the parameters.

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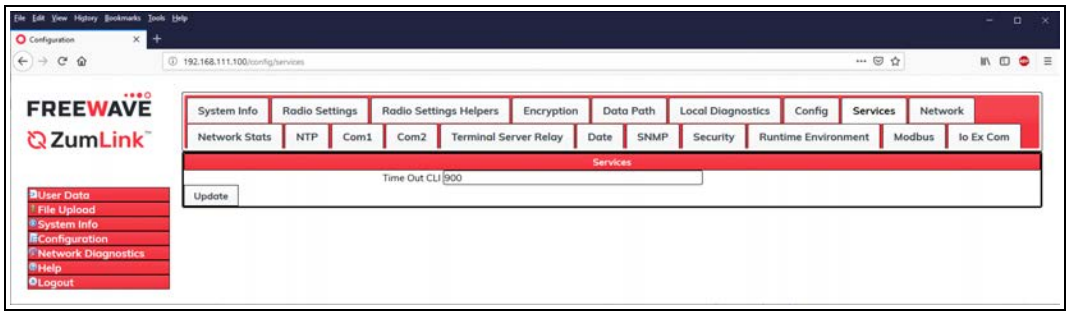

Figure 259: Services window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the Services Parameters (on page 119).

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36.21. SNMP window

The **SNMP** window is used to enable, disable, and define SNMP access.

> **Note**: See the SNMP Parameters (on page 322) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 260

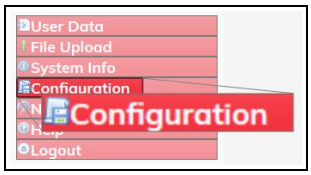

Figure 260: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **SNMP** tab to access the **SNMP** parameters.

   > **Note**: See the SNMP Parameters (on page 322) for detailed information about the parameters.

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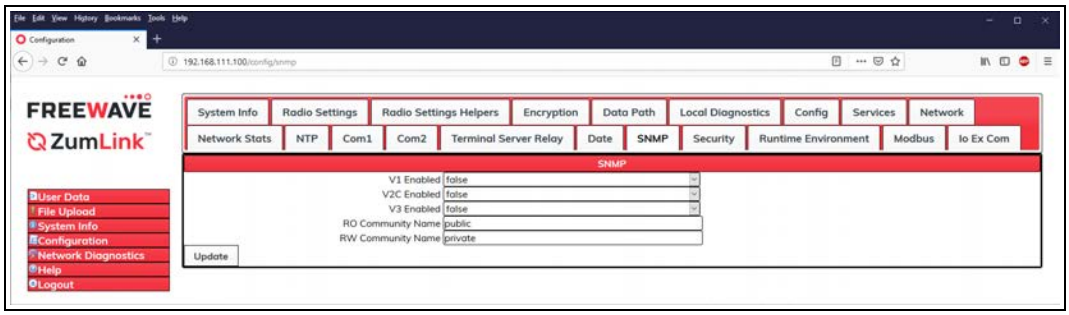

Figure 261: SNMP window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the SNMP Parameters (on page 121).

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36.22. System Info window

The **System Info** window provides system level information for the Z9-P2 or Z9-PE2.

> **Note**: See the System Info Parameters (on page 336) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 262

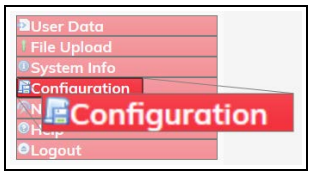

Figure 262: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

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6. Click the **System Info** tab to access the **System Info** parameters. Figure 263

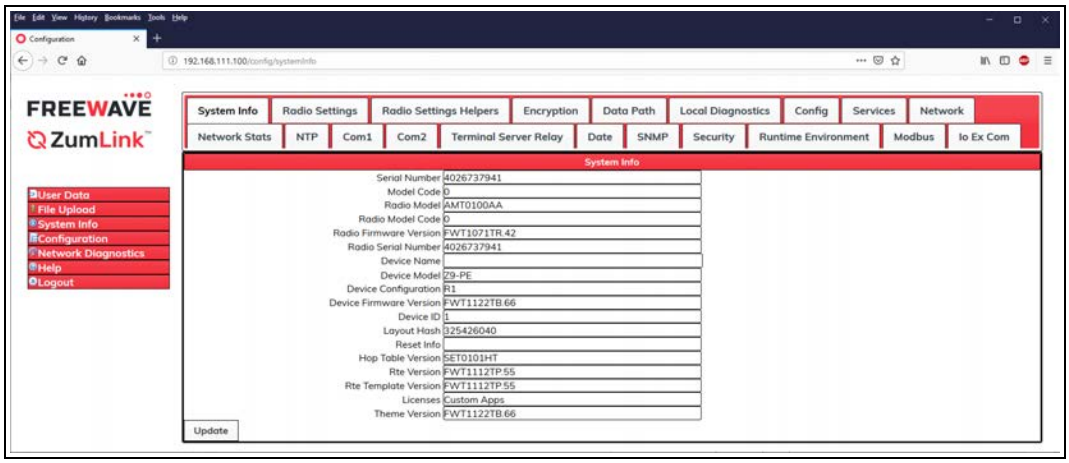

Figure 263: System Info window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the System Info Parameters (on page 123).

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36.23. Terminal Server Relay window

The **Terminal Server Relay** window is used to connect the local Terminal Servers (hence the COM ports) to any remote Terminal Server.

> **Note**: See the Terminal Server Relay Parameters (on page 347) for detailed information about the parameters.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration (on page 86) procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   > **Note**: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   > If the IP address was changed, enter that IP Address.
   > See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **Configuration** link. Figure 264

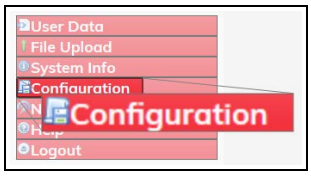

Figure 264: Configuration link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.
   The **Login** dialog box closes and the **System Info** window opens.

   > **Note**: If the **User Name** or **Password** were changed, enter the applicable information.

6. Click the **Terminal Server Relay** tab to access the **Terminal Server Relay** parameters. Figure 265

   > **Note**: See the Terminal Server Relay Parameters (on page 347) for detailed information about the parameters.

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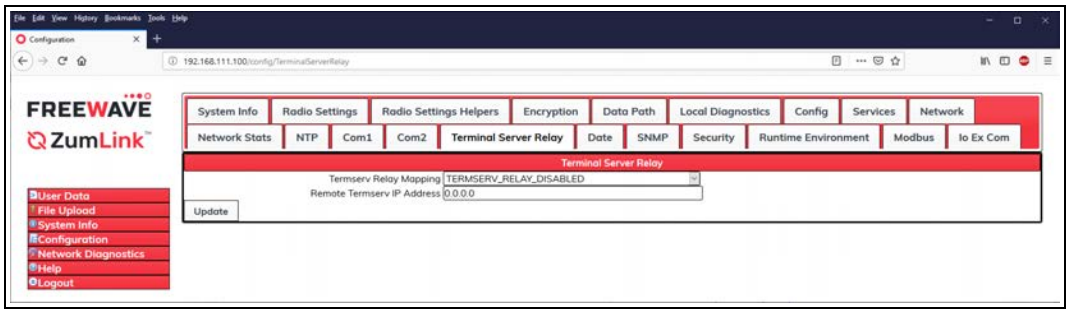

Figure 265: Terminal Server Relay window

7. Optional: On the **Menu** list, click the **Configuration** link to Change the Terminal Server Relay Parameters (on page 125).

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36.24. User Data - Drag and Drop window

The **User Data - Drag and Drop** window lists the default files of the Z9-P2 or Z9-PE2.

Access and Window Description

1. Verify the Setup the Computer IP Address Configuration procedure is completed.
2. Open a web browser.
3. In the URL address bar, enter the IP address of the connected Z9-P2 or Z9-PE2 and press <Enter>.
   The Home window (on page 378) opens.

   Note: If this is the first time the Z9-P2 or Z9-PE2 is accessed, enter its default IP address of **192.168.111.100**.
   If the IP address was changed, enter that IP Address.
   See the System Info Parameters (on page 336) for detailed information about the parameters.

4. On the **Menu** list, click the **User Data - Drag and DropUser Data** link.

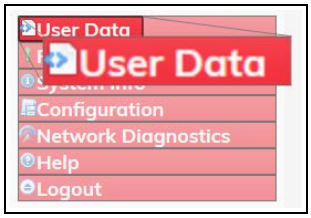

Figure 266: User Data - Drag and Drop Files link

   The **Authentication Required** (Login) dialog box opens.

5. Enter **admin** in both the **User Name** and **Password** text boxes and click **OK**.

   Note: If the **User Name** or **Password** were changed, enter the applicable information.

   The **Login** dialog box closes and the **User Data** window opens. Figure 267

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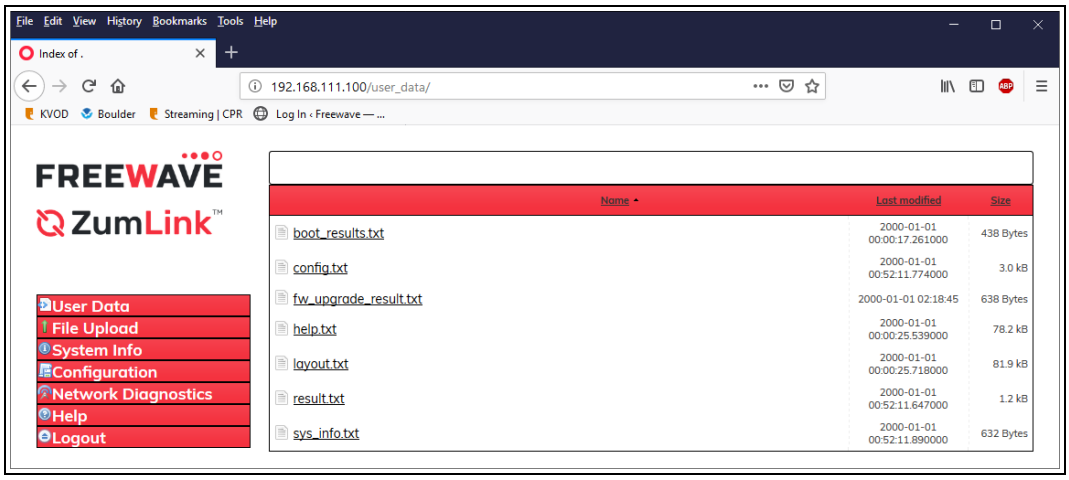

Figure 267: User Data window

Files and Descriptions - Z9-P2 or Z9-PE2	
File Name	**Description**
boot_results.txt	The **boot_results.txt** file shows the firmware version the device is currently running.
config.txt	The **config.txt** file contains all of the configuration parameters of the Z9-P2 or Z9-PE2. These parameters determine how the device functions and connects to other devices in the network.
fw_upgrade_ result.txt	The **fw_upgrade_result.txt** file shows the status of the update procedure for the device firmware. **Note**: This file appears after the **ZumLink** has been updated to a newer version of firmware.
help.txt	The **help.txt** file contains online user assistance information using the CLI commands. **Example**: In a CLI window, enter **help=txPower** or **help txpower** to see the help information for the **radioSetting.txpower** setting.
layout.txt	The **layout.txt** file is used for management applications to provide the CLI and **config.cfg** with a format description of the commands.
result.txt	The **result.txt** is used to verify the acceptance or rejection of each parameter change applied to the **config.txt** file. **Note**: This file appears after the **config.txt** file of the **ZumLink** has been changed.
sys_info.txt	The **sys_info.txt** file provides information about the radio including serial number, model number, firmware versions, and device name.

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37. Release Notes

These sections describe the additions, changes, and known limitations in each software version for the ZumLink Z9-P2 or Z9-PE2. The most recent version is listed first.

The latest firmware and software versions and the most recent list of known limitations and workarounds are available on support.freewave.com.

37.1. Version 1.1.2.2 (Initial Release)

Release Date: July 2019

Additions and Changes

- The Web Interface has been re-designed for improved usability on the Z9-P2 or Z9-PE2.
- Support has been added for:

  Note: See the Supply Voltage (on page 248) parameter for more information.

  - VLAN Management
    - Users can only access the device from the VLAN ID.
    - If the VLAN tag is set on a specific Ethernet port, that port cannot be used to access the Management VLAN ID.

  Note: See the VLAN MGMT (on page 271) parameter for additional information.

- **Windows® File Explorer** now shows 4.4 GB of space instead of the 1.8 GB in previous software versions.
  - This is a result of the ptp directory moving to a new partition.

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- To view space available for applications, login as **devuser** and run the command **df -h**.
  - The /persist directory is where applications reside.

Corrections have been implemented for:

- The **devuser** login password and the sudo password were out of sync when loading a new **IQ Application Environment** when the default password was changed on the existing **IQ Application Environment**. These passwords are now in sync.
- Files uploaded using the Web Interface cannot be deleted by users.
- After updating the Rte Template Version (on page 344) parameter, a reboot is necessary to update the **sys_info.txt** file.

