

LUXUL
WIRELESS

USER GUIDE

SHOCK-WAV™ OUTDOOR WI-FI SIGNAL BOOSTER



FOR USE WITH THE MOTOROLA AP-5181
MODEL NUMBER: SWM-1000-O



SHOCK-WAV WI-FI SIGNAL BOOSTER

MODEL NUMBER: SWM-1000-O

INSTALLATION GUIDE

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This product is covered by one or more U.S. and foreign patents.

Patents: 7,379,717, 6,606,075, 6,373,448, other patents pending

SHOCK-WAV WI-FI SIGNAL BOOSTER

MODEL NUMBER: SWM-1000-O

FCC ID: W59SWM1000O

IC: 8584A-SWM1000O

MOTOROLA (SYMBOL TECHNOLOGIES INC)

MODEL NUMBER: AP-5181

FCC ID: H9PAP5181D

IC: T549D-AP5181D

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1 - INTRODUCTION

The Luxul Wireless Shock-WAV Wi-Fi Signal Booster is designed to complement and enhance the performance of the Motorola AP-5181 Wireless Access Point (WAP). When combined with the AP-5181 and approved antenna, it delivers up to the maximum transmit power allowed by the FCC (EIRP of 36dBm), resulting in a farther reaching and higher performing network.

Luxul Wireless Shock-WAV Wi-Fi Signal Boosters feature patented RF technology that dynamically optimizes output strength and provides the cleanest, most consistent signal amplification available for Wi-Fi networks. Designed for bidirectional signal amplification, Shock-WAV Wi-Fi Signal Boosters utilize patented Digital Automatic Gain Control (D-AGC) technology that actively monitors the incoming signal from each packet and makes adjustments so that the output signal maintains constant power levels, ensuring the cleanest and most consistent RF signal possible.

1.1 DOCUMENT CONVENTIONS

The following graphical alerts are used in this document to indicate notable situations:



NOTE: Tips, hints, or special requirements that you should take note of.



CAUTION: Care is required. Disregarding a caution can result in data loss or equipment malfunction.



WARNING!: Indicates a condition or procedure that could result in personal injury or equipment damage.

1.2 WARNINGS

- Read all installation instructions and site survey reports, and verify correct equipment installation before connecting the Shock-WAV Wi-Fi Signal Booster or AP-5181 to its power source.
- Remove jewelry and watches before installing this equipment.
- Verify that the unit is grounded before connecting it to the power source.
- Verify that any device connected to this unit is properly wired and grounded.
- Connect all power cords to a properly wired and grounded electrical circuit.
- Verify that the electrical circuits have appropriate overload protection.
- Attach only approved power cords to the device.
- Verify that the power connector and socket are accessible at all times during the operation of the equipment.

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- Do not work with power circuits in dimly lit spaces.
- Do not install this equipment or work with its power circuits during thunderstorms or other weather conditions that could cause a power surge.
- Verify there is adequate ventilation around the device, and that ambient temperatures meet equipment operation specifications.
- Products outside the approved configurations may be in violation of Part 15 of the FCC Rules.

1.3 SITE PREPARATION

- Consult your site survey and network analysis reports to determine specific equipment placement, power drops, and so on.
- Assign installation responsibility to the appropriate personnel.
- Identify and document where all installed components are located.
- Provide a sufficient number of power drops for your equipment.
- Ensure adequate, dust-free ventilation to all installed equipment.
- Identify and prepare Ethernet and console port connections.
- Verify that cable lengths are within the maximum allowable distances for optimal and certified signal transmission.

1.4 PROFESSIONAL INSTALLATION CONSIDERATIONS



CAUTION: Operation of the signal booster without regulatory approval is illegal

The Luxul Shock-WAV Wi-Fi Signal Booster system is required to be professionally installed. The following components are approved for use in the system.

- Luxul SWM-1000-O
- Motorola AP-5181
- Motorola AP-PSBIAS-5181-01R Power Over Ethernet (POE) Injector
- For approved antennas, see section 3.5

The AP-5181 can be used with default RF signal power settings, although some additional throughput performance may be gained by backing the output power down by 3dB. The signal booster only amplifies the RF signal provided to it by the AP-5181. Channel selection, data rates, encryption, etc. are all controlled by the AP-5181.



