USER'S MANUAL ADDENDUM
Matched Pair Bridges

Certain AvaLAN radios are sold as matched pairs, pre-configured as a wireless Ethernet bridge. The manual supplied with the pair does not include information about the pair configuration, hence this addendum.

This addendum applies to these products:

AW900xTR-PAIR	AW2400xTR-PAIR	AW5802xTR-PAIR
AW900iTR-PAIR	AW2400iTR-PAIR	
AW900xTP-PAIR	AW2400xTP-PAIR	AW5802xTP-PAIR
AW900S-PAIR	AW2400S-PAIR	

The pair configuration as shipped from the factory consists of these features:

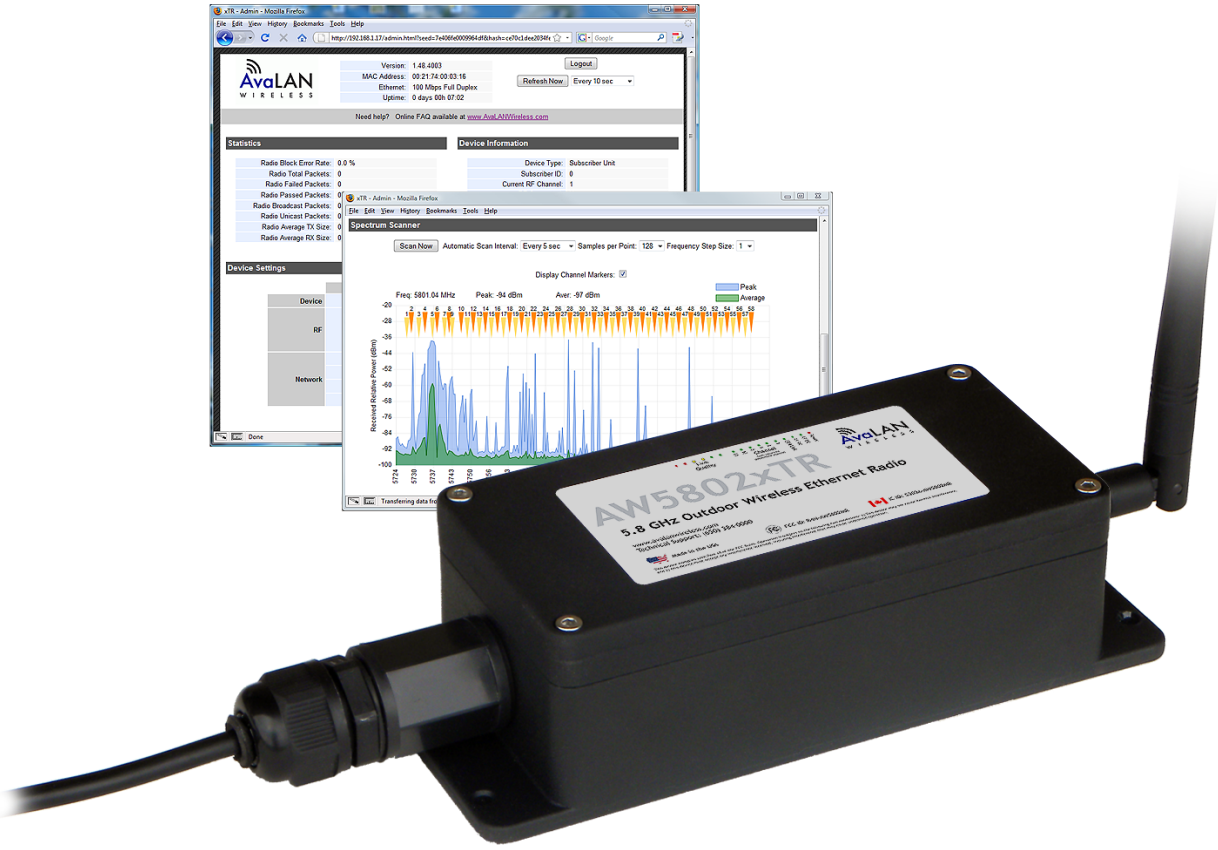
1. One unit of the pair is configured as an Access Point and the other is configured as a Subscriber Unit.
2. The Access Point is given the IP Address 192.168.17.17.
3. The Subscriber Unit is given the IP Address 192.168.17.18.
4. User-specified encryption keys are disabled and the two radios are keyed to each other using the "Auto-Key" method. Note: For the AWxxxS-PAIR FIPS 140-2 radios, follow the instructions in the High Security Supplement to program the security features.
5. RF Channel selection is set to automatic mode.