Known Limitations and Workarounds

- Setting Time String (on page 227) causes the **entire Z9-P2 or Z9-PE2 configuration** to revert to saved settings.
  - **Workaround**: Save settings before changing the **date.timeString** parameter.
- Cannot change the **date.timeString** once the time is set using NTP.
- The **UCD-SNMP-MIB-WP201.txt** file is missing definition for **dskIndex**.
- The Ethernet ports can become unresponsive after changing networks and the VLAN Tag Port 1 (on page 271) and/or VLAN Tag Port 2 (on page 273) IDs.
  - **Workaround**: Reboot the Z9-P2 or Z9-PE2 for changes to take effect.
- Setting the VLAN Tag Port 1 (on page 271) or VLAN Tag Port 2 (on page 273) may affect the connectivity of the other port.
- Unable to get input voltage via Modbus.
- When using the Web Interface on a computer with **Windows**® 8 or **Windows**® 10, clicking **Cancel** does **not** halt the upload process.
- Files uploaded using the Web Interface drag-n-drop procedure are now write-protected and cannot be deleted.
- When changing and saving the Radio Settings Parameters (on page 285), the CLI interface may momentarily lock.
- If there is enough space to transfer the update firmware but not enough to facilitate the update, the update fails and the Upgrade Failed LEDs do not function.
  - **Workaround**: Users should verify the available free space before uploading an update firmware file.
    At least 2x free space is needed on the Z9-P2 or Z9-PE2 for the firmware update file.
- Users should wait at least 30 seconds after a factory default command is issued before making configuration changes.
- The fields in the NTP Parameters (on page 280) parameters are **not** validated by the system.
  - **Workaround**: Verify the NTP parameter settings are correct.

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- Unable to set the time when the NTP Reference (on page 283) parameter `=NETWORK_TIME_SERVER`.
- The highest baud rate supported for RS422 and RS485 is 421 kbps.
- In Firmware v1.1.2.2, when the Flow Control (on page 203) parameter is set to `hardware`, the COM port's flow control does not function.
- Exiting from the CLI may take up to 30 seconds.
- Entering the shortcut text of `ModbusTcp` and `ModbusRtuOverTcp` results in a DUPLICATE_PARAMETER Error.
  - **Workaround**: The fully-qualified parameter of `modbus.modbusTcp` and `modbus.modbusRtuOverTcp` must be entered.
- When issuing the `factoryDefaults=set` command, after making changes for any of the Network Parameters (on page 262), the user is locked out of the CLI.
  - **Workaround**: Reboot the Z9-P2 or Z9-PE2 for changes to take effect.
- VSWR reading may be inconsistent between the **Network Diagram** on the Network Diagnostics window (on page 387) and the information reported in the Local Diagnostics window (on page 381).
- The File Upload window (on page 374) shows a 100% upload when the upload file has not completed on **Windows**® 8 and **Windows**® 10 computers.
  - **Workaround**: Wait the appropriate amount of time or watch the LEDs to indicate completion of file transfer or use the v1112-Firmware Update - Drag and Drop procedure.
- When setting the parameter Arp Filter Enabled`=true`, ARP requests and responses are NOT blocked on VLAN interfaces.
- Rebooting a pair of radios simultaneously when one of the Z9-P2 or Z9-PE2 has the parameter Termserv Relay Mapping`=Enabled`, the terminal server relay takes up to 6 minutes to become active.
- To update the Network Diagnostics window (on page 387), refresh the browser to clear the browser cache.
- When the Termserv Relay Mapping (on page 348) parameter is designated and the Flow Control (on page 203) parameter is set to `Hardware`, the COM port's flow control does not function.
- Significant data is lost between radios when operating in close proximity (3-6 feet) when `radioSettings.rfDataRate=RATE_4M` (See RF Data Rate (on page 307)).
  - **Workarounds**:
    - Reduce power on radios when operating in close proximity.
    - Enable the LNA Bypass (on page 294).
- When using the USB, the CLI may lock up on units with Termserv Relay Mapping (on page 348) enabled.
  - **Workarounds**:
    - Re-seat the cable

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    - Reconfigure the Termserv Relay Mapping using either of these procedures: Drag and Drop Configuration (on page 28) or Web Interface Configuration (on page 39)
- When the Termserv Relay Mapping parameter is in use, the Connection Drops (on page 200) count should be ignored.
- When operating at RF Data Rate = **RATE_4M** and with multiple Repeaters, if a **short** Beacon Interval and a **high** Beacon Burst Count are designated, throughput is very low.
    - **Workaround**: Use either a **longer** Beacon Interval or a **lower** Beacon Burst Count.
- As Repeaters are chained in the network, round trip delay increases.
    - When issuing pings of large packet sizes at the lower data rates, such as 115.2K, and a Beacon Interval=**TWENTY_FIVE_MS**, the latency can increase causing the pings to fail.
        - **Workaround**: Allow an appropriate delay between pings.

    FREEWAVE Recommends: Set the **beaconBurstCount=2** or more and **beaconInterval=ONE_HUNDRED_MS** or more for optimal throughput when extended Repeater networks are used.

- The Signal Level (on page 236) parameter reports a maximum of -42 dBm when the RF Data Rate=**RATE_1M**.

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38. Available Accessories

These are the Z9-P2 or Z9-PE2 accessories available from FreeWave.

- Z9-P2 or Z9-PE2 Accessories (on page 424)
- Z9-P2 Only Accessories (on page 425)
- Z9-PE2 Only Accessories (on page 425)

38.1. Z9-P2 or Z9-PE2 Accessories

Available Accessories - Z9-P2 or Z9-PE2	
Part Number	**Description**
EAN0900SQ	• ¼ Wave Omni-directional 900 MHz Stub Antenna • 0 (zero) dBi gain • Straight, SMA Male RF connector
EAN0900SR	• ½ Wave Omni-directional 900 MHz Stub Antenna • 2 dBi gain • Right-angle 360 degree swivel, SMA Male RF connector
EAN0900WC	• Open coil Omni-directional 896-940 MHz Antenna • 5.15 dBi gain. **Important!**: Does NOT include mounting hardware or cable.
EAN0905WC	• Closed coil Omni-directional 896-970 MHz Antenna • 5 dBi gain

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Available Accessories - Z9-P2 or Z9-PE2	
Part Number	**Description**
EAN0906YC	• 3 Element 890-960 MHz Yagi antenna • 8.65 dBi gain • 24” feedline terminated with N female connector
ECD0324ER	3 foot long RJ-45 to DB-9 cable adapter
ECD0658EB	6.5 foot long shielded Ethernet cable
EMD1280AX	12 VDC @ 800 mA AC-to-DC power supply with Phoenix Contact (# 1776692)

38.2. Z9-P2 Only Accessories

Available Accessories - Z9-PE Only	
Part Number	**Description**
AOH0001HT	Multi-position DIN rail bracket kit

38.3. Z9-PE2 Only Accessories

Available Accessories - Z9-PE2 Only	
Part Number	**Description**
EMD1280AX	12 VDC @ 800 mA AC-to-DC power supply with DC plug
AOH4003SP	Reversible DIN rail bracket kit

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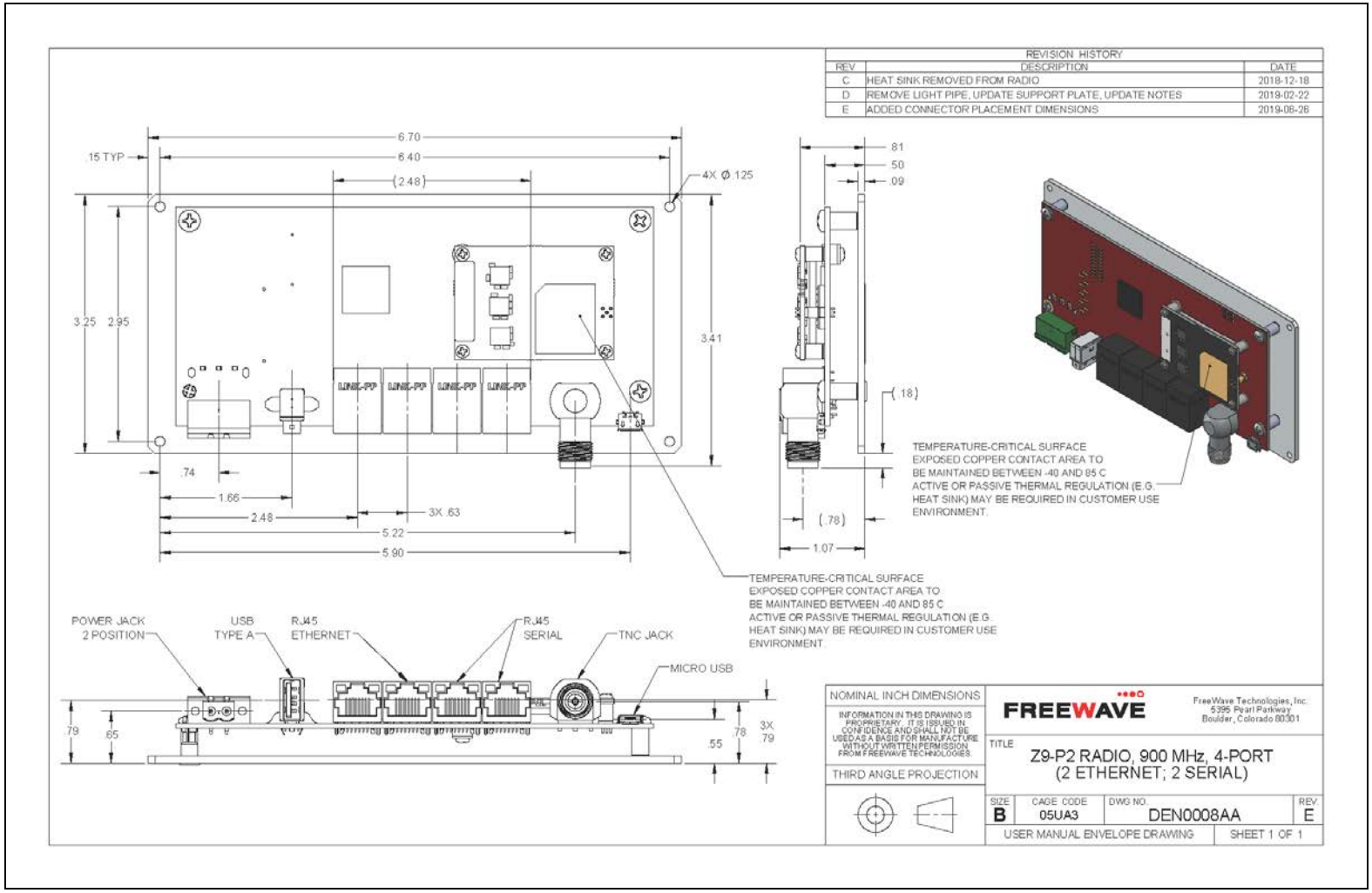
39. Mechanical Drawing - Z9-P2

39.1. Z9-P2 - Top and Sides



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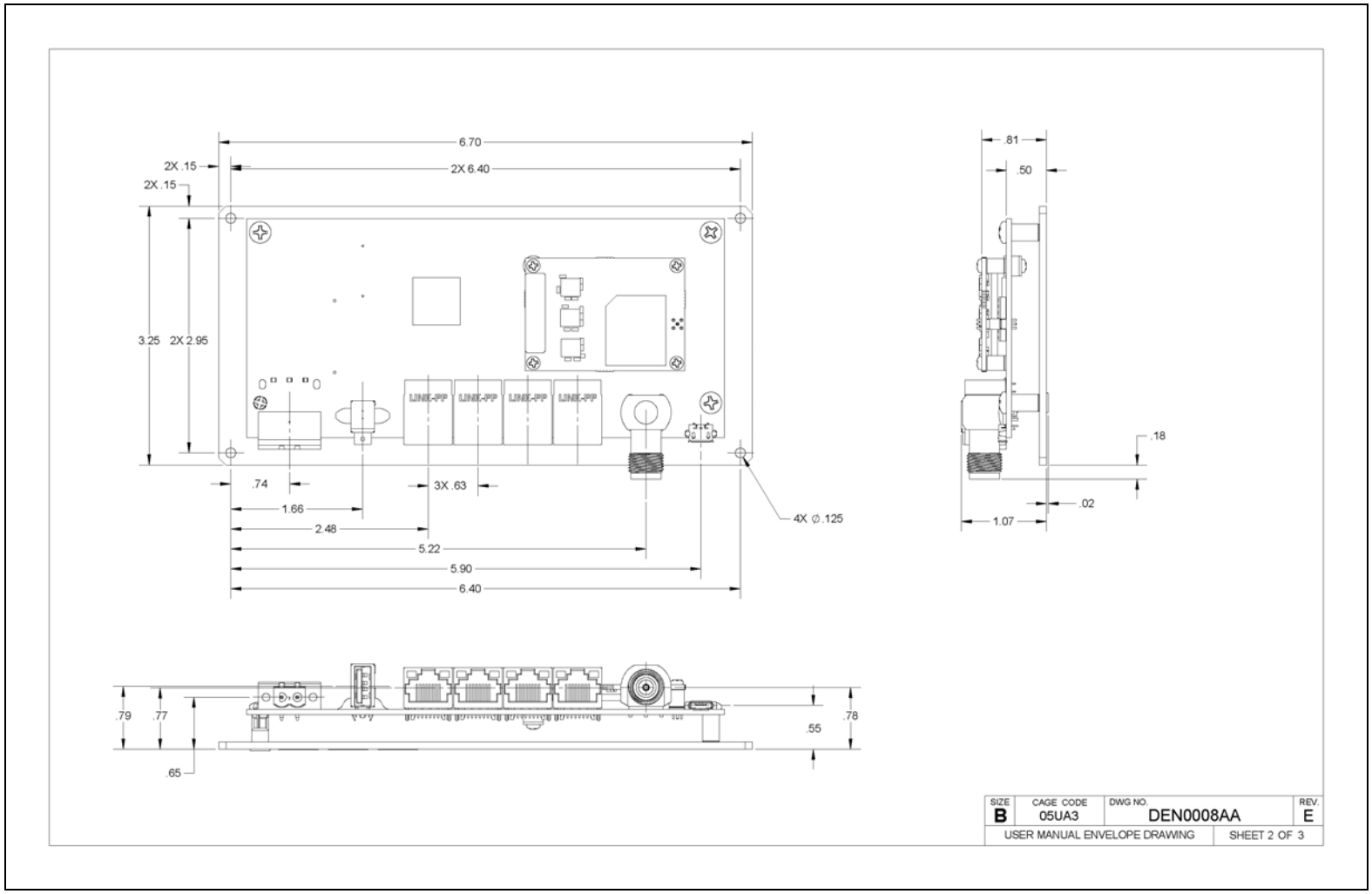
39.2. Z9-P2 - Dimensions