The output power of the amplifier is set and tested during manufacturing. There are no user modifiable parameters in the amplifier. The Luxul Shock-WAV Wi-Fi Signal Booster incorporates a Digital Automatic Gain Control (D-AGC) that ensures a consistent and approved output power.

Please reference section 4 for installation instructions.

2 - SHOCK-WAV WI-FI SIGNAL BOOSTER SPECIFICATIONS

Operating Range	2400 - 2483 MHz
Transmit Power	(27dBm)
Transmit Gain	20dB Typical (under D-AGC Control)
Receive Gain	15dB Typical
TX Input Power	+8dBm to +24dBm
Noise Figure	3.5dB Typical
LED Indicators TX\RX	Solid for RX/Blink for TX
Power Consumption	400mW (RX) 5W (TX) Max
Power Options	Power Over Ethernet (POE)
Operating Voltage	12 to 48VDC
Operating Temp	-40F (-40c) to +158F (+70c)
Dimensions	W: 4" (101.6 mm) L: 6" (152.4 mm) H: 1.7" (43.18mm)
Enclosure	Outdoor, Aluminum
RF Connectors	Two (2) Type N Female
Weight	1.5lbs. (68Kg)

3 - GETTING STARTED

3.1 PRECAUTIONS

Before installing the Shock-WAV Wi-Fi Signal Booster and AP-5181 verify the following:

- Do not install in wet or dusty areas without additional protection. Contact a Luxul Wireless representative for more information.
- Verify the environment has a continuous temperature range between -40F to +149F (-40c - +65c).

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3.2 PACKAGE CONTENTS

The Luxul Shock-WAV Wi-Fi Signal Booster consists of the following:



One Shock-WAV Wi-Fi Signal Booster



One 36" (914.4mm) N-Male to N-Male cable



Two Weather proof RJ45 connector kit



Four Phillips Pan Head Mounting screws

3.3 ADDITIONAL ITEMS REQUIRED

Before installing your Shock-WAV Wi-Fi Signal Booster, be sure to have the following items available:

- Motorola AP-5181 Wireless Access Point (WAP)
- Motorola AP-PSBIAS-5181-01R Power Over Ethernet (POE) injector
- An antenna (See section 3.5 for a list of certified antennas)

3.4 OPTIONAL PRODUCTS AND ACCESSORIES

X-WAV™ Antennas: Luxul Wireless offers a wide range of antenna products to complement your Shock-WAV Wi-Fi Signal Booster purchase. X-WAV antennas deliver superior range and signal penetration over other antenna products. A list of antennas approved for use with the AP-5181 and Shock-WAV Wi-Fi Signal Booster combination can be found in section 3.5 Antenna Options.

Cables: This Shock-WAV Wi-Fi Signal Booster is FCC certified for use with various antenna options (see section 3.5). In order to comply with FCC certification, cables connecting the device to the antenna must be no less than 1 foot in length. Luxul Wireless offers a variety of cable lengths that can be purchased separately and used in conjunction with the Shock-WAV device.

Splitters and Surge Protectors: Signal splitters, lightning surge protectors, and other useful accessories are available for making the most of your Luxul Wireless purchase.

Mounting Brackets: Luxul Wireless offers several mounting brackets and stands for mounting the Shock-WAV Wi-Fi Signal Booster and associated antennas.

3.5 ANTENNA OPTIONS

The following antennas have been certified for use with the Shock-WAV Wi-Fi Signal Booster and AP-5181 WAP.

- **Motorola OD24M-9** - 9dBi Omni Directional Antenna
- **Luxul XW-24-FP7** - 7dBi Circular Polarized Patch Antenna
- **Luxul XW-24-FPS11** - 11dBi Circular Polarized Sector Antenna
- **Luxul XW-24-H10** - 10dBi Circular Polarized Helical Antenna

4 - INSTALLATION PROCEDURES



NOTE: The combination of the Motorola AP-5181 and the Shock-WAV Wi-Fi Signal Booster requires professional installation. Please contact Luxul Wireless for more information.