If these configuration parameters work for you in your system, you need only to connect antennas, power and LAN and the pair should work transparently, looking just like an Ethernet cable.

If you need to change any of the pair's parameters, you may use the browser interface as described in the accompanying manual. You might need to do this if you need to set the pair to a particular channel, or you wish to provide your own encryption keys. If the default IP Addresses won't work in your system, the best way to change them is by using the ipfinder utility described in the manual and downloadable from www.avalanwireless.com.

In case of difficulty, you may find additional help under the Support tab on our website or by contacting AvaLAN Technical Support using the information in the manual.

Revision 02.05.2013



AW5802xTR

USER'S MANUAL

5.8 GHz Outdoor Wireless Ethernet Radio

Industrial-grade, long-range wireless Ethernet systems

AvaLAN WIRELESS

Thank you for your purchase of the AW5802xTR 5.8 GHz Outdoor Wireless Ethernet Radio. This unit is intended for use with other AW5802 Family products to form point-to-point or point-to-multipoint wireless Ethernet systems. It is not compatible with AvaLAN's older AW5800 Family or the high speed AW58100 Family.

The AW5802xTR includes:

- (1) AW5802xTR Radio
- (1) AW5-5800 Omnidirectional Antenna
- (1) 120 VAC to 12 VDC power adapter
- (1) AW-POE Power Over Ethernet Injector

Table of Contents

If you have any questions when configuring your AvaLAN system, the best place to get answers is to visit www.avalanwireless.com. You will also find the latest documentation and firmware updates there. If more assistance is needed, send email to support@avalanwireless.com.

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

Revision 02.05.2013

125A Castle Drive
Madison, AL 35758

Sales: (866) 533-6216
Technical Support: (650) 384-0000
Customer Service: (650) 641-3011
Fax: (650) 249-3591

Quick Start Guide

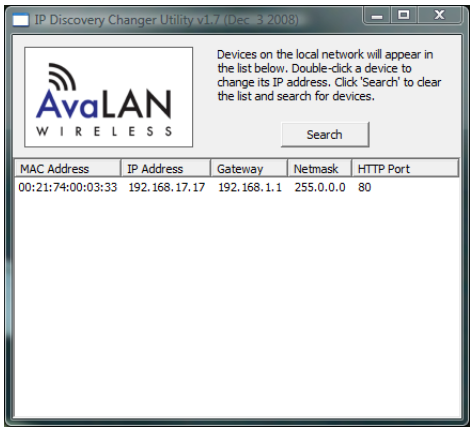
To create a wireless link, you need one AW5802xTR configured as a master (Access Point) and one or more AW5802xTR radios configured as clients (Subscriber Units). We recommend connecting and powering up the units on the bench before deploying in the field because it is much easier to troubleshoot problems and to adjust the configuration if necessary without having to climb poles to do it. Activate the AW5802xTR units one at a time until they can be given distinct IP addresses.

Step 1. Gather the parts: In addition to the AvaLAN radios, the accompanying AW-POE Power Over Ethernet Injectors and 12 VDC Power Adapters, you will need a CAT5 cable and a PC with a LAN connection.

Step 2. Make the connections: Connect a radio to the PC as shown in the diagram. Plug in the power supply to turn on the radio.