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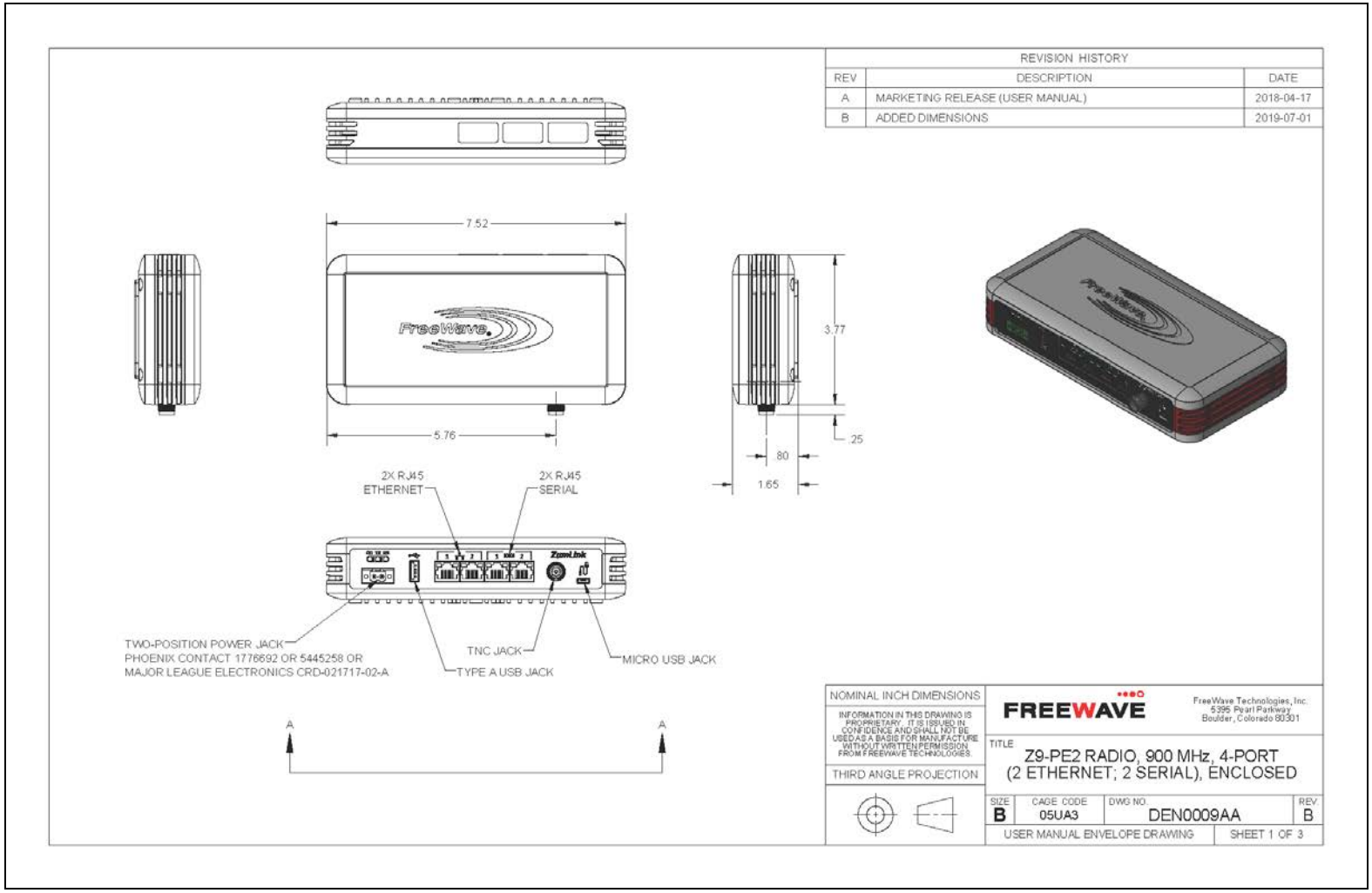
40. Mechanical Drawing - Z9-PE2

40.1. Z9-PE2 - Top and Sides



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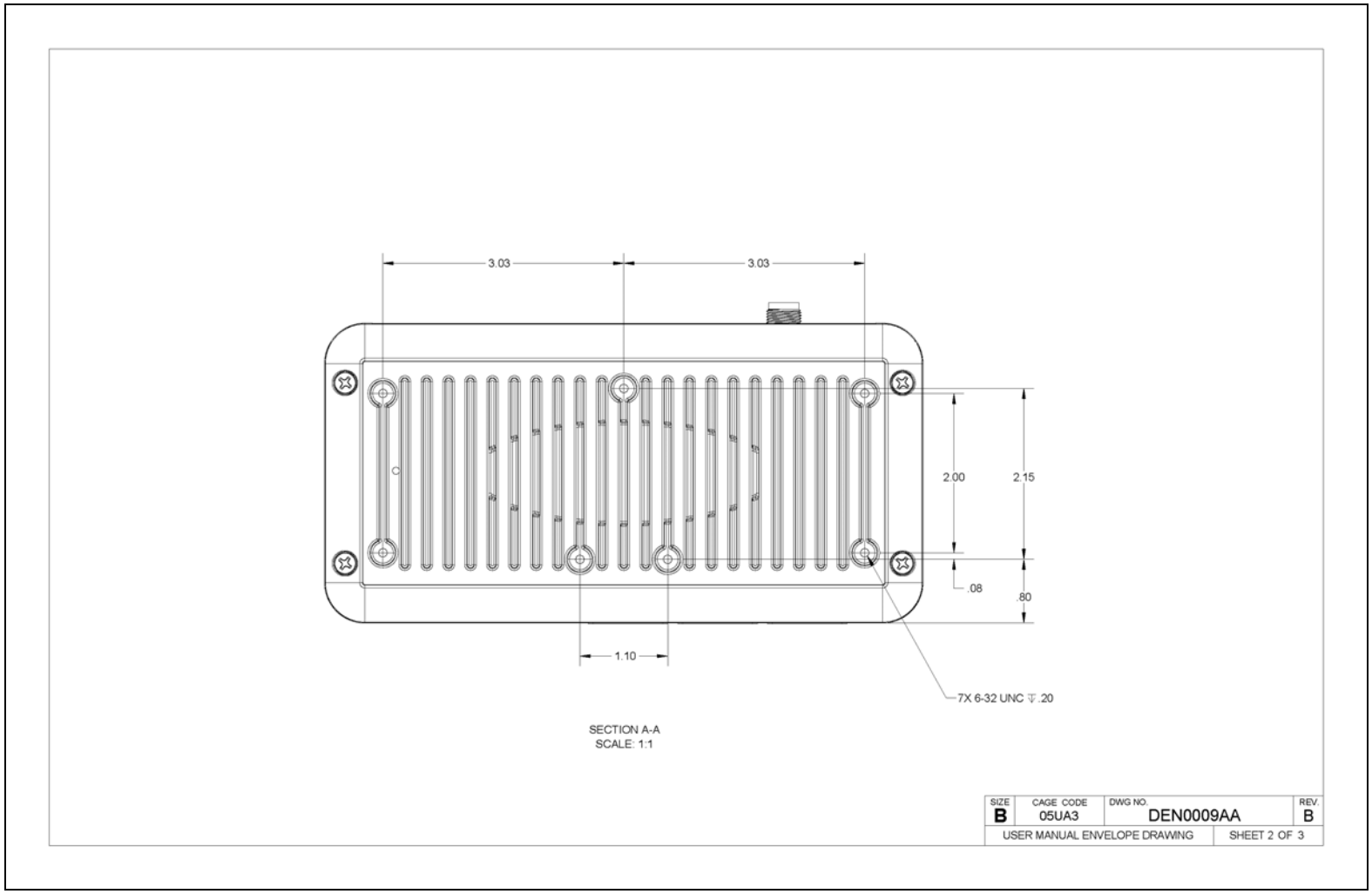
40.2. Z9-PE2 - Back



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41. Z9-P2 or Z9-PE2 Hop Tables

- Standard Hop Set - 900 MHz Channels (on page 431)
- Australia Hop Set - 900 MHz Channels (on page 434)
- Brazil Hop Set - 900 MHz Channels (on page 437)

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41.1. Standard Hop Set - 900 MHz Channels

These are the standard channels supported when the Radio Hopping Mode (on page 299) is **Enabled**.

Note: When the **Radio Hopping Mode** is **Disabled**, the frequency can be set manually.

- RF Data Rate: 115.2 kbps (on page 431)
- RF Data Rate: 250 kbps (on page 432)
- RF Data Rate: 500 kbps (on page 432)
- RF Data Rate: 1 Mbps (on page 432)
- RF Data Rate: 1.5 Mbps (Beta) (on page 433)
- RF Data Rate: 4 Mbps (on page 433)

41.1.1. RF Data Rate: 115.2 kbps

Channel Size (MHz): 0.2304

Number of Channels: 110

Standard Hop Set - ZumLink 900 MHz Channels					
RF Data Rate: 115.2 kbps					
902.4768	907.0848	911.6928	916.3008	920.9088	925.5168
902.7072	907.3152	911.9232	916.5312	921.1392	925.7472
902.9376	907.5456	912.1536	916.7616	921.3696	925.9776
903.1680	907.7760	912.3840	916.9920	921.6000	926.2080
903.3984	908.0064	912.6144	917.2224	921.8304	926.4384
903.6288	908.2368	912.8448	917.4528	922.0608	926.6688
903.8592	908.4672	913.0752	917.6832	922.2912	926.8992
904.0896	908.6976	913.3056	917.9136	922.5216	927.1296
904.3200	908.9280	913.5360	918.1440	922.7520	927.3600
904.5504	909.1584	913.7664	918.3744	922.9824	927.5904
904.7808	909.3888	913.9968	918.6048	923.2128	
905.0112	909.6192	914.2272	918.8352	923.4432	
905.2416	909.8496	914.4576	919.0656	923.6736	
905.4720	910.0800	914.6880	919.2960	923.9040	
905.7024	910.3104	914.9184	919.5264	924.1344	
905.9328	910.5408	915.1488	919.7568	924.3648	
906.1632	910.7712	915.3792	919.9872	924.5952	
906.3936	911.0016	915.6096	920.2176	924.8256	
906.6240	911.2320	915.8400	920.4480	925.0560	
906.8544	911.4624	916.0704	920.6784	925.2864	

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41.1.2. RF Data Rate: 250 kbps

Channel Size (MHz): 0.3456

Number of Channels: 73

Standard Hop Set - ZumLink900 MHz Channels										
RF Data Rate: 250 kbps										
902.5344		907.0272		911.5200		916.0128		920.5056		924.9984
902.8800		907.3728		911.8656		916.3584		920.8512		925.3440
903.2256		907.7184		912.2112		916.7040		921.1968		925.6896
903.5712		908.0640		912.5568		917.0496		921.5424		926.0352
903.9168		908.4096		912.9024		917.3952		921.8880		926.3808
904.2624		908.7552		913.2480		917.7408		922.2336		926.7264
904.6080		909.1008		913.5936		918.0864		922.5792		927.0720
904.9536		909.4464		913.9392		918.4320		922.9248		927.4176
905.2992		909.7920		914.2848		918.7776		923.2704		
905.6448		910.1376		914.6304		919.1232		923.6160		
905.9904		910.4832		914.9760		919.4688		923.9616		
906.3360		910.8288		915.3216		919.8144		924.3072		
906.6816		911.1744		915.6672		920.1600		924.6528		

41.1.3. RF Data Rate: 500 kbps

Channel Size (MHz): 0.6912

Number of Channels: 36

Standard Hop Set - ZumLink 900 MHz Channels										
RF Data Rate: 500 kbps										
902.7072		906.8544		911.0016		915.1488		919.2960		923.4432
903.3984		907.5456		911.6928		915.8400		919.9872		924.1344
904.0896		908.2368		912.3840		916.5312		920.6784		924.8256
904.7808		908.9280		913.0752		917.2224		921.3696		925.5168
905.4720		909.6192		913.7664		917.9136		922.0608		926.2080
906.1632		910.3104		914.4576		918.6048		922.7520		926.8992

41.1.4. RF Data Rate: 1 Mbps

Channel Size (MHz): 1.3824

Number of Channels: 18

Standard Hop Set - ZumLink 900 MHz Channels	
RF Data Rate: 1 Mbps	
903.0528	915.4944
904.4352	916.8768

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Standard Hop Set - ZumLink 900 MHz Channels	
RF Data Rate: 1 Mbps	
905.8176	918.2592
907.2000	919.6416
908.5824	921.0240
909.9648	922.4064
911.3472	923.7888
912.7296	925.1712
914.1120	926.5536

41.1.5. RF Data Rate: 1.5 Mbps (Beta)

Channel Size (MHz): 1.3824

Number of Channels: 17

Standard Hop Set - ZumLink 900 MHz Channels	
RF Data Rate: 1.5 Mbps (Beta)	
903.2562	916.1586
904.8690	917.7714
906.4818	919.3842
908.0946	920.9970
909.7074	922.6098
911.3202	924.2226
912.9330	925.8354
914.5458	

41.1.6. RF Data Rate: 4 Mbps

Channel Size (MHz): 3.2256

Number of Channels: 7

Standard Hop Set - ZumLink 900 MHz Channels
RF Data Rate: 4 Mbps
904.5504
907.7760
911.0016
914.2272
917.4528
920.6784
923.9040

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41.2. Australia Hop Set - 900 MHz Channels

These are the standard channels supported when the Radio Hopping Mode (on page 299) is **Enabled**.