4.1 ATTACHING SHOCK-WAV WI-FI SIGNAL BOOSTER TO THE MOTOROLA AP-5181

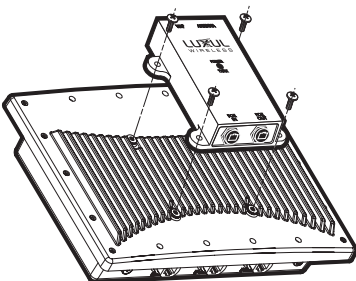


Figure 4.1.1

The Signal Booster is designed to be mounted to the front of the AP-5181 but may be mounted elsewhere to fit the needs of your installation environment.

Remove the four Phillips Pan Head screws from the front of the Motorola AP-5181. Place the Shock-WAV Signal Booster so the N-Male connectors are on the same side as the AP-5181's N-Male connectors and use the four pan head screws provided to attach the Signal booster to the WAP (Figure 4.1.1).

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4.2 CONNECTING THE SHOCK-WAV WI-FI SIGNAL BOOSTER

Shock-WAV Wi-Fi Signal Boosters are connected between the AP-5181 and the antenna. For better coverage, use Luxul Wireless X-WAV Antennas. A list of certified antennas can be found in section 3.5.



NOTE: The primary and secondary radio ports are identified by dots under the "RADIO" label. One dot for the primary port, and two dots for the secondary.

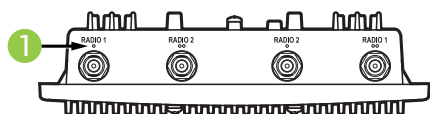


Figure 4.2.1

Remove the stock antenna, from your AP-5181's primary "RADIO 1" port (Figure 4.2.1) 1.

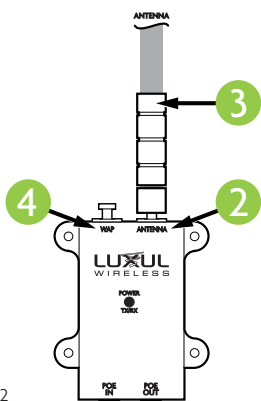


Figure 4.2.2

Connect the antenna (Figure 4.2.2) 3 to the Shock-WAV Wi-Fi Signal Booster. Be sure to connect the antenna to the side of the Signal Booster labeled Antenna (Figure 4.2.2) 2.

Motorola installation specifications suggest the coax cable be routed so that it makes a complete loop around the AP-5181 (Figure 4.2.3) 5. Cable channels on the back of the AP-5181 may be used to secure the cable.

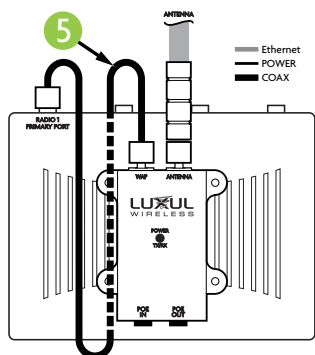


Figure 4.2.3

Using the supplied N-Male to N-Male coax cable, connect the Shock-WAV Wi-Fi Signal Booster to your AP-5181's radio 1, primary port. (Figure 4.2.1) 1. Be sure to connect the other end of the cable to the side of the Signal Booster labeled WAP (Figure 4.2.2) 4.

(Consult your AP-5181's documentation for more details on the radio ports and deployment).

4.3 CONNECTING POWER OVER ETHERNET



CAUTION: Using the wrong power solution (including a POE system used with a legacy Motorola access point) could severely damage the Shock-WAV Wi-Fi Signal Booster and void the product warranty.



WARNING!: Do not attempt to connect or disconnect any components while the Motorola AP-5181 WAP or Shock-WAV Signal Booster are plugged into power. Doing so may cause equipment damage and/or physical injury and will void your warranty.

