ATHN(V)205X-27
ATHN(V)401I-27

User Manual

Includes install, configuration and trouble shooting information for the broadband wireless access outdoor radio.

Version 1.0.1

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Technical Support

If you have difficulty resolving the problem while installing or using the wireless backhaul, Please contact the supplier for support.

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

FCC RF Radiation Exposure Statement:

1. The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
2. This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.
3. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

IMPORTANT NOTE: To comply with the FCC RF exposure compliance requirements, no change to the antenna or the device is permitted. Any change to the antenna or the device could result in the device exceeding the RF exposure requirements and void user's authority to operate the device.

FCC INFORMATION

The Federal Communication Commission Radio Frequency Interference Statement includes the following paragraph:

The 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 instruction, may cause harmful interference to radio communication. However, there is no grantee that interference will not occur in a particular installation. If this equipment dose 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.

The user should not modify or change this equipment without written approval from Yu Jya Technology. Modification could void authority to use this equipment.

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Conventions

This publication uses the following conventions to convey instructions and information:

This symbol means ***reader take note*.** Notes contain helpful suggestions or references to materials not contained in this manual.

This symbol means ***reader be careful*.** In this situation, you might do something that could result in equipment damage or loss of data.

This warning symbol means ***danger***. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

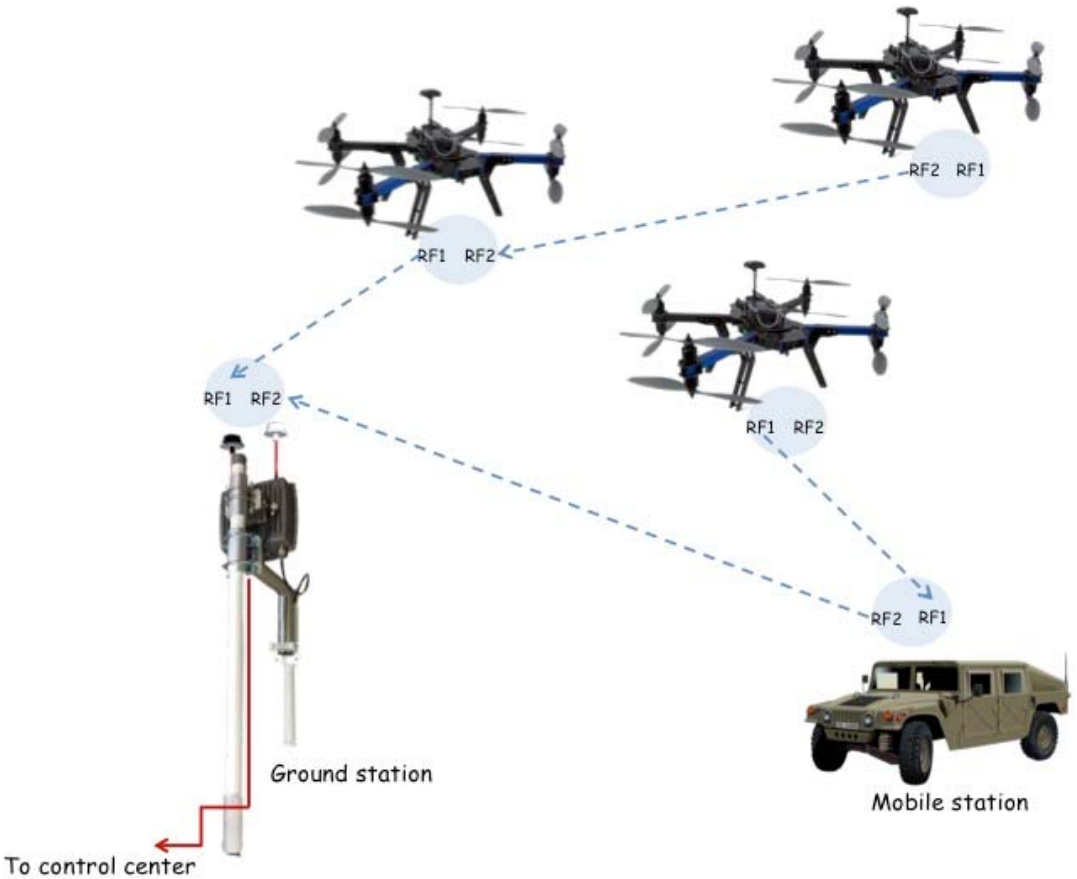
Chapter 1 Introduction

With MIMO High Throughput OFDM (HT-OFDM) and Dual Channels Mobile Mesh Network technology, this radio is a high capacity Mobile Mesh node for 5GHz ISM band wireless deployment as ground station.