Step 3. The default IP address of the radio is written on its product label. This default address is usually 192.168.17.17. The default login password is "password." You must configure your PC's wired LAN port to the same subnet and an IP address different from this one. With this configuration in place, you should be able to use a web browser on your PC to log in to the radio's interface.

Step 4. If you are not able to change your PC's LAN configuration (usually because of an incompatible subnet), another method is available to change the radio's IP address to something your PC can browse to. Download the AvaLAN IP Finder Utility from our website: http://avalanwireless.com/marketing_resources/downloads/ipfinder.zip. Unzip to a folder of your choice and run ipfinder.exe (a stand alone executable). You should see a window similar to that shown on the next page:

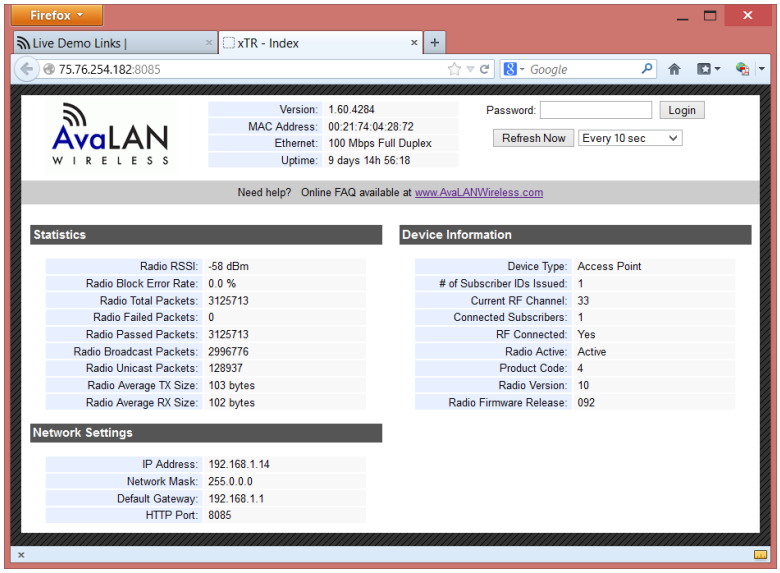


The AW5802xTR should appear in the list, showing you its MAC Address, IP Address, etc. If it does not, click "Search" to regenerate the list. If it still does not appear, you have a connection issue and need to re-examine the cabling. If it does appear in the list and you wish to change the IP Address, double click the radio's line in the list and a second screen will appear that allows you to change the address, subnet mask and gateway.

Step 5. Using your favorite web browser on the PC, browse to the IP Address of the radio:

http://192.168.17.17 [or whatever IP Address has been configured]

This screen should appear:



Step 6. Repeat the above process for each of your AW5802 Family radios, making sure to give each one a unique IP address and making note of the addresses assigned. Once you have verified that all radios can be browsed to, proceed to the detailed configuration steps in this manual.

Operational summary

The AW5802xTR Radio allows the user to create a long-range, wireless Ethernet network with up to 16 subscriber units per access point. The configuration may include any combination of AW5802xTR, and AW5802xTP radios.

Configuring a wireless link with the AW5802xTR requires the establishment of seven 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 with it.
- The AP and all SUs must agree on which radio frequency channel they are using. This can be manually set or allowed to change automatically.
- Each 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 all SUs must share a common 8 digit hex Network Name.
- The AP and all SUs must share a common 32 digit hex encryption key.

AW5802xTR radios are configured by connecting to a computer that will run a web browser and setting parameters via their built-in browser interfaces. This browser interface also provides link quality statistics and a graphical spectrum scan to assist in setup and resolving connection problems.

The access point (AP) automatically scans for the best of the 59 available radio frequency channels, encrypts Ethernet data received from the network, and transmits it wirelessly to the correct subscriber unit (SU). The AP is constantly monitoring the radio link and can automatically change the channel if performance is degraded due to interference. If two AP units are very close to one another, they may interfere with each other if operating on adjacent frequency channels. Place them at least 10 feet apart or manually select non-adjacent channels for their operation. Also, the SU should be placed at least 10 feet from the AP while testing to avoid overloading the radio's receiver.

