

# High Security Supplement

User Manual Supplement  
forAvaLAN Wireless Radios  
with FIPS 140-2 Security

AW900FS

USER'S MANUAL

If you have an AvaLAN radio with FIPS 140-2 Security, this supplement to the User Manual provides instructions for setting up the encryption. Please disregard the AES Encryption instructions in the regular manual: This supercedes them. A feature of the level of security provided is that there is no way to change the encryption method or key through the radio's interface. A separate port must be used.

To program the encryption characteristics of your AvaLAN radio, a PC must be connected to the USB port on the side of the case:



The PC must have two critical pieces of software installed:

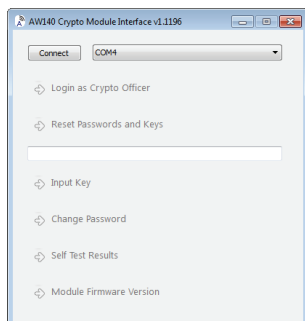
1. A driver that provides a virtual COM port through the USB connection. Such a driver is already included with Windows XP, Vista or 7 and should automatically be located and loaded when the USB connection is first made.
2. A Crypto Module Interface utility that can be downloaded from our website, [www.avalanwireless.com](http://www.avalanwireless.com). Look for it on the Downloads page under the Support tab. The file is a zip archive containing an installer for the utility. Unzip and run it to install the utility on your PC.

If you prefer to use a computer with a non-Windows operating system, it is also possible to program the module with a virtual COM port driver and a generic terminal emulator. Contact AvaLAN Technical Support for help with this feature.

The person having access to the programming interface is referred to by the FIPS 140-2 Standard as the Crypto Officer. As the Crypto Officer, part of the responsibility for data security rests with your choice of a strong login password and encryption key. You should program the encryption modules in both radios of your wireless link at the same time and on the bench prior to deployment. (This is much more convenient than climbing a pole with a laptop strapped around your neck.) Make sure you do not lose the login password and encryption key because they cannot be retrieved from the modules in any fashion.

## Step by step programming procedure:

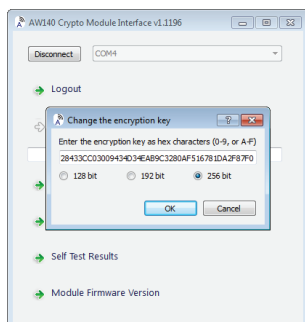
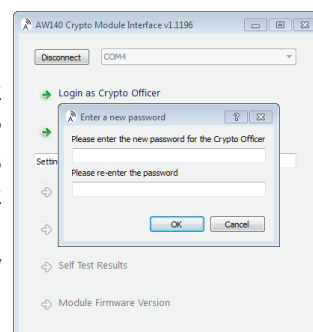
1. Turn off the power for the radio and connect the AW140 module's USB port to your computer using a USB mini B cable.



2. Run the Crypto Module Interface utility on your PC. You should see a startup window like this, with everything greyed out except the Connect button and a dropdown list of COM ports. Usually there will be just one. If there are more, repeat Step 1 to determine which COM port applies to this radio by seeing it disappear and reappear in the list.

3. Choose the correct COM port and press the Connect button. The utility window will then show a successful connection by activating the Login and Reset choices and displaying "Module Connected" in the status box.

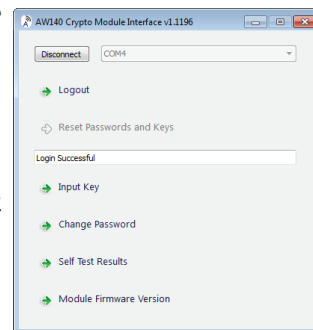
4. If you know the Crypto Officer password and want to change the encryption key, choose Login. if you are initializing the module for the first time or wish to reset both the password and key, choose Reset. After a warning popup, you will be able to enter a new Crypto Officer password. This must be between 8 and 32 characters and may include letters, numbers and symbols and is case-dependent. If you forget the password, there is no way to retrieve it. You will need to reset the module and begin again. If you know the password and have logged in, you may change it by clicking "Change Password."



5. Next, you will be provided with a popup to enter the encryption key and method (128, 192 or 256-bit). (You will be forced here if you are resetting, or can choose "Input Key" after logging in. The encryption key is a hexadecimal number, 32 digits for 128-bit encryption, 48 digits for 192-bit and 64 digits for 256-bit. Enter the digits as 0 - 9 and a - f or A - F (case independent). If you enter fewer than the specified number of digits (not recommended), the remainder will be padded with zeros.

6. Once the encryption module has been programmed, you may login to access the other features. "Self Test Results" will simply display "Self Test Passed" in the status box. If it does not, contact AvaLAN Technical Support. Module Firmware Version displays that information in the status box and may be useful to the aforementioned AvaLAN Technical Support staff.

