WavePoint 10e

Software 1.0.38

User Manual

Part Number: LUM0063AA
Revision: A
Last Updated: 03/21/2014

Warranty

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

FreeWave's policy for handling WavePoint products returned due to a fault, after complaint is validated by FreeWave's Customer Support, is to replace the product with a new or refurbished unit upon receipt of reported faulty product. This means failure analysis on said product will not be performed and reported to customers. All failed units will be bagged and tagged so they can be revisited in the event that FreeWave experiences a high degree of failures or a trend. At which time, FreeWave will perform a root-cause analysis and take the appropriate corrective actions. Any visual or external damage noted on returned units will be communicated back to customers and may void the warranty, at which time, a Purchase Order (PO) will be requested from the customer for product replacement

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2. If Product is used outside of FreeWave specifications as stated in the Product's data sheet.
3. If Product has been modified, repaired, or altered by Customer unless FreeWave specifically authorized such alterations in each instance in writing. This includes the addition of conformal coating.

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FCC Notifications

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

The content of this guide covers FreeWave Technologies, Inc. models sold under FCC ID: KNYPRW1001ER, KNYASM1101CR, KNYASM1101CR, KNYASM1101CR, KNYPRW1001EC, KNYPRW1001EC.

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

IC 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.

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.

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Preface

This document provides information to configure and setup the **WavePoint 10e** device and includes:

- An introduction to the **WavePoint 10e** device and its key features.
- Physical components of the device including its ports and LEDs.
- Configuring a basic **WavePoint 10e** network.
- Setting up wireless access.
- Using a **WavePoint 10e** for local communication or as a Wi-Fi hotspot.
- Performing general administrative tasks (e.g., setting up users, defining the system time).
- Performing basic diagnostics, including troubleshooting tips.

The **WavePoint 10e** has a variety of configurations for installation flexibility.

Note: The information provided in this documentation assumes the user has a general understanding of networking devices (e.g., routers, bridges, etc.) and Ethernet and RF communication.

Contacting FreeWave Technical Support

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

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FreeWave provides technical support Monday through Friday, 7:30 AM to 5:30 PM Mountain Time (GMT -7).

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- Contact us through e-mail at moreinfo@freewave.com.

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Chapter 1: Introduction

WavePoint 10e is a powerful, end-to-end wireless networking and communications platform. It comprises a product family of networking devices to solve network infrastructure and communications needs. The flexible **WavePoint 10e** platform delivers high-speed broadband data communications across an entire network and to any environment.

WavePoint 10e provides:

- Flexible installations on communication towers, rooftops, and street light poles with diverse power and backhaul and antenna options.
- Multiple applications such as voice, Internet access, video surveillance, sensory data, and SCADA.

This chapter introduces **WavePoint 10e** and provides details about:

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- Key Features and Supported Protocols on page 20
- Requirements on page 21
- Accessories on page 22
- Product Variations on page 23
- Certified Antennas on page 25

Key Features and Supported Protocols

The **WavePoint 10e** provides an industrial networking solution for a license-exempt market and includes these features and standard networking technology and protocols.

Wireless Operating Modes

Configurations for the **WavePoint 10e** include:

- **Wireless mode**: Access Point / Repeater / Client that can operate concurrently in the 900 MHz, 2.4 GHz, and 5 GHz bands.
- **Router mode**: Network Address Translation (NAT) / Router / Bridge

For information about how **WavePoint 10e** fits into a network deployment, see Network Deployment Scenarios on page 32.

Available Network Services

The networking services and protocols **WavePoint 10e** provides are:

- Configurable MTU and PMTU discovery when set up as an access point.
- DHCP MAC filtering and MAC binding.
- DHCP server or client.
- Dynamic DNS clients.
- Multi-instance DHCP server on WLAN.
- Multiple LAN subnets.
- PPPoE, PPTP client
- RIPv1 and RIPv2.
- Static and dynamic IP addressing.
- Static and dynamic routing.
- TCP, UDP, and ICMP protocols.
- VLAN setup.
- VPN Tunneling and Transport.