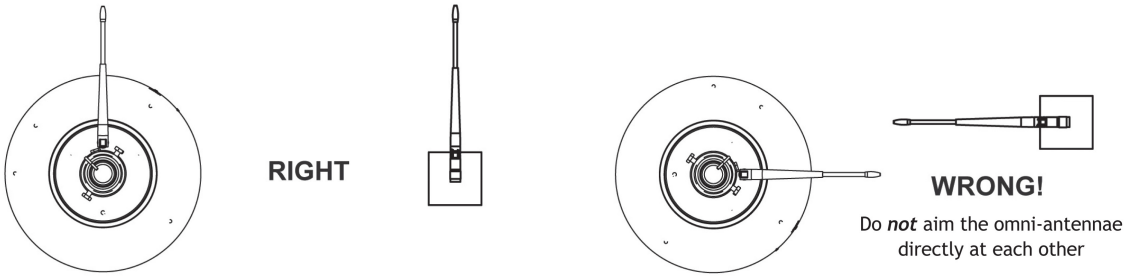
Any 10/100 BaseT Ethernet client device (ECD) can be connected to an AW5802xTR subscriber unit. Each SU encrypts Ethernet traffic received from the attached ECD and transmits the data wirelessly to its AP. Each SU can be plugged directly into an ECD without adding drivers or loading software. Essentially, once the AP/SU pair is configured and running it behaves like a continuous Ethernet cable.

The Ethernet packets that are transmitted over the wireless link are encrypted using FIPS 197 validated 128-bit AES. They are also provided with error correction to make sure that the information is received correctly. Each packet is divided into smaller sub blocks. This step improves overall data rate because an error in one sub block can be detected and corrected without needing to retransmit the entire packet. If an erroneous sub block is received, a retransmit is requested. For this re-transmitted sub block, Forward Error Correction is applied, adding enough redundant bits to the data to allow recovery of up to 3 bits in every 16. This FEC sub block is much larger and consequently takes longer to transmit but has a very high probability of being received correctly. Of course, if the interference is great enough, this robust error correction scheme will still fail. Retransmission of bad sub blocks will be attempted 3 times before reporting a packet failure.

Physical Setup

Step 1. Before mounting the radio in its final location, you may want to perform the digital configuration procedure described in the next section.

Step 2. Mount the AW5802xTR securely. Maximize lightning resistance by providing a strong DC ground connection to the metal housing. Connect the AW5802xTR's RPTNC RF connector to a suitable antenna. A simple omni-directional dipole unit (AW5-5800) is included. This antennas provides 5 dBi of gain in the plane perpendicular to its long axis. The antennas on linked units should be oriented parallel to each other and not pointed toward each other. (There is very little signal coming from the end of the antenna.)



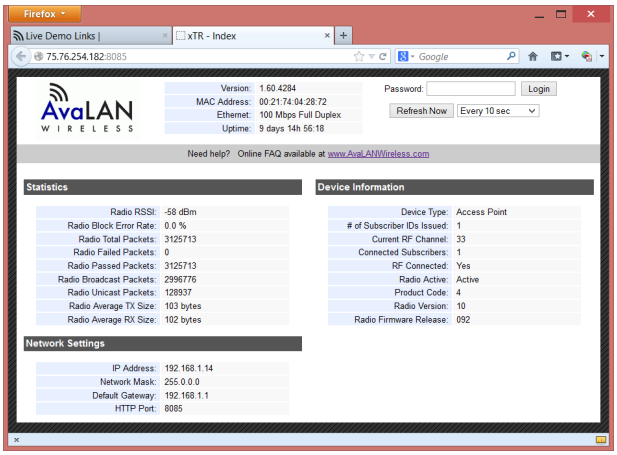
Step 3. Power is provided to the unit by means of the Ethernet cable, allowing the power supply to be located at a convenient location. The included power-over-Ethernet injector (POE) provides the means for adding DC power to unused wires in the cable. It is most convenient to plug the male RJ-45 connector of the POE directly into your LAN router or switch and the accompanying power supply into a 120 VAC outlet near by. The LAN cable to the radio plugs into the female RJ-45 jack and will carry DC power to it. The AW5802xTR is provided with a cable clamping device that allows an RJ45 plug on the cable to pass through it and can be tightened down around the cable to provide a weatherproof seal.