There are 4 channel BWs (5/10/20/40 MHz) can be selected easily by software. This feature provides the flexibility of deployment channel plan in high density city area.

Compare to the traditional Single Channel Mesh Network, the Dual Channels Mobile Mesh Network design makes the Mesh Network working better and more efficiency because of below advantages.

1. Reduce the Co-channel interferences,
2. Better efficiency and throughput after multi-hops repeating.
3. Shorter latency for the Mesh Network.
4. More possibilities of the deployment plan with different antenna design for different applications and environments.



1-1 Features and Benefits

■ Integrated Multi-radios interfaces for Dual Channels Mobile Mesh

Multiple radios interfaces were integrated by “Fast Data Switching” technology inside the Radio, plus the unique dual channels mobile mesh algorithm to makes the whole network working perfect.

■ High efficiency transmission in multi-hops repeating

The backbone throughput will remain in a high level even after several hops repeating. (≧100 Mbps @ 10 hops), and the total latency is short as well (≦15 ms @ 10 hops)

■ Self-healing & self-forming Mesh Protocol

Automatic configuration and routing enables the mesh networks to be self-forming and self-healing. One or more fixed mesh nodes failed won’t affect the normal operation of the network. Customers can build the reliable networks anywhere in very short time by this intelligent radio.

■ Effective spectrum utility / variable capacities with 14 channel BWs

This radio has 4 channel bandwidths (5/10/20/40 MHz) for optional, which is adjustable via software. This function provides flexibilities of channel plan in crowded urban environment and variable capacities for different applications.

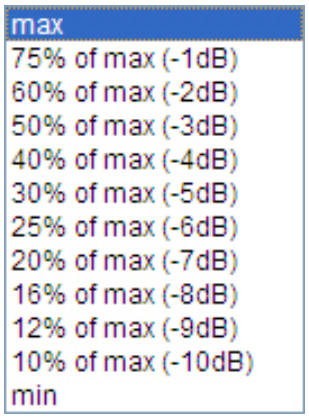
■ MIMO HT-OFDM technology provides amazing spectral efficiency

Up to 5.2 bits/s/Hz amazing spectral efficiency for all channel BW provided by the MIMO HT-OFDM technology. Work with the variable channel BW options, these two combination features provides great benefits for both crowded urban area and rural area with less interference.

Channel BW (MHz)	5	10	20	40
Real TCP throughput (Mbps)	25	51	104	215
Application area	Crowded urban		Rural	

■ FETURES

- This 5GHz dual 2x2 MIMO MESH Radio supports easy configurations and installation with high performance dual channels Mesh Network.
- Technique operating in the 5GHz ISM Band.
- Transmit Power Control :



Supports settable transmit power levels to adjust coverage cell size, ranging from max.(100%) to 10% of max., the adjustment step is 1dB.

- Provides Web-based configuration utility, user friendly interface.
- Support SNMP (Simple Network Management Protocol) for management.
- IP-68 rated weather-proof housing

Chapter 2 Hardware Installation

This chapter describes initial setup of the 5GHz dual 2x2 MIMO MESH Radio On Ground

Warnings

In order to comply with international radio frequency (RF) exposure limits, dish antennas should be laced at a minimum of 8.7 inches (22 cm) from the bodies of all persons. Other antennas should be laced a minimum of 7.9 inches (20 cm) from the bodies of all persons.

Do not work on the system or connect or disconnect cables during periods of lightning activity.

This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

Ultimate disposal of this product should be handled according to all national laws and regulations.

Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.:NFPA 70, National Electrical Code, Article 810, in Canada: Canadian Electrical Code, Section 54).

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

To meet regulatory restrictions, the radio and the external antenna must be professionally installed. The network administrator or other IT professional responsible for installing and configuring the unit is a suitable professional installer. Following installation, access to the unit should be password protected by the network administrator to maintain regulatory compliance.

The 5GHz dual 2x2 MIMO MESH Radio On Ground and POE injector can be damaged by incorrect power application. Read and carefully follow the installation instructions before connecing the system to its power source.