Device Management

Each **WavePoint 10e** is configured and monitored through a web browser interface.

The management options are:

- Policy definition for when the **WavePoint 10e** is on and listening for network traffic.
- Remote access and provisioning.

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- Logging services to monitor and track system performance using email logs, alerts, and external SYSLOG servers.
- Network Time Protocol (NTP).
- Unlimited users definition (subject to the network capacity).
- Over the air firmware updates.

Network Security

The security features **WavePoint 10e** provides to ensure the data passed through the network is secure are:

- Device certificates
- Hidden, guest, and maintenance SSIDs
- IPsec
- MAC address filtering
- RADIUS for authentication.
- Rogue AP detection
- SSL and SSH secured management
- TCP Establish
- VLAN-based per-SSID isolation
- WPA, WPA2

Requirements

Important: Use the www.freewave.com/home/WavePointLogin site to download the latest **WavePoint 10e** software. Updating the software to the latest version provides the best experience with **WavePoint 10e**.

Installation Settings

Attention Network Administrator! Complete the information in this table.

SSID: _____ (8-64 ASCII characters. The SSID field is case sensitive.)	
Security Mode:	**Security Key: (This field is case sensitive.)**
IP Address:	**Subnet Mask:**
DHCP Setup Mode:	**Max Range:(Double the distance of the longest link in Km)**

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Equipment and Configuration

This equipment and configurations are needed prior to the initial **WavePoint 10e** setup and installation:

- A computer or laptop with:
  - Windows 7 operating system.
  - A web browser to access the web pages for configuration.
    - Supported browsers include: Microsoft Internet Explorer 9 and 10, Firefox 27, Google Chrome, Safari, and Opera.

Note: Configuration pages are NOT optimized for browsers on mobile devices (e.g., tablets, smart phones, etc.)

- A device with wireless capability to verify the wireless connection.
- A NEMA-4 rated enclosure (for outdoor installations only).
- A screwdriver for attaching mounting brackets and power connector.

FreeWave Recommends: A Path Study, as applicable, for the network site.

Accessories

The items shipped in the box are:

- The **WavePoint 10e** device.
- The **WavePoint 10e** Quick Start Guide.
- A CAT 5e Ethernet cable.
- An AC power adapter.

These options are available and, if ordered, are included in the shipping box:

- An RJ-45-to-DB9 serial cable.
- A mounting kit.

Contact a FreeWave reseller or FreeWave Technical Support if the package is missing parts or any parts were damaged during shipping.

Note: Antennas are shipped separately.

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Product Variations

WavePoint™ has a variety of configurations offering multiple feature sets. This manual describes these features and indicates the features that are only available on certain models.

To identify the variation and model number of the **WavePoint 10e**, see the product label on the back panel.

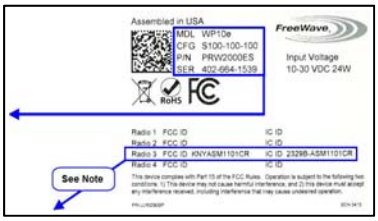
> **Note:** For a list of features included in each Model , see the WavePoint™ Configurations on page 157.

WavePoint 10e Labels

The labels on the back of the **WavePoint 10e** contain information about the device's port assignments and Configuration (CFG).

Sample: Configuration Label

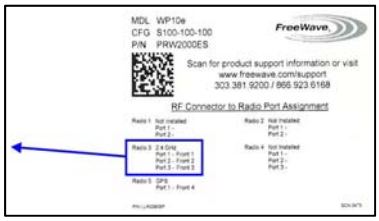
1. MDL - WP10e
2. CFG - S100-100-100
3. P/N - PRW2000ES
4. SER - 123-456-7890



> **Note:** The **Configuration** label identifies the installed radios. This sample label shows only one radio (Radio 3) installed in this **WavePoint 10e** device.