Note: For pole mounted applications, a mounting kit (AW-XPM) is orderable from our website.

Digital Configuration

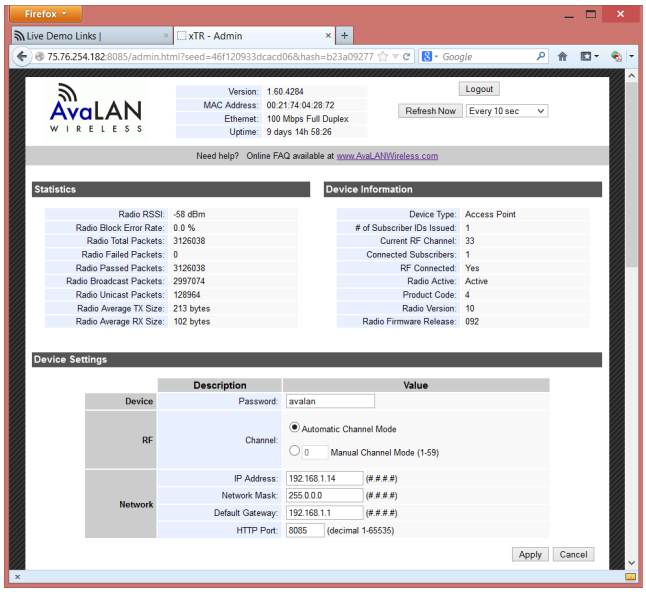
This section of the manual assumes that you have successfully powered up a radio and are able to browse to its IP address as discussed in the Quick Start Guide earlier.

Login: Browse to the radio you wish to designate as the master (Access Point) first. This login page should appear:



This initial page presents many useful pieces of information: operating statistics, current radio configuration and firmware version numbers.

The default login Password is "password". Enter it into the box in the top right corner of the login page and click "Login" to go to the Admin page. If you have changed the password and have forgotten what it is, the only way to recover is to remove the radio's cover, being very careful not to damage the water tight gasket. With the radio powered on, press the small white reset button on the PC board and hold it for at least 5 seconds. This resets the radio to the factory default IP address and password.

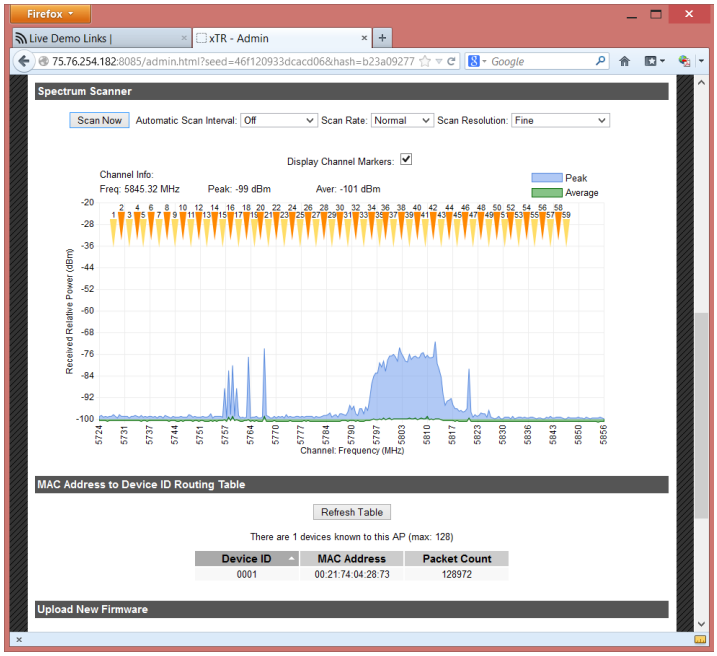


Admin Page Settings: The Admin page has Statistics and Device Information sections similar to the Login page plus the addition of several new sections.