7. When you are finished with the configuration of the encryption module, disconnect the USB cable.





## 900 MHz Industrial Wireless Ethernet Radios



Thank you for your purchase of the AW900FS Indoor Wireless Ethernet Radio.

The AW900FS includes:

- (1) AW900FS radio in extruded aluminum box
- (1) AW2-900 2.5dBi omnidirectional antenna
- (1) AW-12VPS 12 VDC Power Supply (USA plug only)
- (1) USB Cable

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## RF Exposure



Professional installation is required. The radio equipment described in this guide emits radio frequency energy. Although the power level is low, the concentrated energy from a directional antenna may pose a health hazard. Do not allow people to come closer than 23 cm (9 inches) to the antenna when the transmitter is operating in indoor or outdoor environments. More information on RF exposure is on the Internet at [www.fcc.gov/oet/info/documents/bulletins](http://www.fcc.gov/oet/info/documents/bulletins)

If you have any questions when configuring your AvaLAN system, the best place to get answers is to visit [www.avalanwireless.com](http://www.avalanwireless.com). You will also find the latest updates there. If more assistance is needed, send email to [support@avalanwireless.com](mailto:support@avalanwireless.com).

To speak to a live technician, please call technical support at the number below during normal business hours.

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Revision 09.5.2014

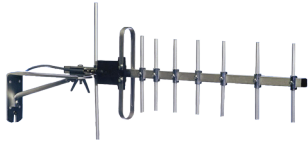
125A Castle Drive  
Madison, AL 35758

Sales and Technical Support: (650) 384-0000

## Compatible Accessories

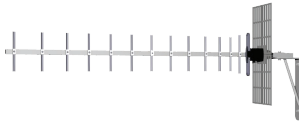
### Antennas

AW11-900



900 MHz Directional 11 dBI  
YAGI Antenna

AW15-900



900 MHz Directional 15 dBI  
YAGI Antenna

AW5M-900



900 MHz Omnidirectional  
5 dBI Magnetic Antenna

AW5P-900



900 MHz Omnidirectional  
15 dBI Pole Antenna

### Accessories

AW-12VA



Auto Adapter

AW-LA



Lightning Arrestor

AW-RFx900

x = 4ft, 10ft, 25ft or 50ft



900 MHz Antenna Extension  
Cable

### Warranty

AW-Warranty-900

These items can be found on our website,  
[www.avalanwireless.com](http://www.avalanwireless.com)

## Quick Start Guide

### PROGRAMMING:

**Step 1.** Gather the AvaLAN radios, power supplies, 2x CAT5 cables and a computer with an RJ45 Ethernet interface.

**Step 2.** Set the 128-256bit encryption key. Use this key for all radios in the group. Refer to pages 1-3 for instructions to complete this step.

**Step 3.** Connect the radios one at a time directly to the PC via an Ethernet cable. Set your computer to an IP address of 192.168.17.1 (refer to page 6 for detailed instructions). Enter the radio's default IP address\* of 192.168.17.17 into a web browser.

**Step 4.** Enter the password and click login. The default password is "password".

**Step 5.** Toggle to select the device type - Access Point or Subscriber Unit. An access point (AP) can communicate with up to 4 Subscriber Units (SU).

- For each SU:
  - Record the Radio Address (Ex. 00.17.3A) for the AP steps below. The Radio Address is shown for 5 seconds on the LCD display during of the boot up of the radio and is also displayed on the Browser interface in Device Information section.
  - Click the Subscriber Unit button.
  - Set the Subscriber's ID as 1,2,3 or 4. Record this ID for the AP steps below.
  - Set the Transmit Power to the LEGAL level with respect to the Antenna Gain and Cable length - See page 11 for instructions to configure per FCC/IC power limits.
  - Set the administrator Password.
  - Set the IP address to a unique value (Ex. 192.168.17.20). This IP address is only used to manage the radio but all other Ethernet packets will transparently pass through the radios regardless of their subnet.
- For the AP:
  - Enter the Radio Address (see prior steps above) of each SU into the matching Subscriber ID field that was assigned in the prior step.
  - Click the check box of each SU that will be active in the network (this is typically checked for all SUs but can be unchecked to increase throughput when an SU is known to be inactive).
  - Set the Transmit Power to the LEGAL level with respect to the Antenna Gain and Cable length - See page 11 for instructions to configure per FCC/IC power limits.
  - Set the administrator Password.
  - Set the IP address to a unique value (Ex. 192.168.17.30). This IP address is only used to manage the radio but all other Ethernet packets will transparently pass through the radios

regardless of their subnet.