Sample: Port Assignment Label

1. Radio 1 - Not Installed
2. Radio 2 - Not Installed
3. **Radio 3 - 2.4 GHz**
   a. **Port 1 - Front 1**
   b. **Port 2 - Front 2**
   c. **Port 3 - Front 3**
4. Radio 4 - Not Installed



> **Note:** The **Port Assignment** label designates which RF ports (TNC connectors on the **WavePoint™** device) are used by which radio.

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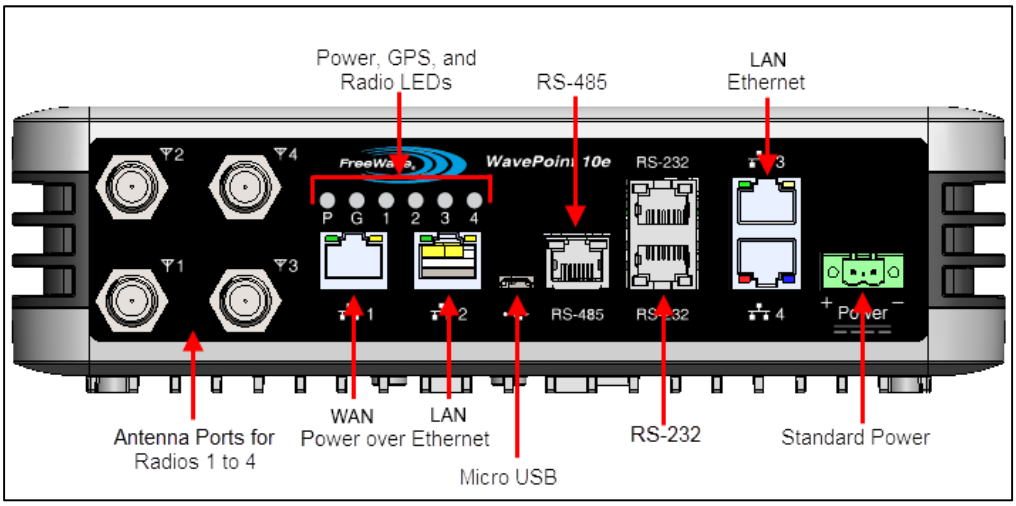
WavePoint™ Components



Data Connectors

Quantity	Connector
4	RJ-45 connector for 4 Ethernet ports
3	RJ-45 connector for: • 2 - RS-232 • 1 - RS-485
1	Micro USB connector
1	Power connector used for DC power

RF Connectors

Module	Maximum Connectors
900MHz RF modules	2 TNC connectors for spatial diversity*
2.4GHz RF modules	3 TNC connectors for 3x3 MIMO operation*
5.8GHz RF modules	3 TNC connectors for 3x3 MIMO operation*
Cellular module	1 RF connector – TNC
GPS module	1 RF connector – TNC

*One active RF port is a typical configuration.

Note: Refer to the label on the **WavePoint 10e** to determine the exact RF Connector configuration. A description of the labels are in WavePoint 10e Labels on page 23.

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Certified Antennas

A **WavePoint™** can have multiple radio modules installed, each potentially operating at different frequencies. The model number reflects the number and frequency of the radios installed inside the **WavePoint™** device and determines the type of antennas that can be used.

Important: The use of an antenna with a higher gain or a different type of antenna other than those approved requires new FCC approval and should not be used.

Antenna Installation Warning

Important: This section provides the required FCC warning information for working in proximity of the **WavePoint™** antennas.

1. All antenna installation and servicing must be performed by qualified technical personnel only.
   a. When servicing the antenna, or working at distances closer than those listed below, verify the transmitter has been disabled.
   b. Output is measured at the antenna terminal of the transmitter.
   c. The antennas used for the **WavePoint™** must be fixed-mounted on outdoor permanent structures to provide the minimum separation distances described in this filing for satisfying RF exposure compliance requirements.
   d. When applicable, RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC Bureaus, including antenna co-location requirements of §1.1307(b)(3).
2. Typically, the antenna connected to the transmitter is a directional (high gain) antenna, fixed-mounted on the side or top of a building, or on a tower.
   a. Depending upon the application and the gain of the antenna, the total composite power could exceed 20 watts EIRP.
   b. The antenna location must only be accessible by qualified technical personnel.
   c. Under normal operating conditions, no other person can touch the antenna or approach within 3.05 meters of the antenna.