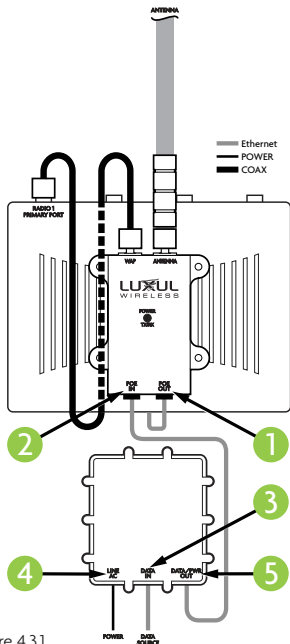


Figure 4.3.1

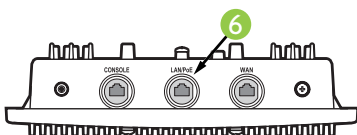


Figure 4.3.2

For maximum flexibility the Shock-WAV Wi-Fi Signal Booster can receive power via an Ethernet cable connected to a POE (Power Over Ethernet) injector.

The Motorola Power Injector (Part No. AP-PSBIAS-5181-01R), in certain AP-5181 kits, is an integrated AC-DC converter and 802.3af power injector which requires suitable AC power to combine DC voltage with Ethernet data in a single Ethernet cable, reducing the burden of installation and allowing optimal WAP and Signal Booster placement in respect to the intended radio coverage area.

Install the included weather proof RJ45 connector kit on your Ethernet cable and attach the Ethernet cable ends.

(Consult the AP-5181 Access Point Deployment Guide for more information about the weather proof connector kit).

Connect the Ethernet cable from the Signal Booster “POE OUT” port (Figure 4.3.1) **1** to the LAN/POE port on the bottom of your Motorola AP-5181, (Figure 4.3.2) **6**. Connect the Ethernet cable from Data/PWR Out port (Figure 4.3.1) **5** of the Motorola AP-PSBIAS-5181-01R POE injector to the “POE IN” port of Signal Booster (Figure 4.3.1) **2**. Connect your Data Source Ethernet cable to the Data In port of the POE injector (Figure 4.3.1) **3**. Plug the POE injector power supply into your power source. Tighten all of the Weather proof connectors.

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(Consult your Motorola Documentation for more information on the AP-5181 WAP and the AP-PSBIAS-5181-01R POE injector).



NOTE: Your Data/PWR Out Ethernet cable should not exceed a maximum length of 328' (100 meters).

4.4 SETTING THE AP-5181 TO THE PRIMARY ANTENNA PORT

Consult your AP-5181 documentation to access the Radio Configuration Software to configure Radio 1 to use only the Primary Antenna Port. Using the Left side navigation tree, navigate to the Radio 1 (802.11 b/g). The file path is: Network Configuration\Wireless\Radio Configuration\Radio 1 (802.11 b/g) (Figure 4.4.1) ①. In the Radio Settings dialog box set Antenna Diversity drop down to Primary Only (Figure 4.4.1) ②. Then apply your change.

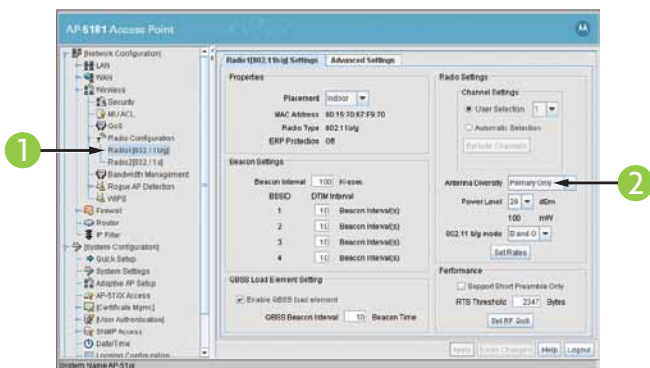


Figure 4.4.1

(Consult your AP-5181's documentation for more details on Radio Configuration and Antenna Diversity).

5 - ANTENNA PLACEMENT

For best results, the Antenna should be deployed where the maximum amount of signal can be sent throughout the desired coverage area.

Luxul Wireless products, particularly those implementing our patented Signal Booster technology, are often capable of emitting enough signal strength to cover the desired area regardless of orientation.

5.1 ANTENNA DEPLOYMENT

Be sure you place the antenna so there is a minimum of 2 feet (.6 meters) of open space around it. Refer to Figure 6 for examples of antenna deployment.