**Step 5: Bench Testing**

Power up the units on the bench before deploying in the field. It is important to keep the radios at least 20 feet apart using the 2dBi omni antennae and Transmit power set to 10dBm to prevent over driving of radio's receiver (permanent damage can occur).

- Power on all the radios with the computer wired directly to the AP.
- Open a web browser to the IP addresses assigned in the prior steps to view the operation of all the radios.
- Perform PING testing to simulate network data and observe overall performance.

**INSTALLATION:**

Every installations is different, however radio performance is typically best at shorter distances using directional antennae with unobstructed paths in low noise environments. It can be challenging to determine the best approach for a unique installation. The radio's browser interface has a link performance statistics that is helpful for troubleshooting radio interference noise levels. Please call AvaLAN Technical Support for assistance as needed.



## Operational Summary

The AW900FS Radio allows the user to create a long-range, wireless Ethernet network with up to 4 subscriber units per access point.

Configuring a wireless link with the AW900FS requires the establishment of six elements:

- Each radio must know whether it is to be an access point (AP) or subscriber unit (SU).
- Each radio must have an IP address that is unique among all others on the same network.
- The AP must know how many SUs are expecting communication.
- The SU must be assigned a unique subscriber ID to specify which time division slot it will use when communicating with the AP.
- The AP and any given SU must share a common 128/256-bit encryption key and each radio's unique 64-bit Radio Address.

The access point (AP) automatically scans to locate the other radios in the group, encrypts Ethernet data received from the network, and transmits it wirelessly to the correct subscriber unit (SU). Any 10/100 BaseT Ethernet client device (ECD) can be connected to an AW900FS subscriber unit. Each SU encrypts Ethernet traffic received from the attached ECD and transmits the data wirelessly to its AP. Each SU can be plugged directly into an ECD without adding drivers or loading software. Essentially, once the AP/SU is configured and running, it behaves like a transparent Ethernet cable that encrypts and then passes all traffic including VLANs.

**Note:** Every SU should be placed at least 50 feet from the AP to avoid overloading the radio's receiver. If two AP units are installed very close to one another, they may interfere with each other causing degraded throughput and range. Locate APs at least 25 feet apart (see antenna guide on page 16).

## Physical Setup

1. Before placing the radio in its final location, it may be best to perform the digital setup procedure described in the next section.
2. Connect the AW900FS's RP-TNC RF connector to a suitable antenna. A 2 dBI omni-directional dipole antenna (AW2-900) is included and is suitable for testing and general applications. Application specific antennas are available if greater range and/or directionality is required. Choose one of our other antenna models that can be found on our website at [www.avalanwireless.com](http://www.avalanwireless.com).
3. Power is provided to the unit by means of the 120 VAC to 12 VDC wall power supply.

## Digital Setup

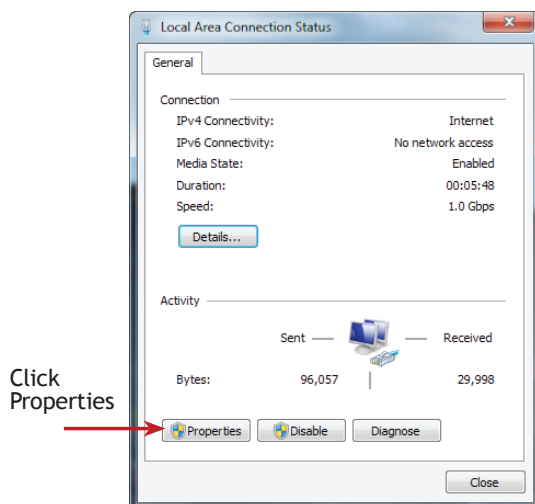
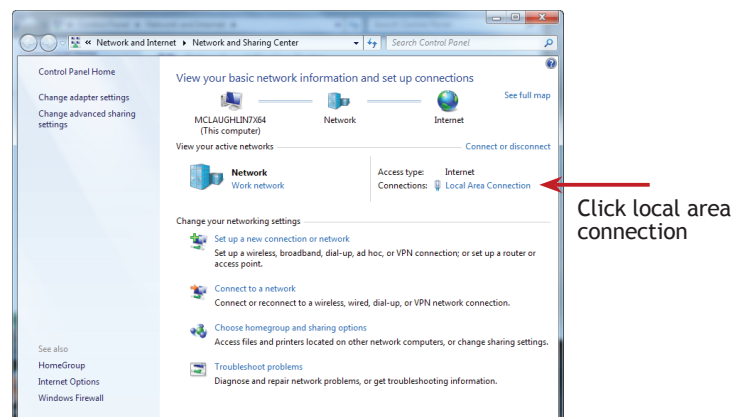
1. Digital configuration is done by means of the AW900FS's built in browser interface. It should be powered on and connected at least temporarily to a network containing a computer that can run a conventional web browser.
2. Download the AvaLAN IP Discovery Utility from our website and extract ipfinder.exe from the zip archive, placing it on your desktop or in a convenient folder.