> **Note**: When the **Radio Hopping Mode** is **Disabled**, the frequency can be set manually.

- RF Data Rate: 115.2 kbps (on page 434)
- RF Data Rate: 250 kbps (on page 434)
- RF Data Rate: 500 kbps (on page 435)
- RF Data Rate: 1 Mbps (on page 435)
- RF Data Rate: 1.5 Mbps (Beta) (on page 436)
- RF Data Rate: 4 Mbps (on page 436)

41.2.1. RF Data Rate: 115.2 kbps

Channel Size (MHz): 0.2304

Number of Channels: 54

Australia Hop Set - ZumLink 900 MHz Channels										
RF Data Rate: 115.2 kbps										
915.3792		917.6832		919.9872		922.2912		924.5952		926.8992
915.6096		917.9136		920.2176		922.5216		924.8256		927.1296
915.8400		918.1440		920.4480		922.7520		925.0560		927.3600
916.0704		918.3744		920.6784		922.9824		925.2864		927.5904
916.3008		918.6048		920.9088		923.2128		925.5168		
916.5312		918.8352		921.1392		923.4432		925.7472		
916.7616		919.0656		921.3696		923.6736		925.9776		
916.9920		919.2960		921.6000		923.9040		926.2080		
917.2224		919.5264		921.8304		924.1344		926.4384		
917.4528		919.7568		922.0608		924.3648		926.6688		

41.2.2. RF Data Rate: 250 kbps

Channel Size (MHz): 0.3456

Number of Channels: 35

Australia Hop Set - ZumLink 900 MHz Channels						
RF Data Rate: 250 kbps						
915.6672		919.1232		922.5792		926.0352
916.0128		919.4688		922.9248		926.3808
916.3584		919.8144		923.2704		926.7264
916.7040		920.1600		923.6160		927.0720

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Australia Hop Set - ZumLink 900 MHz Channels						
RF Data Rate: 250 kbps						
917.0496		920.5056		923.9616		927.4176
917.3952		920.8512		924.3072		
917.7408		921.1968		924.6528		
918.0864		921.5424		924.9984		
918.4320		921.8880		925.3440		
918.7776		922.2336		925.6896		

41.2.3. RF Data Rate: 500 kbps

Channel Size (MHz): 0.6912

Number of Channels: 17

Australia Hop Set - ZumLink 900 MHz Channels	
RF Data Rate: 500 kbps	
915.8400	922.0608
916.5312	922.7520
917.2224	923.4432
917.9136	924.1344
918.6048	924.8256
919.2960	925.5168
919.9872	926.2080
920.6784	926.8992
921.3696	

41.2.4. RF Data Rate: 1 Mbps

Channel Size (MHz): 1.3824

Number of Channels: 8

Australia Hop Set - ZumLink 900 MHz Channels
RF Data Rate: 1 Mbps
Frequency
916.8768
918.2592
919.6416
921.0240
922.4064
923.7888
925.1712
926.5536

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41.2.5. RF Data Rate: 1.5 Mbps (Beta)

Channel Size (MHz): 1.3824

Number of Channels: 7

Australia Hop Set - ZumLink900 MHz Channels
RF Data Rate: 1.5 Mbps (Beta)
916.1586
917.7714
919.3842
920.9970
922.6098
924.2226
925.8354

41.2.6. RF Data Rate: 4 Mbps

Channel Size (MHz): 3.2256

Number of Channels: 3

Australia Hop Set - ZumLink 900 MHz Channels
RF Data Rate: 4 Mbps
917.4528
920.6784
923.9040

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41.3. Brazil Hop Set - 900 MHz Channels

These are the standard channels supported when the Radio Hopping Mode (on page 299) is **Enabled**.

Note: When the **Radio Hopping Mode** is **Disabled**, the frequency can be set manually.

- RF Data Rate: 115.2 kbps (on page 437)
- RF Data Rate: 250 kbps (on page 438)
- RF Data Rate: 500 kbps (on page 438)
- RF Data Rate: 1 Mbps (on page 438)
- RF Data Rate: 1.5 Mbps (Beta) (on page 439)
- RF Data Rate: 4 Mbps (on page 439)

41.3.1. RF Data Rate: 115.2 kbps

Channel Size (MHz): 0.2304

Number of Channels: 75

Brazil Hop Set - ZumLink 900 MHz Channels									
RF Data Rate: 115.2 kbps									
902.4768		905.9328		917.4528		920.9088		924.3648	
902.7072		906.1632		917.6832		921.1392		924.5952	
902.9376		906.3936		917.9136		921.3696		924.8256	
903.1680		906.6240		918.1440		921.6000		925.0560	
903.3984		906.8544		918.3744		921.8304		925.2864	
903.6288		907.0848		918.6048		922.0608		925.5168	
903.8592		915.3792		918.8352		922.2912		925.7472	
904.0896		915.6096		919.0656		922.5216		925.9776	
904.3200		915.8400		919.2960		922.7520		926.2080	
904.5504		916.0704		919.5264		922.9824		926.4384	
904.7808		916.3008		919.7568		923.2128		926.6688	
905.0112		916.5312		919.9872		923.4432		926.8992	
905.2416		916.7616		920.2176		923.6736		927.1296	
905.4720		916.9920		920.4480		923.9040		927.3600	
905.7024		917.2224		920.6784		924.1344		927.5904	

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41.3.2. RF Data Rate: 250 kbps

Channel Size (MHz): 0.3456

Number of Channels: 49

Brazil Hop Set - ZumLink 900 MHz Channels									
RF Data Rate: 250 kbps									
902.5344		905.9904		917.7408		921.1968		924.6528
902.8800		906.3360		918.0864		921.5424		924.9984
903.2256		906.6816		918.4320		921.8880		925.3440
903.5712		907.0272		918.7776		922.2336		925.6896
903.9168		915.6672		919.1232		922.5792		926.0352
904.2624		916.0128		919.4688		922.9248		926.3808
904.6080		916.3584		919.8144		923.2704		926.7264
904.9536		916.7040		920.1600		923.6160		927.0720
905.2992		917.0496		920.5056		923.9616		927.4176
905.6448		917.3952		920.8512		924.3072		

41.3.3. RF Data Rate: 500 kbps

Channel Size (MHz): 0.6912

Number of Channels: 24

Brazil Hop Set - ZumLink 900 MHz Channels				
RF Data Rate: 500 kbps				
902.7072		916.5312		922.0608
903.3984		917.2224		922.7520
904.0896		917.9136		923.4432
904.7808		918.6048		924.1344
905.4720		919.2960		924.8256
906.1632		919.9872		925.5168
906.8544		920.6784		926.2080
915.8400		921.3696		926.8992

41.3.4. RF Data Rate: 1 Mbps

Channel Size (MHz): 1.3824

Number of Channels: 11

Brazil Hop Set - ZumLink 900 MHz Channels	
RF Data Rate: 1 Mbps	
903.0528	921.0240
904.4352	922.4064
905.8176	923.7888

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Brazil Hop Set - ZumLink 900 MHz Channels	
RF Data Rate: 1 Mbps	
916.8768	925.1712
918.2592	926.5536
919.6416	

41.3.5. RF Data Rate: 1.5 Mbps (Beta)

Channel Size (MHz): 1.3824

Number of Channels: 10

Standard Hop Set - ZumLink900 MHz Channels	
RF Data Rate: 1.5 Mbps (Beta)	
903.2562	919.3842
904.8690	920.9970
906.4818	922.6098
916.1586	924.2226
917.7714	925.8354

41.3.6. RF Data Rate: 4 Mbps

Channel Size (MHz): 3.2256

Number of Channels: 4

Brazil Hop Set - ZumLink 900 MHz Channels
RF Data Rate: 4 Mbps
904.5504
917.4528
920.6784
923.9040

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42. Z9-P2 or Z9-PE2 MIB

These are the supported item groups in the Z9-P2 or Z9-PE2 MIB file:

- CPU Usage (on page 441)
- Disk Usage (on page 441)
- Memory Usage (on page 443)
- FreeWave Technologies - MIB-FWT1122TB.66
- SNMP Write Access (on page 455)

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42.1. CPU Usage

ZumLink MIB - CPU Usage

Objective Type	Syntax	MAX Access	Status	Description	::=
ssCpuUser	Integer32	Read-only	Deprecated	The percentage of CPU time spent processing user-level code, calculated over the last minute.	{ systemStats 9 }
ssCpuSystem	Integer32	Read-only	Deprecated	The percentage of CPU time spent processing system-level code, calculated over the last minute.	{ systemStats 10 }
ssCpuIdle	Integer32	Read-only	Deprecated	The percentage of processor time spent idle, calculated over the last minute.	{ systemStats 11 }
ssCpuNice	Integer32	Read-only	Deprecated	The percentage of processor time spent nice, calculated over the last minute.	{ systemStats 12 }

42.2. Disk Usage

ZumLink MIB - Disk Usage

Objective Type	Syntax	MAX Access	Status	Description	::=
dskTable	Sequence of DskEntry	Not Accessible	Current	Disk watching information. Partitions to be watched are configured by the **snmpd.conf** file of the agent.	{ ucdavis 9 }

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ZumLink MIB - Disk Usage					
Objective Type	**Syntax**	**MAX Access**	**Status**	**Description**	**::=**

dskEntry	DskEntry	Not Accessible	Current	An entry containing a disk and its statistics.
				Index = { dskIndex }
				`DskEntry ::= SEQUENCE {`
				`dskPath DisplayString,`
				`dskDevice DisplayString,`
				`dskTotal Integer32,`
				`dskAvail Integer32,`
				`dskUsed Integer32,`
				`dskPercent Integer32,`
				`dskPercentNode Integer32`
				`}`
					{ dskTable 1 }

dskPath	DisplayString	Read-only	Current	Path where the disk is mounted.	{ dskEntry 2 }
dskDevice	DisplayString	Read-only	Current	Path of the device for the partition.	{ dskEntry 3 }
dskTotal	Integer32	Read-only	Current	Total size of the disk / partition (kBytes).	{ dskEntry 6 }
dskAvail	Integer32	Read-only	Current	Available space on the disk.	{ dskEntry 7 }
dskUsed	Integer32	Read-only	Current	Used space on the disk.	{ dskEntry 8 }
dskPercent	Integer32	Read-only	Current	Percentage of space used on disk.	{ dskEntry 9 }
dskPercentNode	Integer32	Read-only	Current	Percentage of nodes used on disk.	{ dskEntry 10 }

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42.3. Memory Usage

ZumLink MIB - Memory Usage

Objective Type	Syntax	Units	MAX Access	Status	Description	::=
memTotalSwap	Integer32	kB	Read-only	Current	The total amount of swap space configured for this host.	{ memory 3 }
memAvailSwap	Integer32	kB	Read-only	Current	The amount of swap space currently unused or available.	{ memory 4 }
memTotalReal	Integer32	kB	Read-only	Current	The total amount of real / physical memory installed on the host.	{ memory 5 }
memAvailReal	Integer32	kB	Read-only	Current	The amount of real / physical memory currently unused or available.	{ memory 7 }
memShared	Integer32	kB	Read-only	Current	The total amount of real or virtual memory currently allocated for use as shared memory. This object will not be implemented on hosts where the underlying operating system does not explicitly identify memory as specifically reserved for this purpose.	{ memory 13 }
memBuffer	Integer32	kB	Read-only	Current	The total amount of real or virtual memory currently allocated for use as memory buffers. This object will not be implemented on hosts where the underlying operating system does not explicitly identify memory as specifically reserved for this purpose.	{ memory 14 }
memCached	Integer32	kB	Read-only	Current	The total amount of real or virtual memory currently allocated for use as cached memory. This object will not be implemented on hosts where the underlying operating system does not explicitly identify memory as specifically reserved for this purpose.	{ memory 15 }

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ZumLink MIB - Memory Usage						
Objective Type	**Syntax**	**Units**	**MAX Access**	**Status**	**Description**	**::=**
memUsedReal	Integer32	kB	Read-only	Current	The amount of real / physical memory currently used or available.	{ memory 18 }
memSpeed	Integer32	Hz	Read-only	Current	The Speed of real / physical memory.	{ memory 19 }

42.4. FreeWave Technologies - MIB

FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkSerialNumber	Serial Number	Read-only	Unsigned32
fwtZumLinkModelCode	Model Code	Read-only	Unsigned32
fwtZumLinkRadioModel	Radio model	Read-only	DisplayString
fwtZumLinkRadioModelCode	Radio Model Code	Read-only	Unsigned32
fwtZumLinkRadioFirmwareVersion	Radio Firmware Version	Read-only	DisplayString
fwtZumLinkRadioSerialNumber	Radio Serial Number	Read-only	DisplayString
fwtZumLinkDeviceName	Device Name	Read-only	DisplayString
fwtZumLinkDeviceModel	Device Model	Read-only	DisplayString
fwtZumLinkDeviceConfiguration	Device Configuration	Read-only	DisplayString
fwtZumLinkDeviceFirmwareVersion	Device Firmware Version	Read-only	DisplayString
fwtZumLinkDeviceId	Device Identifier	Read-only	Unsigned32
fwtZumLinkLayoutHash	Unique Layout Identifier	Read-only	Unsigned32
fwtZumLinkResetInfo	Reset Information	Read-only	DisplayString
fwtZumLinkHopTableVersion	Radio Hop Table Version	Read-only	DisplayString
fwtZumLinkRteVersion	Runtime Environment Version	Read-only	DisplayString
fwtZumLinkRteTemplateVersion	Runtime Template Environment Version	Read-only	DisplayString
fwtZumLinkLicenses	License Information	Read-only	DisplayString
fwtZumLinkThemeVersion	Theme Version	Read-only	DisplayString