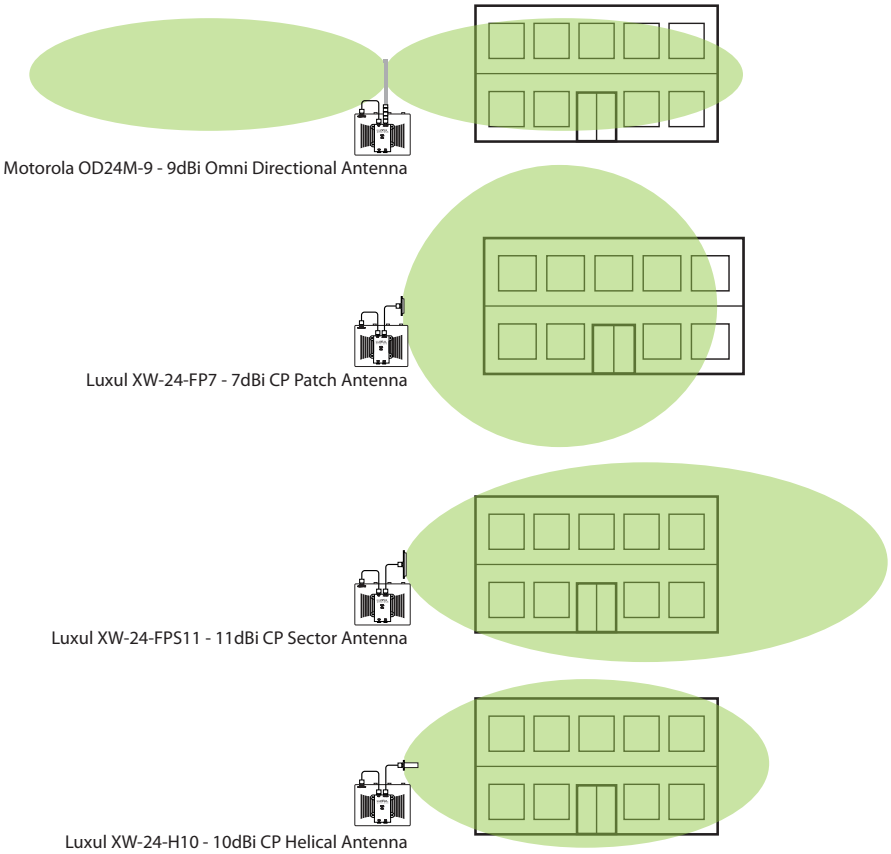


Figure 5.1

Pattern shapes and sizes are representative and not to scale

Figure 5.1 shows the signal propagation differences between the various certified antennas. See section 3.5 for a list of approved antennas.

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5.2 ANTENNA DIRECTION

For maximum coverage it is important to have your antenna pattern radiating in the correct direction. If the antenna is tipped at an angle, the pattern will radiate out at that angle. See Figure 5.2.1 for an example of pattern radiation.

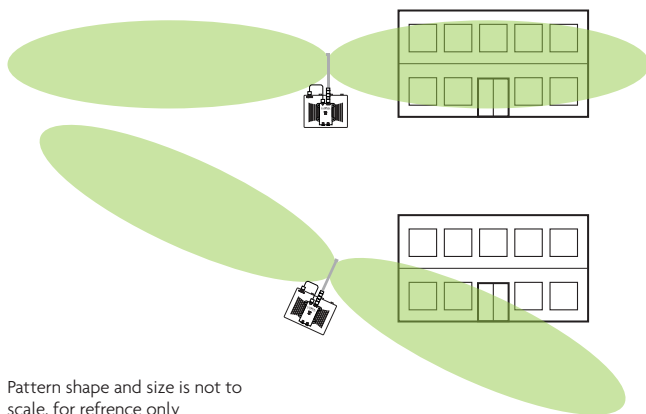


Figure 5.2.1

Pattern shape and size is not to scale, for reference only

6 - REGULATORY COMPLIANCE

This device is approved under the Luxul Wireless brand and designed to comply for use specifically with the Motorola AP-5181. This device is designed to be compliant with rules and regulations in locations where they are sold and will be labeled as required. Any changes or modifications to Luxul equipment, not expressly approved by Luxul, could void the user's authority to operate the equipment. This Luxul device when used in conjunction with the Motorola AP-5181 should be professionally installed and the Radio Frequency Output Power will not exceed the maximum allowable limit for those countries that have regulatory approval.