[http://www.avalanwireless.com/marketing\\_resources/downloads/ipfinder.zip](http://www.avalanwireless.com/marketing_resources/downloads/ipfinder.zip)

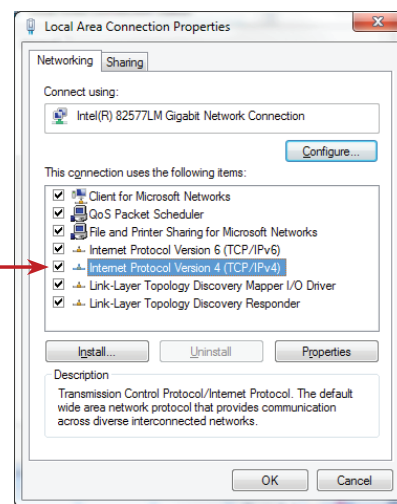
**Note:** This utility only runs on Microsoft Windows, not linux or MAC. If you must use a non-Windows computer for configuration, make sure your subnet mask allows your computer to see 192.168.17.17. Connect to that default IP address with your web browser and continue the setup procedure with step 6.

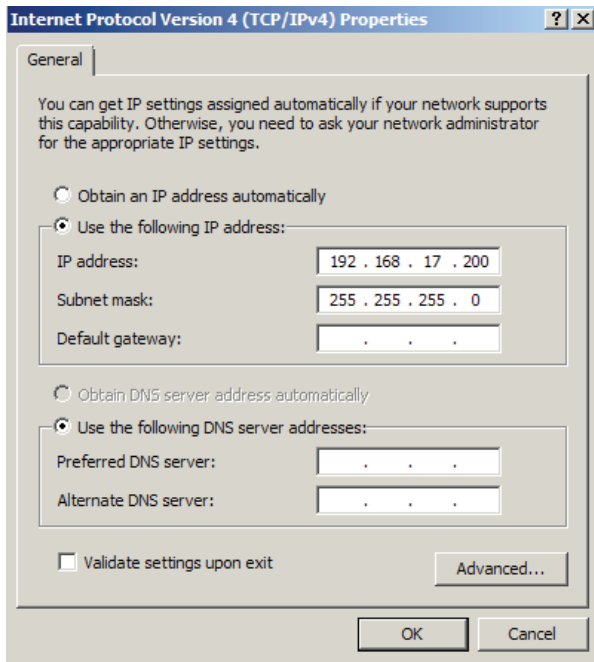
How to configure static IP address for Windows 7.

Start > Control Panel > Network and Internet > Network and Sharing Center



Double Click  
Internet  
Protocol  
Version 4  
(TCP/IPv4)





Click “Use the following IP address”

Populate the following information:

IP address: 192.168.17.200

Subnet mask: 255.255.255.0

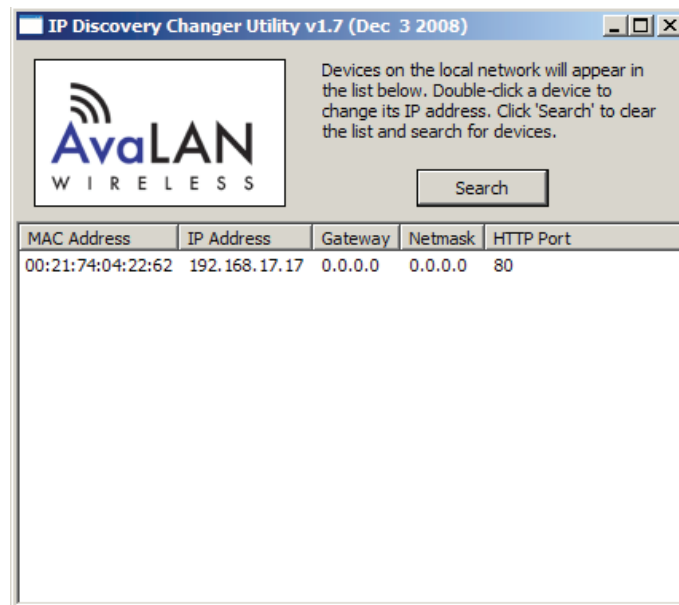
Default gateway: leave blank

Click OK

Click OK

Click Close

3. Run the IP Discovery Utility, ipfinder.exe and you should see a window similar to the view on the next page.



The AW900FS should appear in the list at the default IP address of 192.168.17.17. If it does not, click “Search” to regenerate the list. If it still does not appear, it may be a connection issue and need to re-examine the cabling or you may have a subnet or firewall issue on your computer.