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkRadioMode	Radio Operational Mode	Read-Write	ZUMLINK_RADIO_MODE_THOR
fwtZumLinkRfDataRate	RF Link Data Rate	Read-Write	ZUMLINK_RF_DATA_RATES
fwtZumLinkRadioMaxRepeaters	Max Repeater slots in the Network	Read-Write	Unsigned32
fwtZumLinkRadioRepeaterSlot	Repeater Slot	Read-Write	Unsigned32
fwtZumLinkTxPower	Transmit Power	Read-Write	ZUMLINK_RADIO_TX_POWER
fwtZumLinkNetworkId	Network Identifier	Read-Write	Unsigned32
fwtZumLinkNodeId	Node ID	Read-Write	Unsigned32
fwtZumLinkFrequencyKey	Frequency Key	Read-Write	ZUMLINK_FREQUENCYKEYS
fwtZumLinkRadioFrequency	Operating Center Frequency in MHz	Read-Write	Float32TC
fwtZumLinkRadioHoppingMode	Radio Hopping Mode	Read-Write	ZUMLINK_RADIO_HOPPING_MODE
fwtZumLinkBeaconInterval	Beacon Interval	Read-Write	ZUMLINK_BEACON_INTERVALS
fwtZumLinkBeaconBurstCount	The number of beacons to send per beacon time.	Read-Write	Unsigned32
fwtZumLinkLnaBypass	LNA Bypass	Read-Write	ZUMLINK_LNA_BYPASS
fwtZumLinkMaxLinkDistanceInMiles	The max link distance in miles	Read-Write	Unsigned32
fwtZumLinkFrequencyMasks	Frequency Masks	Read-Write	DisplayString
fwtZumLinkFrequencyMasksErrors	Frequency Masks Error	Read-only	DisplayString
fwtZumLinkEncryptionMode	Encryption mode	Read-Write	ZUMLINK_ENCRYPTION_MODE
fwtZumLinkActiveKey	The active selected key.	Read-Write	ZUMLINK_ENCRYPTION_KEYS
fwtZumLinkSetKeySelect	Selection of the next encryption key to be modified.	Read-Write	ZUMLINK_ENCRYPTION_KEYS
fwtZumLinkSetKeyValue	Set the value of the selected key.	Read-Write	DisplayString

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkCompressionEnabled	If compression is enabled out going packets will be sent compressed if the compressed packet is smaller.	Read-Write	TruthValue
fwtZumLinkOtaMaxFragmentSize	OTA Max Fragment Size	Read-Write	Unsigned32
fwtZumLinkFecRate	Sets the FEC (Forward Error Correction) rate.	Read-Write	ZUMLINK_FEC_RATES
fwtZumLinkAggregateEnabled	Enables the aggregation of smaller packets to enhance throughput.	Read-Write	TruthValue
fwtZumLinkRouteMinSignalMarginThresh	The radio route minimum signal level threshold in dB.	Read-Write	INTEGER
fwtZumLinkMacTableEntryAgeTimeout	The number of seconds before an inactive entry in the MAC Table ages out and becomes expired.	Read-Write	INTEGER
fwtZumLinkSignalLevel	Signal Level	Read-only	INTEGER
fwtZumLinkSignalMargin	Signal Margin	Read-only	INTEGER
fwtZumLinkTimestamp	Diagnostics Time Stamp	Read-only	Unsigned32
fwtZumLinkRadioTx	Radio Tx Data Packets	Read-only	Unsigned32
fwtZumLinkRadioRx	Radio Rx Data Packets	Read-only	Unsigned32
fwtZumLinkRadioReliableTx		Read-only	Unsigned32
fwtZumLinkRadioReliableRx		Read-only	Unsigned32
fwtZumLinkRadioRexmit		Read-only	Unsigned32
fwtZumLinkRadioAckTx		Read-only	Unsigned32
fwtZumLinkRadioNoAckTx		Read-only	Unsigned32
fwtZumLinkRadioTimedOut		Read-only	Unsigned32
fwtZumLinkRadioBadAckRx	Radio Bad ACK Received	Read-only	Unsigned32
fwtZumLinkRadioTooLong		Read-only	Unsigned32
fwtZumLinkRadioTooShort		Read-only	Unsigned32
fwtZumLinkRadioBadSync	Radio Bad Synchronization	Read-only	Unsigned32
fwtZumLinkRadioBadCRC	Radio Bad CRC on RX packets.	Read-only	Unsigned32

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkRadioContentionDrop	Radio Contention Drop	Read-only	Unsigned32
fwtZumLinkRadioSendingDrop		Read-only	Unsigned32
fwtZumLinkRadioLLTx	Radio Low Level Transmit	Read-only	Unsigned32
fwtZumLinkRadioLLRx	Radio Low Level Receive	Read-only	Unsigned32
fwtZumLinkCntSTX		Read-only	Unsigned32
fwtZumLinkCntETX		Read-only	Unsigned32
fwtZumLinkCntBadSync		Read-only	Unsigned32
fwtZumLinkCntBadBCC		Read-only	Unsigned32
fwtZumLinkInterfaceDataTx		Read-only	Unsigned32
fwtZumLinkInterfaceDataRx		Read-only	Unsigned32
fwtZumLinkInterfaceBytesTx		Read-only	Unsigned32
fwtZumLinkInterfaceBytesRx		Read-only	Unsigned32
fwtZumLinkResetsDetected		Read-only	Unsigned32
fwtZumLinkResetsSent		Read-only	Unsigned32
fwtZumLinkResetStats	Reset Statistics	Read-Write	ZUMLINK_NOW_OPTION
fwtZumLinkMonitoredNode	Monitor Node	Read-Write	Unsigned32
fwtZumLinkChannelDiagsTable	Show Channel Diagnostics	Not Accessible	
fwtZumLinkChannelDiagsEntry	A row containing diagnostics for a channel.	Not Accessible	
fwtZumLinkChannelDiagsIdx	Index to a set of diagnostics for a channel	Not Accessible	Unsigned32
fwtZumLinkChannelDiagsFreq	Channel Diagnostics Frequency	Read-only	Float32TC
fwtZumLinkChannelDiagsRSSI	Channel Diagnostics RSSI	Read-only	INTEGER
fwtZumLinkChannelDiagsMargin	Channel Diagnostics Margin	Read-only	INTEGER
fwtZumLinkChannelDiagsNodeId	Channel Diagnostics Node ID	Read-only	Unsigned32
fwtZumLinkNodeDiagsTable	Show Monitored Node Diagnostics	Not Accessible	
fwtZumLinkNodeDiagsEntry	A row containing diagnostics for a node.	Not Accessible	
fwtZumLinkNodeDiagsNodeId	Node Diagnostics Node ID	Read-only	Unsigned32

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkNodeDiagsFreq	Node Diagnostics Frequency	Read-only	Float32TC
fwtZumLinkNodeDiagsRSSI	Node Diagnostics RSSI	Read-only	INTEGER
fwtZumLinkNodeDiagsMargin	Node Diagnostics Margin	Read-only	INTEGER
fwtZumLinkMacTableClear	Clear the MAC to nodeId mapping table and force routes to be relearned.	Read-Write	ZUMLINK_NOW_ OPTION
fwtZumLinkNoiseLevel	Noise Level	Read-only	INTEGER
fwtZumLinkVSWR	VSWR	Read-only	Unsigned32
fwtZumLinkTxSuccess	Transmit Success Percentage	Read-only	Unsigned32
fwtZumLinkTxAvailability	Transmit Availability Percentage	Read-only	Unsigned32
fwtZumLinkRxSuccess	Receive Success Percentage	Read-only	Unsigned32
fwtZumLinkSupplyVoltage	Supply Voltage	Read-only	INTEGER
fwtZumLinkReset		Read-Write	ZUMLINK_RESET_ OPTIONS
fwtZumLinkFactoryDefaults		Read-Write	ZUMLINK_FDR_ OPTIONS
fwtZumLinkSave		Read-Write	ZUMLINK_NOW_ OPTION
fwtZumLinkTimeOutCli	The number of seconds of idle before CLI connection will be closed.	Read-Write	Unsigned32
fwtZumLinkMac_address		Read-only	MacAddress
fwtZumLinkIp_address	IP address of unit.	Read-Write	IpAddress
fwtZumLinkNetmask	Netmask of unit.	Read-Write	IpAddress
fwtZumLinkGateway	Gateway of unit.	Read-Write	IpAddress
fwtZumLinkStpEnabled	Spanning tree protocol is enabled or disabled.	Read-Write	TruthValue
fwtZumLinkTxqueuelen	Sets the Ethernet transmit packet queue length.	Read-Write	Unsigned32
fwtZumLinkMtu	Sets the MTU frame size for the unit.	Read-Write	Unsigned32
fwtZumLinkNetmaskFilterEnabled	Enable or disable bridge firewall.	Read-Write	TruthValue

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkNameserver_address1	DNS for name-to-address resolution.	Read-Write	IpAddress
fwtZumLinkNameserver_address2	DNS for name-to-address resolution.	Read-Write	IpAddress
fwtZumLinkArpFilterEnabled	Enable or disable ARP filtering in bridge firewall.	Read-Write	TruthValue
fwtZumLinkVlanMgmt	Management VLAN ID for the device	Read-Write	Unsigned32
fwtZumLinkVlanTagPort1	VLAN Tag ID for the Ethernet Port1	Read-Write	Unsigned32
fwtZumLinkVlanTagPort2	VLAN Tag ID for the Ethernet Port2	Read-Write	Unsigned32
fwtZumLinkRx_bytes	Number bytes of Ethernet packets received from the radio network.	Read-only	Unsigned32
fwtZumLinkRx_packets	Number of Ethernet packets received from the radio network.	Read-only	Unsigned32
fwtZumLinkRx_dropped	Number of Ethernet packets received from the radio network that were dropped at the Ethernet interface.	Read-only	Unsigned32
fwtZumLinkRx_errors	Number of Ethernet packets received from the radio network that were had Ethernet errors.	Read-only	Unsigned32
fwtZumLinkTx_bytes	Number bytes of Ethernet packets received from the Ethernet port and sent over the radio network.	Read-only	Unsigned32
fwtZumLinkTx_packets	Number Ethernet packets received from the Ethernet port and sent over the radio network.	Read-only	Unsigned32
fwtZumLinkTx_dropped	Number Ethernet packets received from the Ethernet port but dropped because the txqueue was full.	Read-only	Unsigned32
fwtZumLinkTx_errors	Number Ethernet packets received from the Ethernet port that were in error.	Read-only	Unsigned32
fwtZumLinkNtpReference	Clock reference for NTP.	Read-Write	ZUMLINK_NTP_ REFERENCE

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkNtpRestart	Cause the NTP system to restart.	Read-Write	ZUMLINK_NOW_OPTION
fwtZumLinkNtpDate	Set the local time from other NTP servers on the network.	Read-Write	ZUMLINK_NOW_OPTION
fwtZumLinkNtp_address1	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkNtp_address2	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkNtp_address3	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkNtp_address4	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkNtp_address5	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkCom1Mode	Com port mode	Read-Write	ZUMLINK_UART_MODE
fwtZumLinkCom1Handler	Protocol of the com port	Read-Write	ZUMLINK_UART_HANDLER
fwtZumLinkCom1Baudrate	Com port baud rate	Read-Write	ZUMLINK_UART_BAUDRATES
fwtZumLinkCom1Databits	Com port data bits	Read-Write	ZUMLINK_UART_DATABITS
fwtZumLinkCom1Parity	Com port parity	Read-Write	ZUMLINK_UART_PARITY
fwtZumLinkCom1Stopbits	Com port number of stop bits	Read-Write	ZUMLINK_UART_STOPBITS
fwtZumLinkCom1Duplex	Com port is full or half duplex	Read-Write	ZUMLINK_UART_DUPLEX
fwtZumLinkCom1FlowControl	Com port hardware flow control is not supported.	Read-Write	ZUMLINK_UART_FLOWCONTROL_OFF
fwtZumLinkCom1DelayBeforeSendMs	Com port will delay sending in Ms to allow the other side to switch from tx to rx mode.	Read-Write	Unsigned32

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkCom1BreakBeforeSendUs	Com port will send a break signal for at least the number of microseconds specified before sending the data.	Read-Write	Unsigned32
fwtZumLinkCom1TerminalServerPort	The TCP port number to use when handler is set to TerminalServer.	Read-Write	Unsigned32
fwtZumLinkCom1TerminalServerTimeOut	Terminal Server TimeOut	Read-Write	Unsigned32
fwtZumLinkCom1TxBytes	The total bytes sent out of the Com port.	Read-only	Unsigned32
fwtZumLinkCom1RxBytes	The total bytes received from the Com port.	Read-only	Unsigned32
fwtZumLinkCom1ConnectionDrops	The number of terminal server connections dropped due to inactivity.	Read-only	Unsigned32
fwtZumLinkCom2Mode	Com port mode	Read-Write	ZUMLINK_UART_MODE
fwtZumLinkCom2Handler	Protocol of the com port	Read-Write	ZUMLINK_UART_ HANDLER
fwtZumLinkCom2Baudrate	Com port baud rate	Read-Write	ZUMLINK_UART_ BAUDRATES
fwtZumLinkCom2Databits	Com port data bits	Read-Write	ZUMLINK_UART_ DATABITS
fwtZumLinkCom2Parity	Com port parity	Read-Write	ZUMLINK_UART_ PARITY
fwtZumLinkCom2Stopbits	Com port number of stop bits	Read-Write	ZUMLINK_UART_ STOPBITS
fwtZumLinkCom2Duplex	Com port is full or half duplex	Read-Write	ZUMLINK_UART_ DUPLEX
fwtZumLinkCom2FlowControl	Com port hardware flow control is on or off	Read-Write	ZUMLINK_UART_ FLOWCONTROL
fwtZumLinkCom2DelayBeforeSendMs	Com port will delay sending in Ms to allow the other side to switch from tx to rx mode.	Read-Write	Unsigned32
fwtZumLinkCom2BreakBeforeSendUs	Com port will send a break signal for at least the number of microseconds specified before sending the data.	Read-Write	Unsigned32
fwtZumLinkCom2TerminalServerPort	The TCP port number to use when handler is set to TerminalServer.	Read-Write	Unsigned32