Antennas: Use only the supplied or an approved replacement antennas. Unauthorized antennas, modifications, or attachments could cause damage and may violate regulatory approvals.

6.1 HEALTH AND SAFETY RECOMMENDATIONS

Warnings for the use of Wireless Devices: Please observe all warning notices with regard to the usage of wireless devices

Potentially Hazardous Atmospheres: You are reminded of the need to observe restrictions on the use of radio devices in fuel depots, chemical plants etc. and areas where the air contains chemicals or particles (such as grain, dust, or metal powders).

Safety in Hospitals: Wireless devices transmit radio frequency energy and may affect medical electrical equipment. When installed adjacent to other equipment, it is advised to verify that the adjacent equipment is not adversely affected.

Power Supply: Use only a Motorola approved power supply for the AP-PSBIAS-5181-01R POE injector output rated at 48VDC and 500mA. Refer to the Motorola AP-PSBIAS-5181-01R POE injector documentation for installation instruction and operational guidelines.

6.2 RF EXPOSURE GUIDELINES

Safety Information: The device complies with internationally recognized standards covering human exposure to electromagnetic fields from radio devices.

Warning: Exposure To Radio Frequency (RF) Radiation:

- The radiated output of this device is below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized.
- The end user must avoid any extended human RF exposure directly in front of the Model SWM-1000-O, up to a distance of 20cm, when unit is switched on.
- When servicing the equipment and selecting a location for the antennas, it is important to note that a minimum distance of 20cm is required between personnel and the Model SWM-1000-O antennas to comply with the radio frequency exposure limit.
- The antenna used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.
- The following safety precautions should be observed:
 - Do not touch or move the antenna while the unit is transmitting or receiving.
 - Do not hold any component containing the radio such that the antenna is very close or touching any exposed parts of the body, especially the face or eyes, while transmitting.
 - Do not operate the radio or attempt to transmit data unless the antenna is connected; this behavior may cause damage to the radio.

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Remote and Standalone Antenna Configurations: To comply with FCC RF exposure requirements, antennas that are mounted externally at remote locations or operating near users at stand-alone desktop of similar configurations must operate with a minimum separation distance of 20 cm from all persons.

6.3 RADIO FREQUENCY INTERFERENCE REQUIREMENTS—FCC

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

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

6.4 RADIO TRANSMITTERS (PART 15)

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.

6.5 INDUSTRY CANADA (RSS-GEN ISSUE 2)

In accordance with Industry Canada Regulations, this radio frequency power amplifier may only be used with a transmitter with which the amplifier has been certified by Industry Canada. The Industry Canada Identification Number for the transmitter with which this amplifier is permitted to operate is 1549D-AP5181D

This device has been designed to operate with the antennas listed in section 3.5, and having a maximum linear gain of 9dBi or maximum CP gain of 11dBi. Antennas not included in this list or having a linear gain greater than 9dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

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.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

7 - SALES AND SUPPORT CONTACTS

For Sales Assistance:

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For Technical Assistance:

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Results may vary depending on building layout, type of construction and other environmental factors including Wi-Fi traffic, Microwaves Ovens, Cordless Phones, etc.

FCC NOTICE: The use of all radio equipment is subject to regulations in each country. To comply with FCC part 15 rules in the United States, radio equipment must only be used in systems that have been FCC certified. It is the responsibility of the user/professional installer/operator to ensure that only approved equipment/systems are deployed. To ensure FCC part 15 compliance, Luxul amplifier products should only be installed in certified systems by licensed professionals.

FCC Certification Support for OEMs: Luxul Wireless offers FCC certification assistance and engineering support for qualified OEMs interested in certifying complete amplified WLAN systems. Please contact us for details.



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