Follow the guidelines in this chapter to ensure correct operation and safe use of the 5GHz dual 2x2 MIMO MESH Radio On Ground.

2-1 Product Kit

Before installation, make sure that you the following items:

- **5GHz dual 2x2 MIMO MESH Radio**……x 1
- **Power over Ethernet**……x 1
- **Power Adapter**……x 1
- **Power Cord**……x 1
- **Water-proof connector for SFTP cable**……x 1
- **Mounting kit** ……x 1
- **Product CD**……x 1
- **Quick Installation Guide**……x 1

NOTE: If any of the above items are missing or damaged, please contact your local dealer for support.

System Requirements

2-2 System Requirements

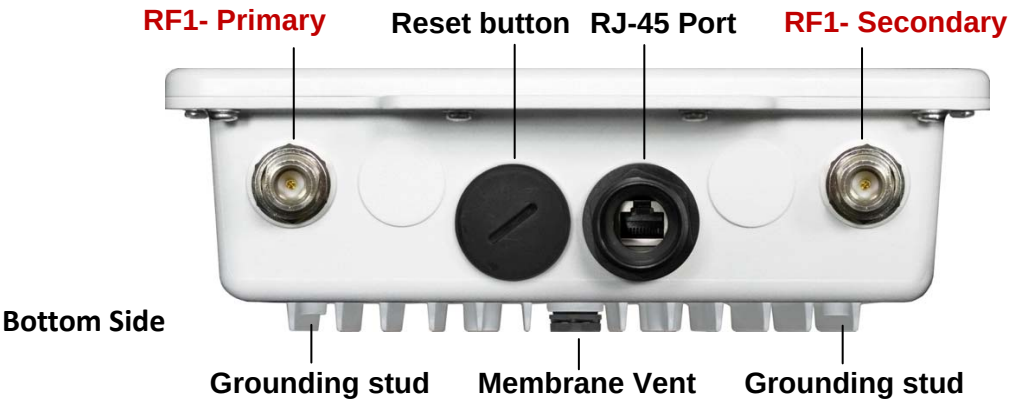
Before installing the long distance wireless backhaul, please make sure that these requirements have been met:

- A 10/100 Mbps Local Area Network device such as a hub or switch. (optional)
- Category 5 UTP or STP networking cable. (From the PC to POE)
- Category 5 SSTP or SFTP networking cable. (From the radio to POE)
- A Web browser for configuration: Google Chrome or Microsoft IE 9.0 or later.
- Installing TCP/IP protocol to the computer.

2-3 Mechanical Description

Please refer to the following table for the meaning of each feature.

ODU: (External antenna)



Outdoor Multi-function Radio Figure

Note:
1. RF1-Primary port connect to V. polarization of the MIMO antenna.
2. RF1-Secondary port connect to H. Polarization of the MIMO antenna.

1	**RJ-45 Port**	Use the SFTP cat.5 cable with weatherproof connector to connect to the "To ODU" side of the POE injector.
2	**N- Jack Antenna Connector**	Here you can attach the N-type external antenna to the dual 2x2 MIMO MESH On Ground. In order to improve the RF signal radiation of your antenna, proper antenna installation is necessary.
3	**Grounding stud**	Connect to the ground conductor with the ground wire.
4	**Reset button**	Revolve the plastic cap by coin, you will see the reset button. Press it and hold for 5~10 seconds, the radio will back to factory default settings.
5	**Membrane Vent**	1. Moisture vapor permeable to help aid in condensation and fogging reduction in the ODU. 2. High airflow allows pressure equalization to prevent stress on enclosure seals

Note: screw the cap back well after you use the reset button or beeper.

This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

Antenna location definition:

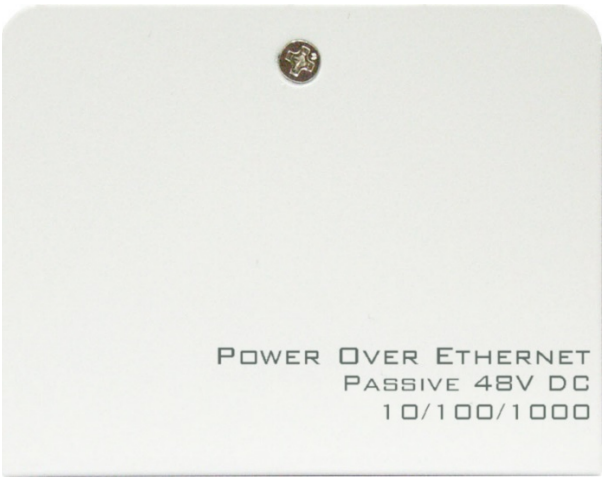
ATHN4000 Series

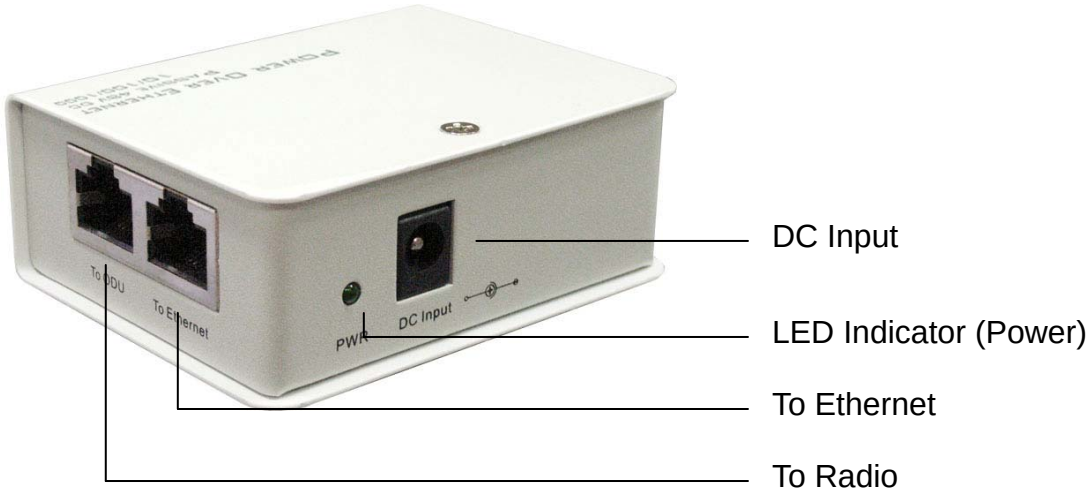
※ **Note:**

1. **When you set the RF to 1x1 instead of 2x2 MIMO, only Primary port works.**
2. **RF1 = Wireless 1 / RF2 = Wireless 2 in the configuration page.**