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkCom2TerminalServerTimeOut	Terminal Server Time Out	Read-Write	Unsigned32
fwtZumLinkCom2TxBytes	The total bytes sent out of the Com port.	Read-only	Unsigned32
fwtZumLinkCom2RxBytes	The total bytes received from the Com port.	Read-only	Unsigned32
fwtZumLinkCom2ConnectionDrops	The number of terminal server connections dropped due to inactivity.	Read-only	Unsigned32
fwtZumLinkTermserv_relay_mapping	Options for streaming between serial device servers.	Read-Write	ZUMLINK_TERMSERV_RELAY_MAPPING
fwtZumLinkRemote_termserv_ip_address	IP address of remote terminal server.	Read-Write	IpAddress
fwtZumLinkUpTime	The number of seconds since the unit restarted.	Read-only	Unsigned32
fwtZumLinkUpTimeString	The number days, hours:minutes:seconds since the unit restarted.	Read-only	DisplayString
fwtZumLinkDcAppUptime	The number of seconds since the main app restarted.	Read-only	DisplayString
fwtZumLinkDcAppStartTime	The timestamp of when the main app restarted.	Read-only	DisplayString
fwtZumLinkTimeString	The current time.	Read-Write	DisplayString
fwtZumLinkFileTransferStatus	File Transfer Status	Read-only	DisplayString
fwtZumLinkEnablePtpInterface	Enable PTP interface	Read-Write	TruthValue
fwtZumLinkEnableEthernetLogin	Enable SSH logins	Read-Write	TruthValue
fwtZumLinkNeighborTableNumNeighbors	Number of Neighbors	Read-only	Unsigned32
fwtZumLinkNeighborTableNodeId	Device Node ID	Read-only	Unsigned32
fwtZumLinkNeighborTableNodeType	Node Type	Read-only	Unsigned32
fwtZumLinkNeighborTableIpAddress	Neighbor IP Address	Read-only	IpAddress
fwtZumLinkNeighborTableMacAddress	Neighbor MAC Address	Read-only	MacAddress
fwtZumLinkNeighborTableDeviceName	Device Name	Read-only	DisplayString
fwtZumLinkNeighborTableFWVersion	Device Node ID	Read-only	DisplayString
fwtZumLinkNeighborTableCounter	Neighbor Table Counter	Read-only	Unsigned32

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkNeighborTable	This table gives detailed status information for each neighbor of this node.	Not Accessible	
fwtZumLinkNeighborEntry	A row containing status information for a specific neighbor.	Not Accessible	
fwtZumLinkNeighborNodeId	Neighbor Node ID	Read-only	Unsigned32
fwtZumLinkNeighborIpAddress	Neighbor IP Address	Read-only	IpAddress
fwtZumLinkNeighborMacAddress	Neighbor MAC Address	Read-only	MacAddress
fwtZumLinkNeighborNodeType	Neighbor Node Type	Read-only	Unsigned32
fwtZumLinkNeighborRSSI	Neighbor RSSI	Read-only	INTEGER
fwtZumLinkNeighborLinkMargin	Neighbor Link Margin	Read-only	INTEGER
fwtZumLinkNeighborCounter	Neighbor Table Counter	Read-only	Unsigned32
fwtZumLinkNeighborTimestamp	Time When Node Info Received	Read-only	Unsigned32
fwtZumLinkNetworkTableDiscoveryState	Start or Stop Network Discovery	Read-Write	INTEGER
fwtZumLinkNetworkTableDiscoveryStatus	Get Discover Network Status	Read-only	DisplayString
fwtZumLinkNetworkTableNumNodes	Number of nodes in network	Read-only	Unsigned32
fwtZumLinkNetworkTableTimeStamp	Timestamp for when network table was last updated	Read-only	Unsigned32
fwtZumLinkNetworkTable	This table gives detailed status information for each neighbor of this node.	Not Accessible	
fwtZumLinkNetworkEntry	A row containing status information for a specific node.	Not Accessible	
fwtZumLinkNetworkNodeId	Device ID	Read-only	Unsigned32
fwtZumLinkNetworkNodeType	Node Type / Role	Read-only	Unsigned32
fwtZumLinkNetworkIpAddress	IP Address	Read-only	IpAddress
fwtZumLinkNetworkMacAddress	MAC Address	Read-only	MacAddress
fwtZumLinkNetworkDeviceName	Device Name	Read-only	DisplayString
fwtZumLinkNetworkFwVersion	Firmware Version	Read-only	DisplayString

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FreeWave Technologies - MIB			
Object	**Description**	**Access**	**Syntax**
fwtZumLinkNetworkHopCount	number of hops from node id	Read-only	Unsigned32
fwtZumLinkNetworkNeighborTable	Neighbor Nodes	Not Accessible	
fwtZumLinkNetworkNeighborEntry	A row containing status information for a specific neighbor node.	Not Accessible	
fwtZumLinkNetworkNeighborNodeId	Neighbor Node ID	Read-only	Unsigned32
fwtZumLinkNetworkNeighborRSSI	RSSI From Neighbor Node	Read-only	INTEGER
fwtZumLinkNetworkPathTable	List of nodes in path from current node where info is gathered to current node	Not Accessible	
fwtZumLinkNetworkPathEntry	A row containing status information for a node in the path.	Not Accessible	
fwtZumLinkNetworkPathIdx	Index to a node in the path	Not Accessible	Unsigned32
fwtZumLinkNetworkPathNodeId	Node In Path From Current Node	Read-only	Unsigned32
fwtZumLinkNetworkPathRSSITable	RSSI values between all the nodes along the path	Not Accessible	
fwtZumLinkNetworkPathRSSIEntry	A row containing RSSI for a node along the path.	Not Accessible	
fwtZumLinkNetworkPathRssiIdx	Index to a pair of source and destination nodes along the path	Not Accessible	Unsigned32
fwtZumLinkNetworkPathRssiSrc	Source Node	Read-only	Unsigned32
fwtZumLinkNetworkPathRssiDst	Destination Node	Read-only	Unsigned32
fwtZumLinkNetworkPathRssiSrcDstRSSI	Source Destination RSSI	Read-only	INTEGER
fwtZumLinkNetworkPathRssiDstSrcRSSI	Source Destination RSSI	Read-only	INTEGER

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42.5. SNMP Write Access

1. Verify V2C Enabled (on page 326) is enabled.
2. Make a note of the RW Community Name (on page 323).

> **Note**: The default is private if it was not changed.

```
>snmp
[Page=snmp]
v1Enabled=false
v2cEnabled=true
v3Enabled=false
roCommunityName=public
rwCommunityName=private
snmpUser
RESULT:0:OK
```

3. Perform the Read/Write using the **snmp.rwCommunityName** identified in Step 2.

Example

```
~$ snmpset -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkRadioMode.0 i gateway
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkRadioMode.0 = INTEGER: gateway(0)
~$ snmpget -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkRadioMode.0
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkRadioMode.0 = INTEGER: gateway(0)
~$ snmpset -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkRadioMode.0 i endpoint
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkRadioMode.0 = INTEGER: endpoint(1)
~$ snmpget -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkRadioMode.0
```


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```
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkRadioMode.0 = INTEGER: endpoint(1)
```

4. After adjusting the settings, issue the `save` command.

> **Note**: This is the same workflow as the CLI.