4. Double click the list item that refers to the AW900FS being configured. You should see a second window that is similar to this:

**Change Parameters**

PC Primary Network Interface Parameters:

Atheros AR8131 PCI-E Gigabit Ethernet Controller ...

IP Address: 192.168.17.200

Default Gateway: 0.0.0.0

Network Mask: 255.255.255.0

Target Device Current Parameters:

IP Address: 192.168.17.17

Default Gateway: 0.0.0.0

Network Mask: 0.0.0.0

MAC Address: 00:21:74:04:22:62

HTTP Port: 80

Target Device New Parameters:

IP Address: 192.168.17.17

Default Gateway: 0.0.0.0

Network Mask: 0.0.0.0

Password: password

The default password is "password".

Go to Device Web Page Cancel Apply

The information on the left is the current status of the radio, while the boxes on the right allow you to change it. It is important that the IP address of the AW900FS is in the same subnet as your computer. For example, if the subnet mask is 255.255.255.0, the first three number groups of the IP address must match. Choose the desired parameters and click “Apply.”

5. Make note of the chosen IP address and password, then click “Go to Device Web Page.” This will cause your default web browser to launch with the device IP address in the browser address bar. Or you may launch the browser on your own and enter the web page address manually: [http://\[the IP address you just set\]](http://[the IP address you just set]). **Note:** You are not assigning a password, you’re matching the password that the unit has built into it.

6. The browser page that loads first shows the current device information and provides a login in the upper right. Log in using the password you just specified (or “password” if you kept the default). If the login succeeds, you will see an admin page similar to this:

**AvaLAN WIRELESS**

Version: 1.01.1021  
MAC Address: 00:21:74:04:00:01  
Ethernet: 100 Mbps Full Duplex  
Uptime: 0 days 00h 02:29

Need help? Online FAQ available at [www.AvalanWireless.com](http://www.AvalanWireless.com)

**Statistics**

Radio RSSI: -65 dBm  
Radio Total Packets: 200  
Radio Failed Packets: 0  
Radio Passed Packets: 200  
Radio Broadcast Packets: 142  
Radio Unicast Packets: 148  
Radio Average TX Size: 66 bytes  
Radio Average RX Size: 101 bytes

**Device Information**

Device Type: Subscriber Unit  
Device ID: 1  
Current TX Power: 30 dBm  
RF Status: Connected  
Product: 900F  
Radio Firmware Version: 32  
Radio Firmware Build: 119  
Radio Address: 00:17:05

**Device Settings**

	Description	Value
Device	Password	password
	Type	<input checked="" type="radio"/> Access Point <input type="radio"/> Subscriber Unit
	Device ID	Each Subscriber must have a unique Device ID from 1 to 4 1
	Tx Power	30 dBm
Network	IP Address	192.168.17.17
	Network Mask	0.0.0.0
	Default Gateway	0.0.0.0
	HTTP Port	80 (decimal 1-65535)

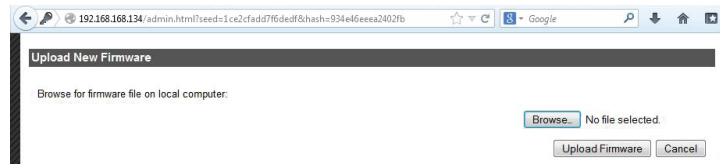
Apply Cancel

The Device Settings section is where the password, output power, network parameters are defined and/or reconfigured.

7. The admin page has sections similar to the login page showing radio statistics and device information plus it adds several new sections. The Device Settings section allows setting the network information.

Scroll down in the Admin browser page to see these additional sections:

1. A section to be used if an update to the AW900FS's firmware is required



8. On the web browser

- Choose Device Type: Access Point or Subscriber Unit.
- Give each device a System Name (optional).
- Set a Network Number from 1-63 to be the same for the Access Point and all of the Subscriber Units.
- For Subscriber Units, assign unique ID numbers in numeric order from 1 to 4.
- For an Access Point, first list the number of subscriber units in the box. Then enter the Radio address for each Subscriber Unit in the Connection List

After entering the parameters, click the “Apply” button to save them to the radio.