Device Settings: Here you may change the Login Password, select the RF Channel to use (or enable Automatic Channel Mode) and modify the Network configuration.

RF Channel selection: In Automatic Channel Mode, the Access Point radio will choose a channel based on avoiding interference from other RF sources, changing it as necessary if block error rates rise. The Subscriber Units will search for and select the frequency channel used by the Access Point. If you have multiple AW5802 Family Access Points operating in the same vicinity or other known sources of interference, choose a channel manually. We recommend also setting the Subscriber Units paired with each Access Point to the same channel so that they won't have to hunt for it.

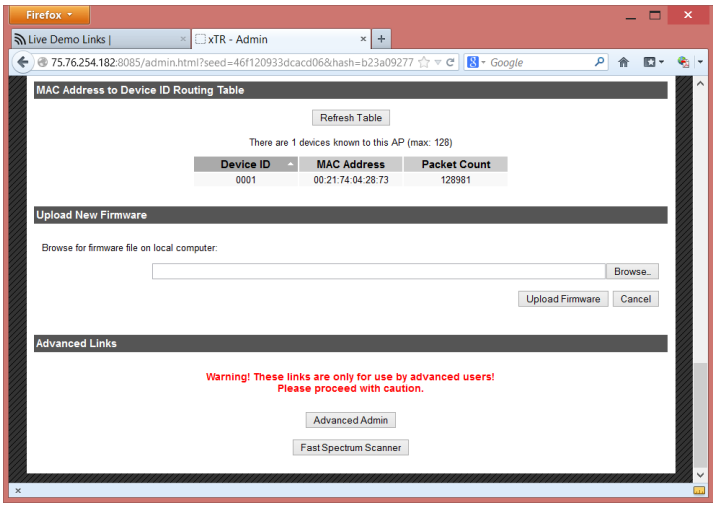
Spectrum Scanner: Scrolling down on the Admin page brings you to the Spectrum Scanner as shown here:



The Spectrum Scanner controls are self-explanatory. Executing a scan interrupts data flow, so you will normally want to turn automatic scanning off. Please note that this Spectrum Scanner works well with Internet Explorer and Firefox browsers, but may not work with Chrome or Safari due to browser javascript differences.

MAC Address Routing Table: Another section visible in this screen shot is the MAC Address to Device ID Routing Table. If radios are linked, this information allows you to determine exactly which devices are communicating through each Subscriber Unit's Device ID.

Scrolling down to the bottom of the Admin Page reveals two more sections as shown on the next page of this manual:

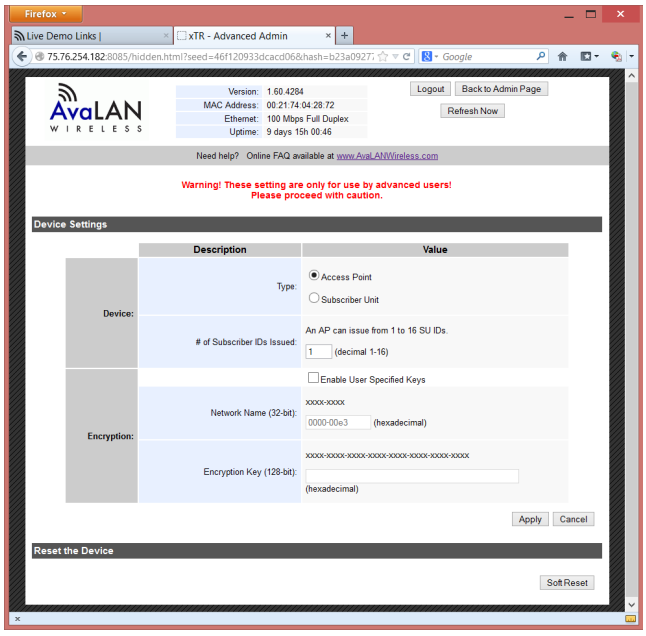


Upload New Firmware: From time to time, updates to the firmware are made available through our website at www.avalanwireless.com/downloads.