```
~$ snmpset -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkSave.0 i now
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkSave.0 = INTEGER: now(1)
```

Best practice for **snmp.v2cEnabled** is to change the **snmp.rwCommunityName** for a production network.

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Appendix A: Technical Specifications

Note: Specifications are subject to change without notice. For the most up-to-date specifications information, see the product's data sheet available at www.freewave.com.

- Computing Resources (on page 458)
- Data Transmission (on page 458)
- General Information (on page 459)
- Interfaces (on page 460)
- Management (on page 460)
- Networking (on page 461)
- Power Requirements and Current Consumption (on page 461)
- Receiver (on page 461)
- Transmitter (on page 462)

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Computing Resources

Note: Access to the **Computing Resources** for the Z9-P2 or Z9-PE2 requires licensing. For information, contact FreeWave Sales at www.freewave.com/how-to-buy.

Computing Resources	
Specification	**Description**
CPU	ARM Cortex-A8 1 GHz
RAM	1 GB
Storage	1 GB
OS	Debian-based Linux

Data Transmission

Data Transmission	
Specification	**Description**
Type	Frequency Hopping Spread Spectrum
Modulation	• 2 level GFSK • 4- and 8-ary FSK
Link Throughput	• Maximum of 1.6 Mbps • 4 Mbps with Compression
Error Detection	• ARQ • CRC • Retransmit on error • Forward Error Correction (FEC)
Hopping Rates	400, 200, 100, 50, 25 ms

Hopping Channels	• Maximum of 110 channels
	• RF Data Rate (on page 307) dependent
	• See:
	  • Australia Hop Set - 900 MHz Channels (on page 434)
	  • Brazil Hop Set - 900 MHz Channels (on page 437)

Hopping Patterns	• Maximum of 16 patterns • RF Data Rate (on page 307) dependent
Protocol	Adaptive Spectrum Learning (ASL)
User Interface Rate	• Ethernet Rate: 10/100 Mbps • Serial Rate: up to 250 kbps
Data Encryption	128-and 256-bit AES CCM

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Data Transmission	
Specification	**Description**
Advanced Features	• Packet Aggregation • Packet Compression

General Information

General Information	
Specification	**Description**

Operating Temperature	• **Z9-P2**
	  • -40°C to +85°C
	  • -40°F to +185°F
	  Caution: This is the **Z9-P2** temperature as defined for the exposed copper heat sink surface of the **ZumLink** radio PCB shown in the Z9-P2-Exposed Copper Heat Sink (on page 462), Figure 268.
	  See Mechanical Drawing - Z9-P2 (on page 426).
	• **Z9-PE2**
	  • -40°C to +75°C
	  • -40°F to +167°F
	  Note: This is the **Z9-PE2** temperature as defined for the local ambient air in contact with the product enclosure and assumes no solar radiation.

Humidity	0 to 95% non-condensing

Dimensions	• **Z9-P2**:
	  • 170.18 L x 86.6 W x 27.18 H (mm)
	  • 6.70 L x 3.41 W x 1.07 H (in)
	• **Z9-PE2**:
	  • 191.00 L x 104.39 W x 41.91 H (mm)
	  • 7.52 L x 4.11 W x 1.65 H (in)

Weight	• **Z9-P2**: 200.5 g (0.44 lbs) • **Z9-PE2**: 750 g (1.7 lbs)
Reliability	MTBF 206,186
Safety	Class I, Division 2, Groups A-D

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General Information	
Specification	**Description**
UL	Z9-P2: Z9-PE2:

Interfaces

Interfaces	
Specification	**Description**

Data Connectors	• Four RJ-45s
	  • 2 Ethernet
	  • 2 Serial

USB Connector	• Micro USB • Type A USB (Future Expansion)
RF Connector	TNC
Power Connectors	Phoenix Contact (# 1776692) **Important!**: Torque to lock the conductors: 0.5-0.6 N-m. Torque for the mating jack: 0.3 N-m.

Management

Management	
Specification	**Description**
Management	• Enterprise MIB • HTTP • MIB-II • Modbus • SNMPv1/v2c/v3 • SSH

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Networking

Networking	
Specification	**Description**
Serial	• Modbus RTU • Modbus/TCP • TCP client • TCP server
Traffic Filtering	• ARP filter • Netmask filter
VLAN	802.1Q

Power Requirements and Current Consumption

Current Consumption

Operating State	Description
Operating Voltage	+6 to +30 VDC
Idle Current	143 mA @ 12 VDC
Receive Current	159 mA @ 12 VDC
Transmit Current	377 mA @ 12 VDC

Power Requirements

Operating Voltage	Maximum Current Draw	Recommended Supplied Current
+6 VDC	870 mA	900 mA
+12 VDC	490 mA	520 mA
+24 VDC	270 mA	300 mA
+30 VDC	220 mA	250 mA

Receiver

Receiver	
Specification	**Description**
IF Selectivity	> 40 dB
System Gain	135 dB

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Receiver	
Specification	**Description**
Sensitivity	

RF Data Rate	Without FEC	With FEC
115.2 kbps	-105 dBm	-108 dBm
250 kbps	-102 dBm	-105 dBm
500 kbps	-99 dBm	-102 dBm
1 Mbps	-95 dBm	-98 dBm
1.5 Mbps (Beta)	-90 dBm	-93 dBm
4 Mbps	-83 dBm	-86 dBm

Transmitter

Transmitter	
Specification	**Description**
Frequency Range	• 902 to 928MHz • Australia: 915 to 928 MHz • Thailand: **Z9-P2-THA** & **Z9-PE2-THA**: 920 to 925 MHz
Frequency Stability	15ppm
Output Power	• 10mW to 1W • User selectable
Output Impedance	50 ohms
Range	97 km (60 miles), clear line of sight
Channel Spacing	• 230.4 kHz • 345.6 kHz • 691.2 kHz • 1382.4 kHz • 1612.8 (Beta) kHz • 3225.6 kHz
RF Data Rate	• 115.2 kbps • 250 kbps • 500 kbps • 1 Mbps • 1.5 Mbps (Beta) • 4 Mbps

Z9-P2-Exposed Copper Heat Sink

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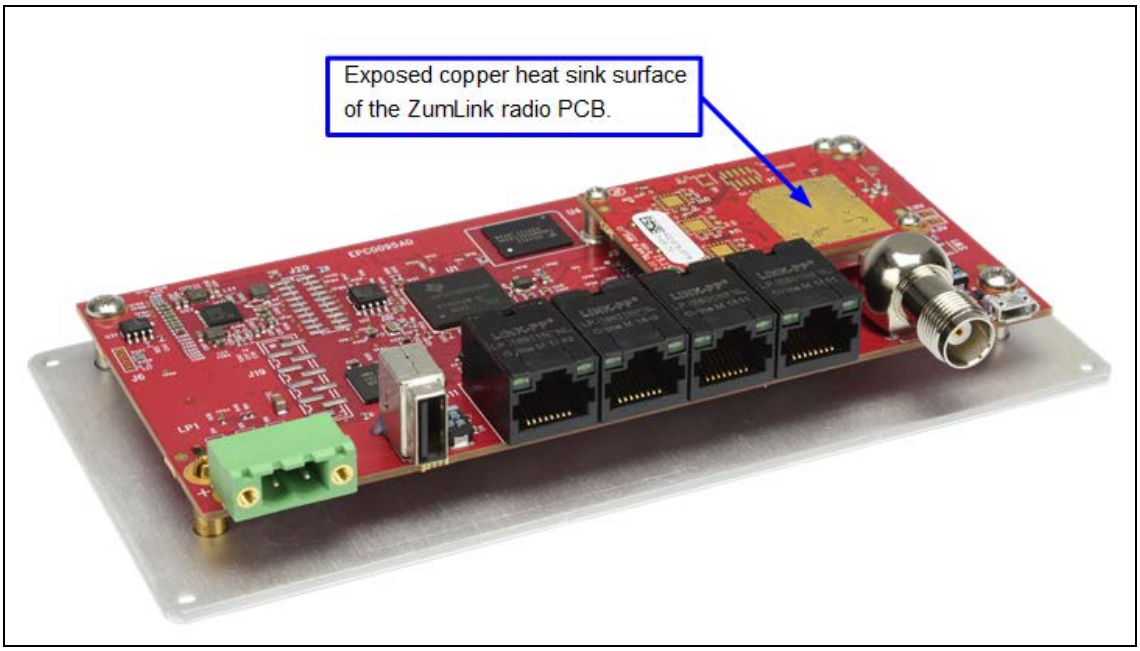

Figure 268: Exposed Copper Heat Sink Surface of the Z9-P2 Radio PCB

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Appendix B: OTA Interoperability

		Model # / Firmware Compatibility						OTA / Firmware Compatibility					
Firmware		Models Supported						RF Data Rate					
Device FW	Radio FW	Z9-PE2	Z9-P2	Z9-PE	Z9-P	Z9-PC	Z9-PC-SR001	115.2kbps	250kbps	500kbps	1Mbps	1.5Mbps (Beta)	4Mbps
1.1.2.2	1.0.7.1	x	x	x	x	x	x	x	XX	XX	x	x	x
1.1.1.2	1.0.7.1	NA	NA	x	x	x	x	x	XX	XX	x	x	x
1.1.0.1	1.0.7.1	NA	NA	x	x	x	x	x	XX	XX	x	x	x
1.0.7.0	1.0.7.0	NA	NA	x	x	x	x	x	XX	XX	x	x	x
1.0.6.0	1.0.4.0	NA	NA	x	x	NA	NA	x	x	x	x	NA	x
1.0.4.3	1.0.4.0	NA	NA	NA	NA	x	x	x	x	x	x	NA	x
1.0.4.2	1.0.4.0	NA	NA	x	x	NA	NA	x	x	x	x	NA	x

Note: XX Enhanced 250kbps & 500kbps RF Data Rates

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Appendix C: Firmware & Feature Interoperability

Firmware & Feature Interoperability							
Device Firmware Version	**v1.1.2.2**	**v1.1.1.2**	**v1.1.0.1**	**v1.0.7.0**	**v1.0.6.0**	**v1..0.4.3**	**v1.0.4.2**
Radio Firmware Version	**v1.0.7.1**	**v1.0.7.1**	**v1.0.7.1**	**v1.0.7.0**	**v1.0.4.0**	**v1.0.4.0**	**v1.0.4.0**
Feature							
Input Voltage	**Z9-P2** **Z9-PE2**	N/A	N/A	N/A	N/A	N/A	N/A
ZumIQ	**Z9-P** **Z9-PE** **Z9-PC** **Z9-PC-SR001** **Z9-P2** **Z9-PE2**	**Z9-P** **Z9-PE** **Z9-PC** **Z9-PC-SR001**	**Z9-P** **Z9-PE** **Z9-PC** **Z9-PC-SR001**	N/A	**Z9-P** **Z9-PE**	N/A	N/A
VLAN Management	X	N/A	N/A	N/A	N/A	N/A	N/A
ARP Filtering	X	X	N/A	N/A	N/A	N/A	N/A
VLAN (tagging and un-tagging)	X	X	N/A	N/A	N/A	N/A	N/A
Encryption Key Radio Web Interface Configuration	X	X	N/A	N/A	N/A	N/A	N/A
Network Diagnostics Diagram	X	X	N/A	N/A	N/A	N/A	N/A
Modbus	X	X	N/A	N/A	N/A	N/A	N/A
VSWR	X	X	X	N/A	N/A	N/A	N/A
Expanded Local Diagnostics Noise level, RX success, TX availability, TX success	X	X	X	N/A	N/A	N/A	N/A

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Firmware & Feature Interoperability							
Device Firmware Version	**v1.1.2.2**	**v1.1.1.2**	**v1.1.0.1**	**v1.0.7.0**	**v1.0.6.0**	**v1..0.4.3**	**v1.0.4.2**
Radio Firmware Version	**v1.0.7.1**	**v1.0.7.1**	**v1.0.7.1**	**v1.0.7.0**	**v1.0.4.0**	**v1.0.4.0**	**v1.0.4.0**
Feature							
Expanded MIB Query & configure most statistics and settings	X	X	X	N/A	N/A	N/A	N/A
Network Diagnostics Radio Web Interface	X	X	X	N/A	N/A	N/A	N/A
Enhanced 250 & 500 kbps data rates Improved sensitivity, noise filtering, interference	X	X	X	X	N/A	N/A	N/A
1.5 Mbps RF Data Rate (Beta)	X	X	X	X	N/A	N/A	N/A
MacTable Entry-Age Timeout (Beta)	X	X	X	X	N/A	N/A	N/A
Terminal Server Connections	128 concurrent TCP	128 concurrent TCP	128 concurrent TCP	20 concurrent TCP	N/A	N/A	N/A
Repeaters	Multiple Repeaters	Multiple Repeaters	Multiple Repeaters	Multiple Repeaters	Single Repeater	Single Repeater	Single Repeater

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Appendix D: LEDs

These are the LEDs for the Z9-P2 or Z9-PE2.

Note: See Z9-P2 Port Connections (on page 21) or Z9-PE2 Port Connections (on page 21) for additional information.

Normal Operation

LEDs - Normal Operation				
CD	**TX**	**RX**	**Condition**	**Notes**
Solid Red (Bright)			Not Linked	While operating with Frequency Hopping enabled, this LED indicates the radio has NOT received the beacon within the last 60 seconds.
Solid Green			Radio linked	The radio is linked with a margin of 20dB or greater above sensitivity or noise level, whichever is highest.
Solid Green or Alternate Solid Green / Solid Red (Bright)		Solid Green	Receiving Data	The radio is actively receiving data over the wireless RF link.

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LEDs - Normal Operation				
CD	**TX**	**RX**	**Condition**	**Notes**
Solid Green or Alternate Solid Green / Solid Red (Bright)	Solid Green		Transmitting Data	The radio is actively transmitting data over the wireless RF link.
Alternate Solid Green / Solid Red (Bright)		Solid Green	Receiving Data	• There are 4 blink rates for levels 15dB, 10dB, 5dB, and 0dB above sensitivity or noise level, whichever is highest. • The blink rates are faster as the levels increase from the sensitivity / noise point. • The RSSI level is based on the last packet received. • The pattern continues for 60 seconds after the last received packet before turning back to if the link has dropped.
Solid Amber (Yellow)	Blinking Red	Blinking Red	Upgrading firmware or changing the configuration.	TX and RX blink in unison at a slow rate.
Blinking Green 5 Times	Off	Off	Upgrade or update succeeded.	
Blinking Red 5 Times	Off	Off	Upgrade or update failed.	

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COM LEDs

Note: During boot, the COM LEDs will cycle indicating startup.

LEDs - COM		
LED	**LED Color**	**Description**
COM1 Left	Blinking Green	Transmitting data on COM1.
COM1 Right	Blinking Green	Receiving data on COM1.
COM2 Left	Blinking Green	Transmitting data on COM2.
COM2 Right	Blinking Green	Receiving data on COM2.

Ethernet LEDs

LEDs - Ethernet		
LED	**LED Color**	**Description**
Ethernet Left	Solid Green	• Shows Power. • LED is lit while power is applied to the Ethernet module.
Ethernet Right	Solid Green	Shows Ethernet link but no activity.
Ethernet Right	Blinking Green	• Shows Activity. • LED will blink / flicker while sending and receiving data on the Ethernet port.

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Appendix E: Z9-P2 or Z9-PE2 Files and Descriptions

When the **Windows® File Explorer** window of the Z9-P2 or Z9-PE2 is opened, there are default files that appear.

This is a list of those files and descriptions of their purpose.

Note: If the Z9-P2 or Z9-PE2 has been updated or rebooted, other files may appear.

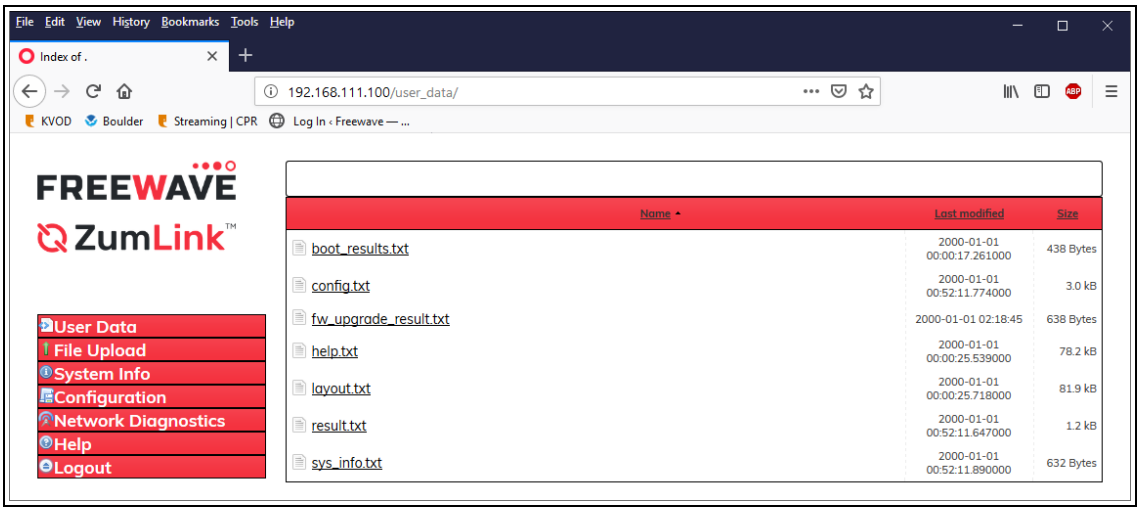

Figure 269: Z9-P2 or Z9-PE2 Files shown in Windows® File Explorer

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Files and Descriptions - Z9-P2 or Z9-PE2	
File Name	**Description**
boot_results.txt	The **boot_results.txt** file shows the firmware version the device is currently running.
config.txt	The **config.txt** file contains all of the configuration parameters of the Z9-P2 or Z9-PE2. These parameters determine how the device functions and connects to other devices in the network.
fw_upgrade_ result.txt	The **fw_upgrade_result.txt** file shows the status of the update procedure for the device firmware. **Note**: This file appears after the **ZumLink** has been updated to a newer version of firmware.
help.txt	The **help.txt** file contains online user assistance information using the CLI commands. **Example**: In a CLI window, enter **help=txPower** or **help txpower** to see the help information for the **radioSetting.txpower** setting.
layout.txt	The **layout.txt** file is used for management applications to provide the CLI and **config.cfg** with a format description of the commands.
result.txt	The **result.txt** is used to verify the acceptance or rejection of each parameter change applied to the **config.txt** file. **Note**: This file appears after the **config.txt** file of the **ZumLink** has been changed.
sys_info.txt	The **sys_info.txt** file provides information about the radio including serial number, model number, firmware versions, and device name.

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Appendix F: Z9-P2 or Z9-PE2 Modbus Register Map

This table provides a register map for the Modbus Input / Output devices.

Note: The **Register Names** that can be polled using Modbus correspond to the pages of the CLI.

Important!: By design, unused registers return 0 (zero).

Z9-P2 or Z9-PE2 Modbus Register Map

Register Name	Type	Protocol Address	Number Registers	Modbus FC	Address
radioSettings.radioMode	uint32_t	31001	2	4	1000
radioSettings.rfDataRate	uint32_t	31003	2	4	1002
radioSettings.radioMaxRepeaters	uint32_t	31005	2	4	1004
radioSettings.radioRepeaterSlot	uint32_t	31007	2	4	1006