Device Settings	
	Value
Device	System Name: AP27MikesOffice (max 31 characters)
	Password: password (max 31 characters)
	Type: <input checked="" type="radio"/> Access Point <input type="radio"/> Subscriber Unit
Connection List	Subscriber 1: <input checked="" type="checkbox"/> 00.1a.78 (xx:xx:xx)
	Subscriber 2: <input type="checkbox"/> 00.00.00 (xx:xx:xx)
	Subscriber 3: <input type="checkbox"/> 00.00.00 (xx:xx:xx)
	Subscriber 4: <input type="checkbox"/> 00.00.00 (xx:xx:xx)
Radio	Network Number: 1 1 - 63
Network	Tx Power: 0 dBm
	IP Address: 192.168.17.27 (###)
	Network Mask: 255.255.255.0 (###)
	Default Gateway: 0.0.0.0 (###)
	HTTP Port: 80 (decimal 1-65535)
Apply Cancel	

Access Point Screen Shot

Device Settings	
	Value
Device	System Name: AP27MikesOffice (max 31 characters)
	Password: password (max 31 characters)
	Type: <input type="radio"/> Access Point <input checked="" type="radio"/> Subscriber Unit
	Each Subscriber must have a unique Device ID from 1 to 4
	Device ID: 1
Radio	Network Number: 1 1 - 63
Network	Tx Power: 0 dBm
	IP Address: 192.168.17.27 (###)
	Network Mask: 255.255.255.0 (###)
	Default Gateway: 0.0.0.0 (###)
	HTTP Port: 80 (decimal 1-65535)
Apply Cancel	

Subscriber Screen Shot

9. When all of the radios are keyed and operating, connect them to your network and Ethernet devices as desired and cycle the radio's power to begin normal operation. Now, browser management of the SUs can be performed over the wireless network. **Note:** Avoid plugging actively linked radios into the same switch because this will corrupt the switch's routing table and may cause network problems just as if you had plugged a CAT5 cable directly between two ports of a switch (commonly called a loop back). Power cycle the radios and switch if this happens.

## Setup Rules

The transceiver must be installed by a professional installer, or factory technicians. The authority to operate the transceiver in the USA and Canada will be void if the radio's transmit power is set above the restricted limits below or by the use of antennae and cables from manufacturers other than AvaLAN Wireless.

The maximum allowable transmit power must follow BOTH rules below.

**FCC RULE 1:** Transmit Power at the product's output connector must not exceed 1 Watt [30dBm]

NOTE: The radio cannot be configured to exceed this limit.

**FCC RULE 2:** The radio system must not exceed 4 watts Effective Isotropic Radiated Power [36dBm EIRP]

NOTE: This rule only applies to antennae with over 6dBi of gain. AvaLAN's Yagi Directional antenna (AW15-900 and AW11-900) must use this rule to determine the LEGAL output power.

ANTENNA GAIN - AvaLAN's approved antenna:

AW11-900 11.0dBi

AW15-900 15.0dBi

CABLE LOSS - AvaLAN's approved cables:

AW4-900 0.5dB

AW10-900 1.2dB

AW25-900 2.0dB

AW50-900 4.1dB

MAXIMUM TRANSMIT POWER = 36dB - ANTENNA GAIN + CABLE LOSS

MAXIMUM TRANSMIT POWER	ANTENNA	APPROVED CABLES
24	AW11-900	1 ft cable (included)
24		AW-RF4
24		AW-RF10
24		AW-RF25
27		AW-RF50
18	AW15-900	1 ft cable (included)
18		AW-RF4
18		AW-RF12
18		AW-RF25
24		AW-RF50
30	AW5P-900 AW5S-900 AW2-900	1 ft cable (included)
30		AW-RF4
30		AW-RF10
30		AW-RF25
30		AW-RF50

## LCD Display

During boot up:

1. Current Version



2. Radio Address:



3. Serial Number

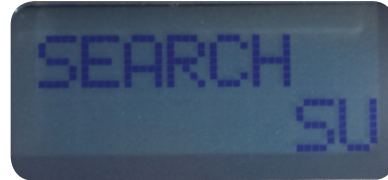


4. IP Address\*

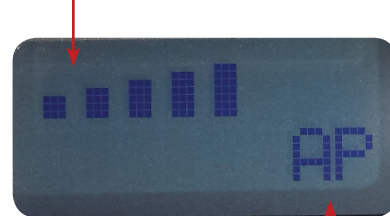


After boot up LCD will display:

Searching for Subscriber radios



Link Quality/Active



Device type: AP or SU



## Limited Warranty

This product is warranted to the original purchaser for normal use for a period of 360 days from the date of purchase. If a defect covered under this warranty occurs, AvaLAN will repair or replace the defective part, at its option, at no cost. This warranty does not cover defects resulting from misuse or modification of the product.

**Compliance Statement ( Part 15.19 )**

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

**Warning ( Part 15.21 )**

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

**RF Exposure ( OET Bulletin 65 )**

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

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

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

--Reorient or relocate the receiving antenna.

--Increase the separation between the equipment and receiver.

--Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

--Consult the dealer or an experienced radio/TV technician for help.



## Technical Specifications

PARAMETER	SPECIFICATION
RF Data Rate	200 kbps
Throughput	120kbps total throughput shared between all radios in the group
Frequency Range	902.75 MHz to 927.25 MHz
Transmit Power	Selectable from 1 mW to 1 W
Receiver Sensitivity	-98 dBm at $10^{-5}$ BER
Security Validation	NIST FIPS 140-2 Level 2 Validated by CMVP Certificate No. 1452
Access Scheme	TDMA, up to 4 Subscriber Units per Access Point with deterministic latency
Modulation/Spreading	FSK - FHSS
Range	Line-of-sight range up to 60 miles with directional antennas, 5 miles with included omnidirectional antenna
Browser Management Tools	Data Communication Statistics, Network Settings, Transmit Power
Data Security	128/256-bit AES
Operating Environment	-40°C to +80°C
Mounting	DIN rail clip
Ethernet Data Interface	10/100baseT
Connectors	RJ-45 for Ethernet, P5
Power System	802.3af POE and 9-30 VDC through power connectors
Power Consumption	When transmitting at +30 dBm: 4 Watts When receiving: 1.8 Watts
Package Size	110 mm wide, 120 mm high, 32 mm thick, weight 0.2 kg
Antenna	RPTNC Connector, 50 Ohm Impedance. 2.5 dBi flexible omnidirectional antenna included.
Warranty	1 Year Parts & Labor, XTRa-Care Extended Warranty 2 Year Extension available at nominal cost
Certification	FCC, IC certified, C1D2 certification pending

## Radio Status Information

The Login or Admin pages of the radio's built-in web browser interface provide many useful pieces of information that let you know how well the wireless link is working:

Top of Web Page	
Version	Current version of the radio's Ethernet interface.
MAC Address	Radio's hardware MAC Address.
Ethernet	Status of Ethernet connection: 10 Mbps or 100 Mbps, full or half duplex, connected or disconnected.
Uptime	Total time radio has been active since last power cycle or hardware reset.
Device Information	
Device Type	Access Point (master) or Subscriber Unit (client)
# of Subscriber Units	For Access Point only, up to 4 permitted.
Subscriber ID	For Subscriber Unit only, the ID selected for this radio.
Current TX Power	The output power from 0dBm to 30dBm
RF Status	Connected or Searching
Product	900fs
Radio Firmware Version	32
Radio Firmware Build	519
Radio Address	XX.XX.XX (ex. 00.17.5d)
Statistics	
Radio RSSI	Received Signal Strength Indicator. The radios operate best with this value between -30 and -95 dBm
Radio Total Packets	# of Ethernet packets received since last reset.
Radio Failed Packets	# of packets unsuccessfully transmitted.
Radio Passed Packets	# of packets successfully transmitted.
Radio Broadcast Packets	Traffic simultaneously addressed to all devices on the network.
Radio Unicast Packets	Traffic sent to a single destination.
Radio Average TX Size	Average bytes per packet transmitted.
Radio Average RX Size	Average bytes per packet received.

## Antenna Alignment Guide

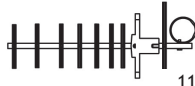
Please be sure to consider the following when installing antennae from AvaLAN:

Vertical polarization for directional antennas

Omni-antenna

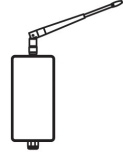


Figure 1

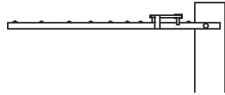


11 dBi antenna

WRONG!



Horizontal polarization for directional antennas



RIGHT



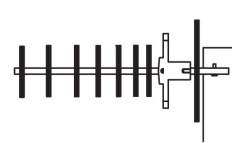
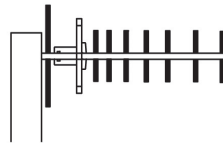
Figure 2



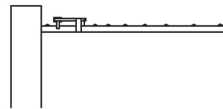
WRONG!

Do **not** aim the 2.5 dBi antenna directly at each other.

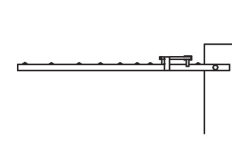
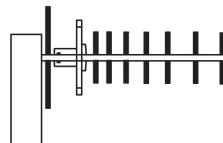
RIGHT



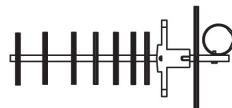
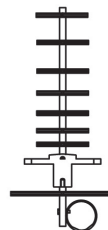
RIGHT



WRONG!



WRONG!