Note: These antennas have been approved for use with **WavePoint 10e** and the designated Tx Streams.

900MHz Antennas

Note: Separation minimum RF safety distances are required for FCC RF exposure compliance.

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900 MHz Antennas					
Type	**Antenna Model**	**Gain**	**No of Tx Streams**	**Channel Size**	**Minimum RF Safety Distance**
Omni	Wavelink - PRO902-11	11dBi	2	20 MHz	94cm
Yagi	Wavelink - PRO890-16	16dBi	2	20 MHz	260cm

2.4GHz Antennas

Note: Separation minimum RF safety distances are required for FCC RF exposure compliance.

2.4GHz Antennas					
Type	**Antenna Model**	**Gain**	**No of Tx Streams**	**Channel Size**	**Minimum RF Safety Distance**
Dipole	98618MNXX001	5dBi	3	20 MHz 40 MHz	20cm
Omni	ZDAQJ2400-12	12dBi	1	20 MHz 40 MHz	20cm
Yagi	YA240016	16dBi	1	20 MHz 40 MHz	20cm
60 degree sector	RadioWaves SEC-25V-60-17HP	17.5dBi	2	20 MHz 40 MHz	20cm
Directional Panel	Superpass SPAPG20	20.5dBi	2	20 MHz 40 MHz	25cm
Dish	RadioWaves SPD4 - 2.4NS	27dBi	3	20 MHz 40 MHz	40cm

5GHz Antennas

Note: Separation minimum RF safety distances are required for FCC RF exposure compliance.

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5GHz Antennas					
Type	**Antenna Model**	**Gain**	**No of Tx Streams**	**Channel Size**	**Minimum RF Safety Distance**
Dipole	98618UNXX000	7dBi	1	20 MHz 40 MHz	20cm
Omni	ZDAQJ5800-12	12dBi	1	20 MHz 40 MHz	20cm
Yagi	Y5815	15dBi	1	20 MHz 40 MHz	26cm
Directional Panel	RadioWaves FP2-5-28	28.2dBi	2	20 MHz 40 MHz	71cm
Dish	RadioWaves SPD4-5.2S	34.9dBi	3	20 MHz 40 MHz	154cm

Antenna Installation

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

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

Mise en garde ! Toute antenne placée à l'extérieur doit être correctement mise à la terre. Soyez très prudent lors de l'installation d'antennes et suivre toutes les instructions du fabricant fournies avec l'antenne.

Per FCC regulations, any antenna used with transceivers must be an approved antenna that has comparable performance parameters.

Placement Considerations

Placement of the **WavePoint 10e** is likely to have a significant impact on its performance. The key to the overall robustness of the RF link is the height and alignment of the antenna. Other antennas in close proximity are a potential source of interference. See Diagnostics and Troubleshooting on page 149 for more information.

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FreeWave Recommends: In general, FreeWave units with a higher antenna placement have a better communications link.
Use grid and dish antennas with low attenuation cable in lengths ranging from 3 to 100 feet.

To help optimize an antenna location, have FreeWave complete a free Path Site study.
Contact a FreeWave sales representative for a Path Study form.
Email the completed form to pathstudy@freewave.com.

Transmit Power Settings

The **Transmit Power** parameter is the output power of the transceiver.

Important: The information in this section describes the FCC maximum Equivalent Isotropically Radiated Power (EIRP) regulations.
The transceiver output power level must be set to satisfy the maximum requirements in the country the **WavePoint 10e** is installed in.
The installer is responsible for ensuring that an installation is within EIRP emission limits.

When setting up the network, consider the power gain that an antenna may add and the power loss through cabling. Adjust the **Transmit Power** on the transceiver so it does NOT exceed the maximum EIRP for the regulating body where **WavePoint 10e** is installed. Use the tables to determine the correct **Transmit Power** parameter setting for each transceiver in the network.