radioSettings.txPower	uint32_t	31009	2	4	1008
radioSettings.networkId	uint16_t	31011	1	4	1010
radioSettings.nodeId	uint16_t	31012	1	4	1011
radioSettings.frequencyKey	uint32_t	31013	2	4	1012
radioSettings.radioFrequency	float	31015	2	4	1014
radioSettings.radioHoppingMode	uint32_t	31017	2	4	1016
radioSettings.beaconInterval	uint32_t	31019	2	4	1018

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Z9-P2 or Z9-PE2 Modbus Register Map					
Register Name	**Type**	**Protocol Address**	**Number Registers**	**Modbus FC**	**Address**
radioSettings.beaconBurstCount	uint32_t	31021	2	4	1020
radioSettings.lnaBypass	uint32_t	31023	2	4	1022
radioSettings.maxLinkDistanceInMiles	uint32_t	31025	2	4	1024
localDiagnostics.signalLevel	int	32001	2	4	2000
localDiagnostics.signalMargin	int	32003	2	4	2002
localDiagnostics.NoiseLevel	int	32005	2	4	2004
localDiagnostics.VSWR	uint32_t	32007	2	4	2006
localDiagnostics.TxSuccess	uint32_t	32009	2	4	2008
localDiagnostics.TxAvailability	uint32_t	32011	2	4	2010
localDiagnostics.RxSuccess	uint32_t	32013	2	4	2012
localDiagnostics.timestamp	uint32_t	32015	2	4	2014
localDiagnostics.RadioTx	uint32_t	32017	2	4	2016
localDiagnostics.RadioRx	uint32_t	32019	2	4	2018
localDiagnostics.RadioReliableTx	uint32_t	32021	2	4	2020
localDiagnostics.RadioReliableRx	uint32_t	32023	2	4	2022
localDiagnostics.RadioRexmit	uint32_t	32025	2	4	2024
localDiagnostics.RadioAckTx	uint32_t	32027	2	4	2026
localDiagnostics.RadioNoAckTx	uint32_t	32029	2	4	2028
localDiagnostics.RadioTimedOut	uint32_t	32031	2	4	2030
localDiagnostics.RadioBadAckRx	uint32_t	32033	2	4	2032
localDiagnostics.RadioTooLong	uint32_t	32035	2	4	2034
localDiagnostics.RadioTooShort	uint32_t	32037	2	4	2036
localDiagnostics.RadioBadSync	uint32_t	32039	2	4	2038
localDiagnostics.RadioBadCRC	uint32_t	32041	2	4	2040
localDiagnostics.RadioContentionDrop	uint32_t	32043	2	4	2042
localDiagnostics.RadioSendingDrop	uint32_t	32045	2	4	2044
localDiagnostics.RadioLLTx	uint32_t	32047	2	4	2046
localDiagnostics.RadioLLRx	uint32_t	32049	2	4	2048
localDiagnostics.cntSTX	uint32_t	32051	2	4	2050
localDiagnostics.cntETX	uint32_t	32053	2	4	2052
localDiagnostics.cntBadSync	uint32_t	32055	2	4	2054
localDiagnostics.cntBadBCC	uint32_t	32057	2	4	2056

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Z9-P2 or Z9-PE2 Modbus Register Map					
Register Name	**Type**	**Protocol Address**	**Number Registers**	**Modbus FC**	**Address**
localDiagnostics.interfaceDataTx	uint32_t	32059	2	4	2058
localDiagnostics.interfaceDataRx	uint32_t	32061	2	4	2060
localDiagnostics.interfaceBytesTx	uint32_t	32063	2	4	2062
localDiagnostics.interfaceBytesRx	uint32_t	32065	2	4	2064
localDiagnostics.resetsDetected	uint32_t	32067	2	4	2066
localDiagnostics.resetsSent	uint32_t	32069	2	4	2068
localDiagnostics.SupplyVoltage	float	32123	2	4	2122
localDiagnostics.SupplyVoltage_mV	int	32125	2	4	2124
networkStats.rx_bytes	uint32_t	32071	2	4	2070
networkStats.rx_packets	uint32_t	32073	2	4	2072
networkStats.rx_dropped	uint32_t	32075	2	4	2074
networkStats.rx_errors	uint32_t	32077	2	4	2076
networkStats.tx_bytes	uint32_t	32079	2	4	2078
networkStats.tx_packets	uint32_t	32081	2	4	2080
networkStats.tx_dropped	uint32_t	32083	2	4	2082
networkStats.tx_errors	uint32_t	32085	2	4	2084
Com1.TxBytes	uint32_t	32087	2	4	2086
Com1.RxBytes	uint32_t	32089	2	4	2088
Com2.TxBytes	uint32_t	32091	2	4	2090
Com2.RxBytes	uint32_t	32093	2	4	2092
date.upTime	uint32_t	32095	2	4	2094
date.time	uint32_t	32097	2	4	2096
rfStats.UpPackets	uint32_t	32099	2	4	2098
rfStats.UpBytes	uint32_t	32101	2	4	2100
rfStats.UpErrors	uint32_t	32103	2	4	2102
rfStats.UpRate	double	32105	4	4	2104
rfStats.UpRateAvg	double	32107	4	4	2106
rfStats.UpRateAvg2	double	32109	4	4	2108
rfStats.DownPackets	uint32_t	32111	2	4	2110
rfStats.DownBytes	uint32_t	32113	2	4	2112
rfStats.DownErrors	uint32_t	32115	2	4	2114
rfStats.DownRate	double	32117	4	4	2116

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Z9-P2 or Z9-PE2 Modbus Register Map					
Register Name	**Type**	**Protocol Address**	**Number Registers**	**Modbus FC**	**Address**
rfStats.DownRateAvg	double	32119	4	4	2118
rfStats.DownRateAvg2	double	32121	4	4	2120

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Appendix G: FreeWave Legal Information

Export Notification

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FreeWave products are designed and manufactured in the United States of America.

Warning! DO NOT OPEN THE ZumLink Z9-P2 or Z9-PE2 WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

GNU License Notification

Some of the software in the firmware is licensed under the GNU General Public License and other Open Source and Free Software licenses. Contact FreeWave to obtain the corresponding source on CD.

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FCC Notifications

FCC Supplier's Declaration of Conformity

FreeWave Technologies, Inc.

5395 Pearl Parkway, Boulder, CO 80301

Phone Number: 303.381.9200

Website: www.freewave.com

declare under our sole responsibility that the product Models: Z9-P2 or Z9-PE2 complies with Part 15 of 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: KNYPMT0101AB.

All models sold under the listed FCC ID(s) 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.

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

FCC Part 15 Class 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 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 energy and, if not installed and used in accordance with the User-Reference Manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

FCC NEMA Installation and Label

Where applicable, 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 Transmitter Module with FCC ID: KNYPMT0101AB.**"

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 52 cm between the radiator and your body.

FCC Notification of Power Warning

The ZumLink Z9-P2 or Z9-PE2 covered in this document has a maximum transmitted output power of +30dBm.

The antennas used MUST provide a separation distance of at least 52 cm from all persons and MUST NOT be co-located or operate in conjunction with any other antenna or transmitter.

Argentina CNC

Identificación CNC

- **Z9-P2** / **Z9-PE2**Contiene CNC ID: C-21612

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Brazil

ADENDO AO MANUAL

Z9-PE; Z9-P; Z9-PC; Z9-PC-SR001; Z9-P2; Z9-PE2

Atendimento à Regulamentação Anatel

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.

Este produto está homologado pela ANATEL, de acordo com os procedimentos regulamentados pela Resolução 242/2000, e atende aos requisitos técnicos aplicados.

Para maiores informações, consulte o site da ANATEL www.anatel.gov.br

03838-18-02478

ISED Notifications

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. CAN ICES-3 (A)/NMB-3(A)

Ce dispositif est conforme aux normes permis-exemptes du Canada RSS d'industrie. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence, et (2) ce dispositif doit accepter n'importe quelle interférence, y compris l'interférence qui peut causer le fonctionnement peu désiré du dispositif. CAN ICES-3 (A)/NMB-3(A)

ISED Host Installation and Label

The content of this documentation covers FreeWave Technologies, Inc. models sold under IC: 2329B-PMT0101AB.

When any FreeWave Technologies, Inc. module is placed inside a Host, a label must be placed on the outside of the Host. The label must include the text "**Contains IC: 2329B-PMT0101AB**".

ISED Radiation Exposure Statement

This system has been evaluated for RF Exposure per RSS-102 and is in compliance with the limits specified by Health Canada Safety Code 6. The system must be installed at a minimum separation distance from the antenna to a general bystander of 7.9 inches (20cm) to maintain compliance with the General Population limits.

L'exposition aux radiofréquences de ce système a été évaluée selon la norme RSS-102 et est jugée conforme aux limites établies par le Code de sécurité 6 de Santé Canada. Le système doit être installé à une distance minimale de 7.9 pouces (20cm) séparant l'antenne d'une personne présente en conformité avec les limites permises d'exposition du grand public.

Professional Installation

All models sold under the listed IC ID must be professionally installed.

Mexico IFETEL

Z9-P2 Número IFETEL: RCPFRZ917-1310-A5

Z9-PE2 Número IFETEL: RCPFRZ917-1310-A6

La operación de este equipo está sujeta a las siguientes dos condiciones: (1) es posible que este equipo o dispositivo no cause interferencia perjudicial y (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

Thailand

"เครื่องโทรคมนาคมและอุปกรณ์นี้มีความสอดคล้องตามมาตรฐานหรือข้อกำหนดทางเทคนิคของกสทช"

This telecommunication equipment conforms to the standard or technical requirements of NBTC.

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"เครื่องวิทยุคมนาคมนี้มีระดับการแผ่คลื่นแม่เหล็กไฟฟ้าสอดคล้องตามมาตรฐานความปลอดภัยต่อสุขภาพของมนุษย์จากการใช้เครื่องวิทยุคมนาคมที่คณะกรรมการกิจการโทรคมนาคมแห่งชาติประกาศกำหนด"

(This radio communication equipment has the electromagnetic field strength in compliance with the Safety Standard for the Use of Radio communication Equipment on Human Health announced by the National Telecommunications Commission.)

UL Power Source

Input power shall be derived from a certified, Class 2:

- single power source or
- a limited power source (LPS) in accordance with:
  - UL 60950-1
  - IEC/EN 60950-1
  - CAN/CSA C22.2 No. 60950-1-07.
- Input voltage for the Z9-P2 or Z9-PE2 is +6 to +30 VDC.

UL and Safety Notification

Z9-P2 is a Recognized component under UL File Numbers: e484141 and e327789.

Z9-PE2 is a Listed component under UL File Numbers: e484141 and e327789.

E484141

Power Source

- Z9-P2 or Z9-PE2 IS intended to be operated from a Limited Power Source (LPS) or Class 2 power source in accordance with IEC/EN/UL 60950-1 and CAN/CSA C22.2 No. 60950-1-07.
- The Z9-P2 or Z9-PE2 IS approved to operate with an input voltage range of +6 to +30 VDC.
- When used with external power supply by Kuantech KSAS012xxxyyyyzz where 'xxx' 060 to 240, 'yyyy' = 0020 minimum, zz = VU or HU or D5, the power supply shall be located within a max 50C ambient; used with external by SHENZHEN MINGXIN POWER TECHNOLOGIES CO LTD MX15 Series, the power supply shall be located within a max 40C ambient.
- Lorsqu'il est utilisé avec une alimentation externe par Kuantech KSAS012xxxyyyyzz où 'xxx' 060 à 240, 'aaaa' = 0020 minimum, zz = VU ou HU ou D5, l'alimentation doit être située dans une température ambiante maximale de 50°C, utilisé avec externe par la série SHENZHEN MINGXIN POWER TECHNOLOGIES CO LTD MX15, l'alimentation doit être située dans une plage de température ambiante maximale de 40°C.

Standards and Editions

- HazLoc Standards
  - ANSI / ISA-12.12.01-2015
  - CAN / CSA C22.2 No. 213-15
  - Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations
- Ordinary Location Standards
  - UL 60950, 2nd Edition

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- CAN / CSA-C22.2 No. 60950, 2nd Edition
- IEC 60950, 2nd Edition
- EN 60950, 2nd Edition

- Essential Health and Safety Requirements related to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to Directive 2014/34/EU of the European Parliament and the Council. Compliance with:
  - EN 60079-0:2012 + A11:2013
  - EN 60079-15:2010
  - **DEMKO 16 ATEX 1705X** Rev 1
  - II 3 G Ex nA IIC T5/T6 Gc

Schedule of Limitations

- Antenna connection is internal wiring only.
- The Ex Components shall only be used in an area of not more than pollution degree 2, as defined in IEC/EN60664-1.
- The Ex Components shall be installed in an enclosure with tool removable door or cover that provides a degree of protection not less than IP 54 in accordance with IEC/EN60679-15.
- Transient protection shall be provided that is set at a level not exceeding 140% of the peak rated voltage value at the supply terminals to the equipment.
- The T6 Tcode is allowed when used in a maximum rated ambient temperature of 60°C. (**Z9-PE2** only)
- The T5 Tcode is allowed when used in a maximum rated ambient temperature of 75°C. (**Z9-PE2** only)

Z9-P2 Only

- The maximum recorded temperature on the **Z9-P2** was 99°C on U8 (interface board).
- All temperatures normalized to 85°C.
- Suitability of temperatures shall be determined in the end-use investigation, with consideration given to conducting the heating test within the end-use application.
- Temperature code determination must be performed in the end-product evaluation.
- Connector J12 may not be provided with mating connectors. As such, the securement of these connectors must be evaluated during end-product investigation.

Installation Instructions

- This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D OR non-hazardous locations only.

Warning! EXPLOSION HAZARD – Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous.
AVERTISSEMENT – RISQUE D'EXPLOSION. NE PAS DEBRANCHER A MOINS QUE L'ALIMENTATION N'AIT ETE COUPEE OU QUE L'ENDROIT SOIT CONNE POUR ETRE NON DANGEREUX.

- This equipment is intended to be mounted within a suitable enclosure that is only accessible with the use of a tool.

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