If needed, these may be downloaded to your PC and then installed in the AW5802xTR radio using this Upload New Firmware section of the Admin page. The firmware should be updated for every member of the linked set at the same time to keep them consistent. Please follow the readme instructions provided with the new download. Some older radios may need tech support help with the upgrade.

Advanced Links: In this section there are buttons to link to an Advanced Admin page and a Fast Spectrum Scanner page. The Fast Spectrum Scanner feature works very much like the one on the Admin Page but is more intrusive, being likely to seriously disrupt the network data flow when used.

Despite the dire warning, an essential step in the digital configuration process must be done on the Advanced Admin page. Click the Advanced Admin button to be taken there:

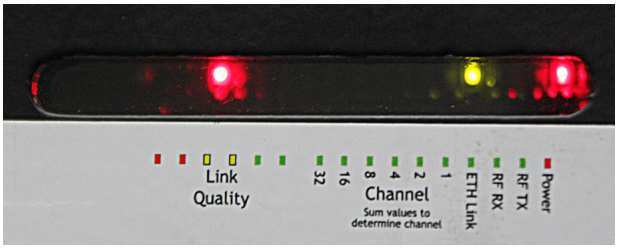


Advanced Admin Page Settings: On the Advanced Admin page, set the parameters as follows:

- Choose Device Type: Access Point or Subscriber Unit.
- For Subscriber Units, assign unique ID numbers in numeric order from 1 to 63.
- For an Access Point, enter the number of Subscriber Units that will be communicating with it.
- Click the box labeled "Enable User Specified Keys."
- Choose an 8-digit hex (0-9 and A-F) Network Name that will be common among the AP and its SUs and enter it. The hyphen is required.
- Choose a 32-digit hex encryption key and enter it. Again, the hyphens are required. This key must also match among all the radios in the set so make a note of it as well.

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

Linking All The Radios: 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. Browser management of the SUs can be performed over the wireless links. Note: avoid plugging actively linked radios into the same Ethernet 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.



Status LEDs: The top cover of each radio provides a window showing status lights with a legend on the product label:

If the radio does not have power, of course all LEDs will be off.

If the radio is powered up but the Eth Link LED is off, you do not have an Ethernet cable connection.

If the radio has not acquired a wireless link with a partner, the channel LEDs will scan in binary fashion looking for a signal. The left-most Link Quality LED will be on if the radio is the Access Point, but off if the radio is a Subscriber Unit.

If the radio has acquired sync and is operating normally, the RF Tx and RF Rx LEDs should be blinking, the Channel LEDs will indicate the RF Channel being used and the Link Quality LEDs will light based on the received signal strength. (The more of these that are lit, the stronger the signal). Either these LEDs or the Radio RSSI value in the Statistics section of the login page may be used for antenna aiming purposes.

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 IDs Issued	For Access Point only, up to 63 permitted.
Subscriber ID	For Subscriber Unit only, the ID selected for this radio.
Current RF Channel	The RF Channel in use. See table in this manual for center frequency.
Connected Subscribers	Access Point only, how many SUs are currently connected (16 maximum).
RF Connected	Yes or No
Radio Active	Active or Standby
Product Code	4 for multi-point radio
Radio Version	Specific radio module in use (AW5802 Family is 10)
Radio Firmware Release	Current version of radio module firmware.
Statistics	
Radio RSSI	Received Signal Strength Indicator. The radios operate best with this value between -30 and -70 dBm
Radio Block Error Rate	Should be less than 10% (check RSSI or spectrum scan if greater.) Higher values indicate degraded data rate, not necessarily lost data.
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.