ATHNV4000 Series

POE – 10 / 100 / 1000 with Passive 48V DC





Power Over Ethernet Injector Figure

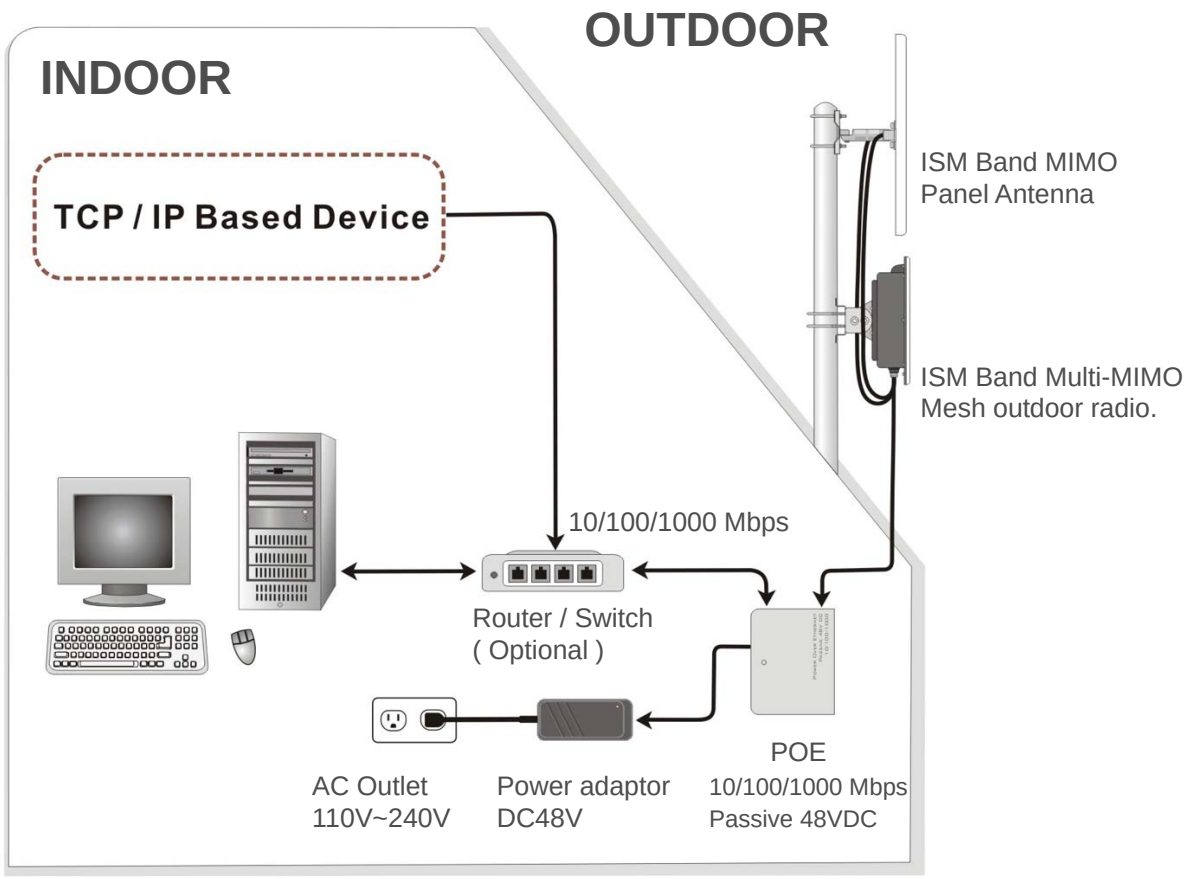
1	**To Ethernet**	This RJ-45 port is used to connect to the 10 / 100 / 1000 Base T complied device such as switch, router or PC.
2	**To ODU**	This RJ-45 port (10 / 100 / 1000) is used to connect to the ODU. .
3	**DC Input**	Connect to the Power adaptor for DC input. (Passive 48V DC)
4	**LED Indicator**	Power LED

Power Over Ethernet Injector is not a waterproof unit, should not be exposed to the outdoor without any protection.

2-4 Hardware Installation

The 5GHz dual 2x2 MIMO MESH Radio is a radio device, so it is susceptible to common causes of interference that can reduce throughput and range. Follow these basic guidelines to ensure the best possible performance:

- IF there is any other 5GHz RF device deployed around the outdoor radio, try to set the channel to the non-overlapping one.



Hardware Installation Figure

- Install the bridge at a height sufficient place where structures, trees, or hills do not obstruct radio signals to and from the unit. A clear line-of-sight path can guarantee the performance of the RF link.

■ Site Surveys

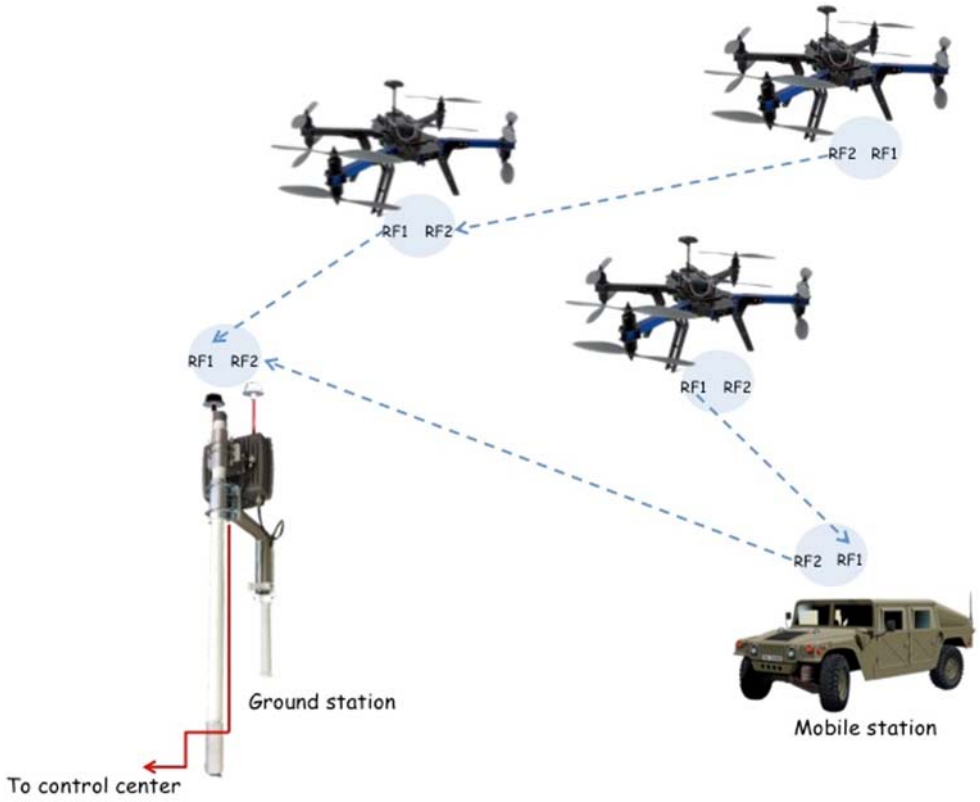
Clear and flat area provide better RF range and data rate, on the contrary, physical obstructions such as trees, electric tower, hills or buildings can reduce the performance of RF devices. Do not deploy your radios in the location where there is any obstacle between the antennas.