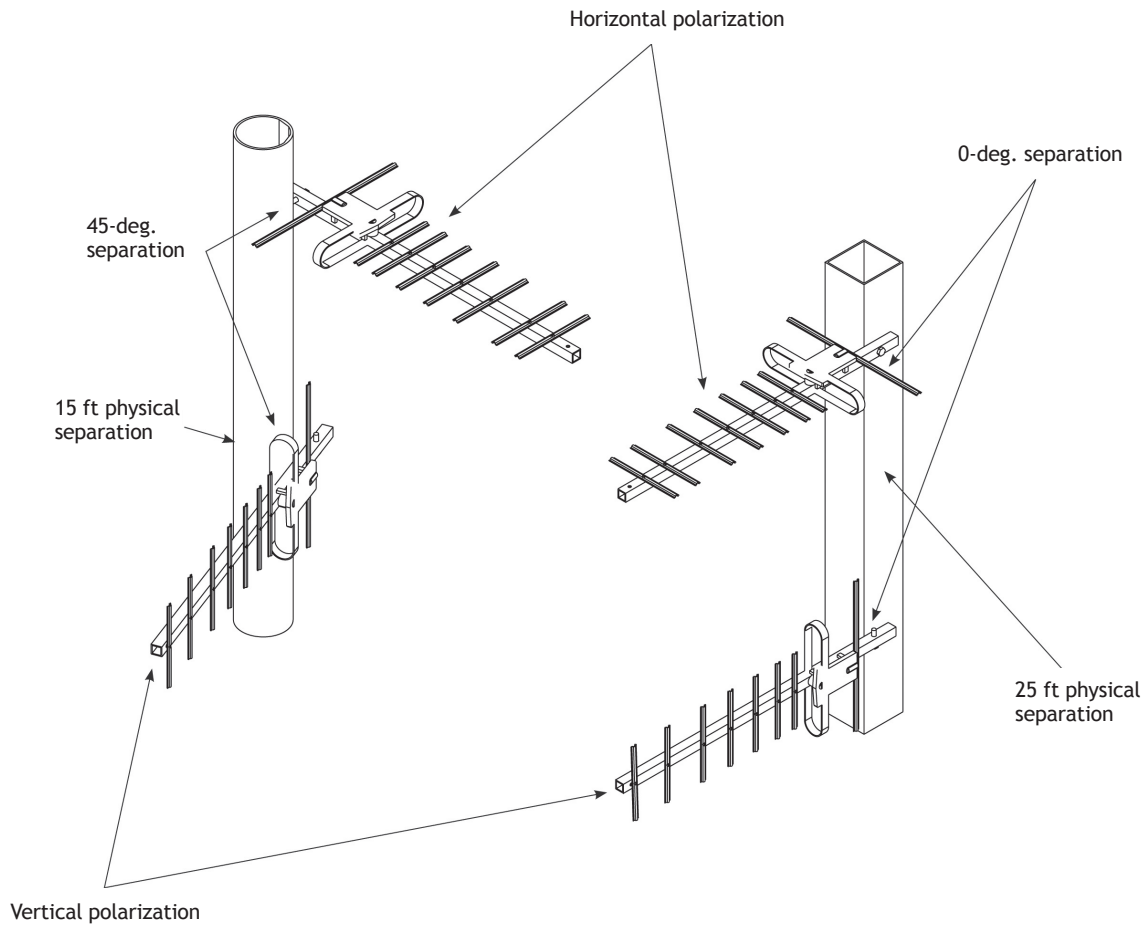
RIGHT



RIGHT



**ATTENTION:** When multiple antennas defined as Access Points are installed in one area and face the same direction, antennas should be spaced a minimum of 25 feet apart. When multiple antennas are installed in one area and face different directions, antennas should be spaced a minimum of 15 feet apart.



## Transmitter to Reciever Placement

If radios are installed either indoors or outdoors at distances closer than recommended, antennas can overpower each other and cause undesired effects. If testing radios within one or two feet, remove both antennas. The radios will still be able to signal each other at close distances. This applies to both indoor and outdoor units.

ANTENNA	RANGE	
	Maximum line-of-sight *	Maximum non-line-of-sight
AW2-900	2 miles	6 walls / 450 ft
AW3x-900	2 miles	6 walls / 450 ft
AW5-900	3.5 miles	7 walls / 500 ft
AW10-900	20 miles	1,500 feet w/ trees
AW11-900	25 miles	1,750 feet w/ trees
AW15-900	60 miles	2,000 feet w/ trees

## Abbreviation Guide

AP: Access Point  
SU: Subscriber Unit  
RF: Radio Frequency  
RX: Recieve  
TX: Transmit  
LCD: Liquid-Crystal Display  
ECD: Ethernet Client Device  
RP: Reversed Polarity  
TNC: RF Connector  
IP: Internet Protocol