When calculating the power gain, use **Equation 1** to determine the total output power at the antenna.

Transceiver Output – Losses + Antenna Gain = Output Antenna Power

Equation 1

Note: Loss calculations should include cable, connectors, surge protectors, etc.

RF Loss

Cable losses for high frequency systems are one of the main losses to consider in **Equation 1**.

This table shows the RF loss at various cable lengths.

Example: Using the information in the table, a cable as short as 25 feet can have an attenuation of almost 1dB.

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Cable Type	Attenuation (db/100 ft)	Run Length (ft)	Total Run Attenuation (dB)
LMR400	3.93	25	1.0
LMR500	3.154	25	0.8
LMR600	2.518	25	0.6
LMR900	1.709	25	0.4

WavePoint™ EIRP Limits

This table provides a summary of the FCC limits for the different frequencies available in WavePoint™.

Note: See the www.fcc.gov site for the most up-to-date information.

EIRP Limits				
Frequency Band	PTP Max EIRP (dBm)	PTP Max EIRP (watts)	PTMP Max EIRP (dBm)	PTMP Max EIRP (watts)
900 ISM (902-928 MHz)	36	4	36	4
2.4 ISM (2.4 - 2.483.5 GHz)	50	158	36	4
UNII - 1 (5.15 - 5.25 GHz)	22	0.16	22	0.16
UNII - 2a (5.25 - 5.35 GHz)	29	0.8	29	0.8
UNII - 2c (5.470 - 5.725 GHz)	29	0.8	29	0.8
UNII - 3 (5.725 - 5.850 GHz)	53	200	35	3.2

RF Considerations for 2.4 GHz ISM Band

The FCC regulations for 2.4 GHz ISM Band are different for Point-to-Point (PTP) and Point-to-Multi-Point (PtMP) links.

Peak Power Output

The maximum peak output power of the intentional radiator cannot exceed 1.000 Watts.

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Digital Transmission Systems (MHz)	Output Limit (Watts)
2400-2483.5	1.000

Important: Point-to-Point applications operating in the 2400-2483.5 MHz band may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Example:
2.4 GHz with a 24 inch dish has a maximum output of 24 dBm.
2.4 GHz with a 27 inch dish has a maximum output of 23 dBm.

Point-to-Point Link

Note: The FCC permits a maximum of 36dBm EIRP when using a transmitter set to 30dBm.
However, for each 1dBm reduction in the transmitter power, the FCC permits an increase in antenna gain of 3dBi.

Extrapolating this rule through different maximum power settings on the **WavePoint™** provides these guidelines.

Guidelines

Maximum Power from Transmitter	Maximum Antenna Gain (dBi)	EIRP (dBm)
30dBm	6	36
29dBm	9	38
28dBm	12	40
27dBm	15	42
26dBm	18	44
25dBm	21	46
24dBm	24	48
23dBm	27	50
22dBm	30	52

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Note: FreeWave has certified a dish antenna with a maximum gain of 27dBi.
This sets the maximum EIRP of a FreeWave system to 50 EIRP.
Dishes below 27dBi can be used with a corresponding reduction in total EIRP.

Point-to-Multi-Point Link

For Point-to-Multi-Point links, the FCC permits 1 Watt output power at the transceiver and 36dBm (4 Watts) at the antenna.

RF Considerations for 900MHz ISM Band

The 900MHz links requires these special considerations:

- A Path Study is needed to confirm the right RF characteristics of the link.
- The noise floor should be sampled at each site using similar antennas to the ones expected to be deployed.

WavePoint™ GUI to Actual RF Power

This table identifies the **WavePoint™** GUI settings on the **Advanced Radio** window and their corresponding actual power out of the radio.

Note: Click **Wireless LAN > Radios > Advanced** to open the window.

GUI Setting (dBm)	Actual Tx Power Out of Radio (dBm)
11	23
10	22
9	21
8	20
7	19
6	18
5	17

GUI Setting (dBm)	Actual Tx Power Out of Radio (dBm)
18	30
17	29
16	28
15	27
14	26
13	25
12	24

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