Technical specifications

CHARACTERISTIC	SPECIFICATION/DESCRIPTION
RF transmission rate	1.536 Mbps
Ethernet throughput	935 Kbps
Receiver Sensitivity	-97 dBm at 10^{-4} BER
Radio link budget	150 dB when used with 22 dBi antennas
Range	30 miles line-of-sight with 22 dBi antenna
Operating Frequency Range	5.728125 GHz to 5.846909 GHz
RF channels/bandwidth	59 non-overlapping channels with 2.048 MHz spacing and 1.75 MHz bandwidth
Frequency selection	Automatic or manually selectable via web browser interface.
Connector types	RF: RPTNC Female / 10/100 base T Ethernet RJ-45
Status LEDs	Power, Ethernet link, RF TX, RF RX, Channel (6), Link Quality (6)
Error correction technique	Sub-block error detection and retransmission with Forward Error Correction
Power regulation	Built-in switching regulator
Browser management tools	QoS Statistics, Network Settings, Spectrum Analyzer, Firmware Upgrade
Power consumption	Transmit: 2.2 Watts Receive: 1.2 Watts
Voltage	9 to 48 VDC via unused pins in RJ-45 jack - pins 4,5 positive, 7,8 ground
Transmit current draw	180 mA at 12 VDC
Temperature range	-40° C to +70° C
Size	200 x 80 x 55 mm not including connectors; 0.570 Kg
Warranty	1 Year Parts & Labor, XTRa-Care Extended Warranty 2 Year Extension available at nominal cost
Compatibility	May be mixed in combination with AW5802xTR and AW5802xTP radios, not compatible with older 5800x, 5800i, 5800xTR, 5800iTR and also not compatible with the higher speed 58100 product family.

Frequency Channels

Channel	Center Frequency	Channel	Center Frequency	Channel	Center Frequency	Channel	Center Frequency
0	Auto Mode						
1	5728.125 MHz	16	5758.845 MHz	31	5789.565 MHz	46	5820.285 MHz
2	5730.173 MHz	17	5760.893 MHz	32	5791.613 MHz	47	5822.333 MHz
3	5732.221 MHz	18	5762.941 MHz	33	5793.661 MHz	48	5824.381 MHz
4	5734.269 MHz	19	5764.989 MHz	34	5795.709 MHz	49	5826.429 MHz
5	5736.317 MHz	20	5767.037 MHz	35	5797.757 MHz	50	5828.477 MHz
6	5738.365 MHz	21	5769.085 MHz	36	5799.805 MHz	51	5830.525 MHz
7	5740.413 MHz	22	5771.133 MHz	37	5801.853 MHz	52	5832.573 MHz
8	5742.461 MHz	23	5773.181 MHz	38	5803.901 MHz	53	5834.621 MHz
9	5744.509 MHz	24	5775.229 MHz	39	5805.949 MHz	54	5836.669 MHz
10	5746.557 MHz	25	5777.277 MHz	40	5807.997 MHz	55	5838.717 MHz
11	5748.605 MHz	26	5779.325 MHz	41	5810.045 MHz	56	5840.765 MHz
12	5750.653 MHz	27	5781.373 MHz	42	5812.093 MHz	57	5842.813 MHz
13	5752.701 MHz	28	5783.421 MHz	43	5814.141 MHz	58	5844.861 MHz
14	5754.749 MHz	29	5785.469 MHz	44	5816.189 MHz	59	5846.909 MHz
15	5756.797 MHz	30	5787.517 MHz	45	5818.237 MHz		

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.

If you wish, you may purchase extended warranty for this product. AvaLAN's XTRa-Care Extended Warranty provides a two-year extension plus free overnight (Continental USA only) product replacement. Visit our website for more details.

Regulatory Compliance

Compliance Statement (Part 15.19)
This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Warning (Part 15.21)
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

RF Exposure (OET Bulletin 65)
To comply with FCC RF exposure requirements for mobile transmitting devices, this transmitter should only be used or installed at locations where there is at least 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.