Configure and verify the 5GHz dual 2x2 MIMO MESH Radio operations first before you mount the radio in a remote location.

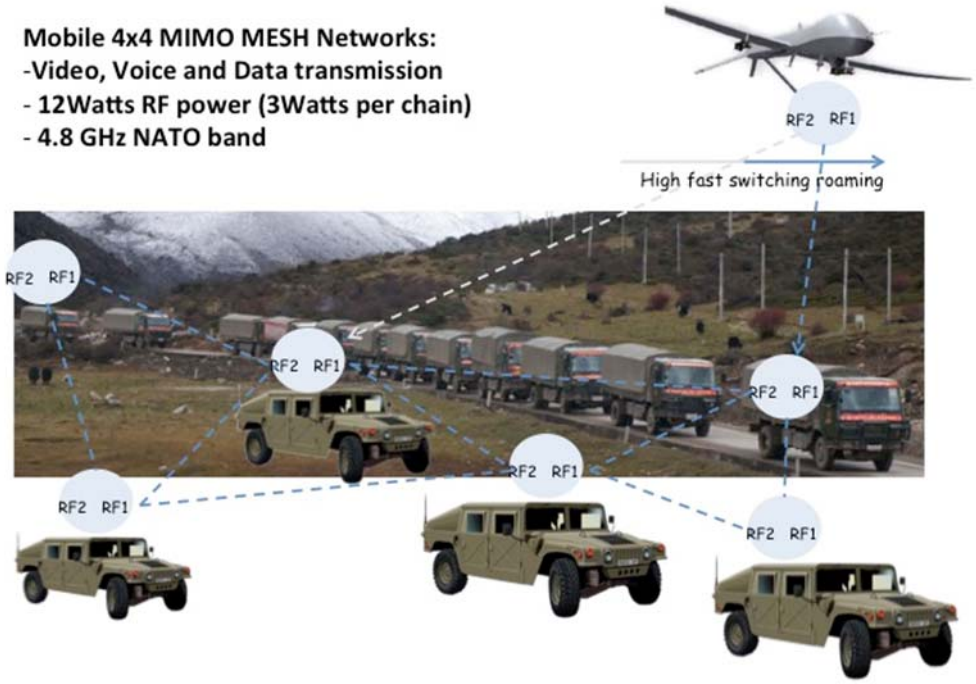
Power Over Ethernet Injector is not a waterproof unit, should not be exposed to outdoor without any protection.

■ Applications

1. With Ground Station



2. Without Ground Station

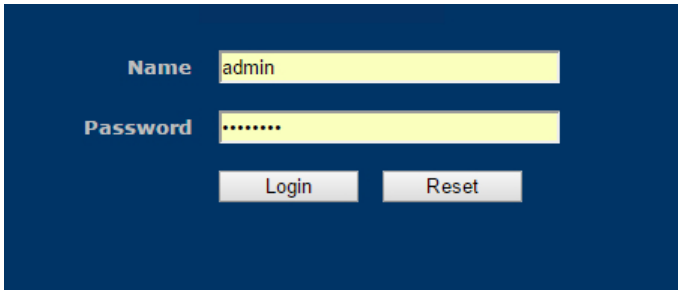


Chapter 3 Configuration

3-1 Start-up and Log in

In order to configure the long distance backhaul, use the web browser and please do the following:

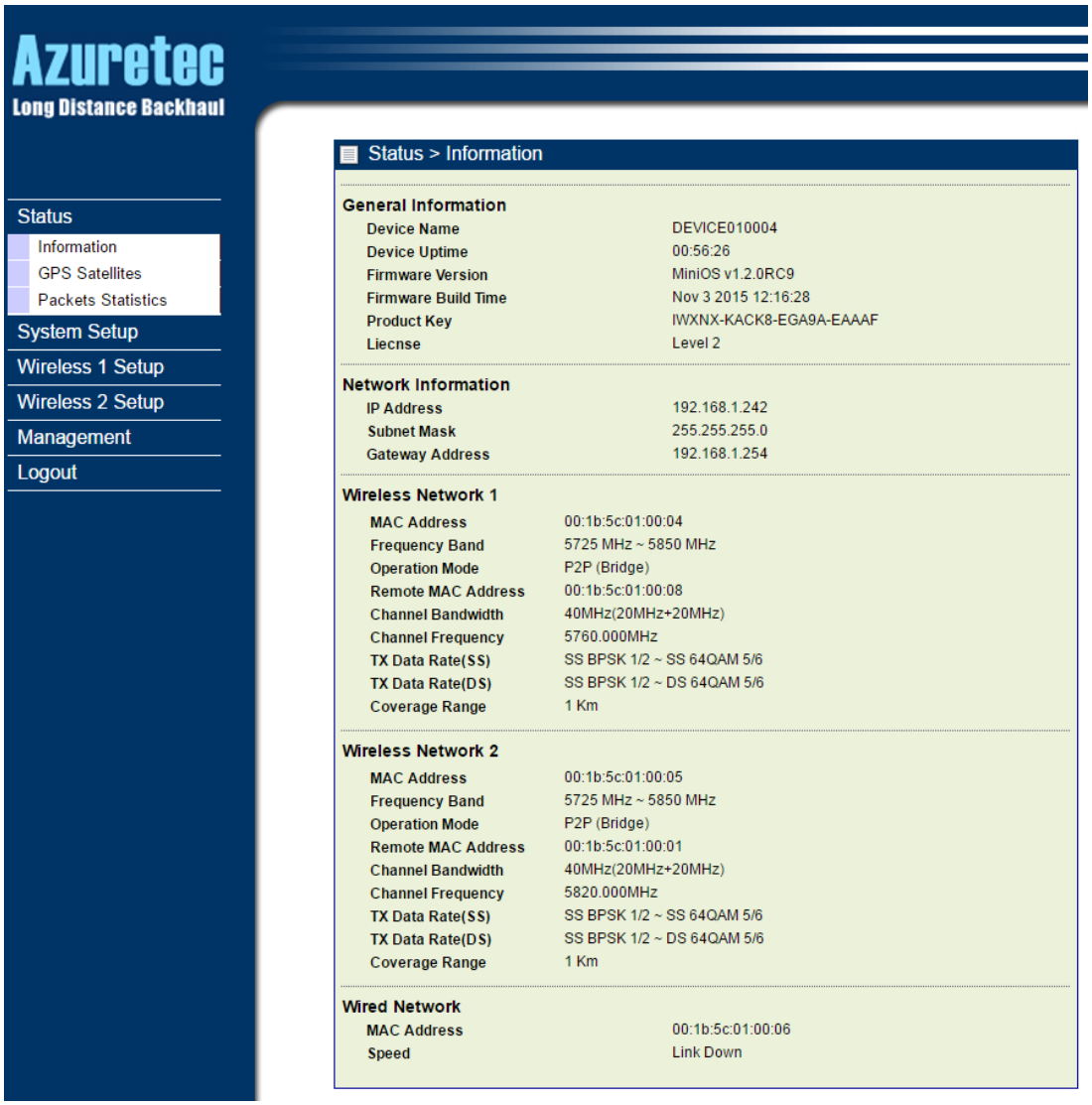
1. Type the IP address **http://192.168.1.1** of this radio in the Location (for IE) or Address field and press Enter.
2. Enter the system name (the default setting is **"admin"**) and password (the default setting is **"password"**).
3. Click on the **"Login"** button.



After you have logged-in the main page, the **About**, **Basic Setup**, **Wireless Setup, Status, Statistics, Management** and **Logout** buttons will be shown. The main menu provides links to the whole sections of the web configuration interface.

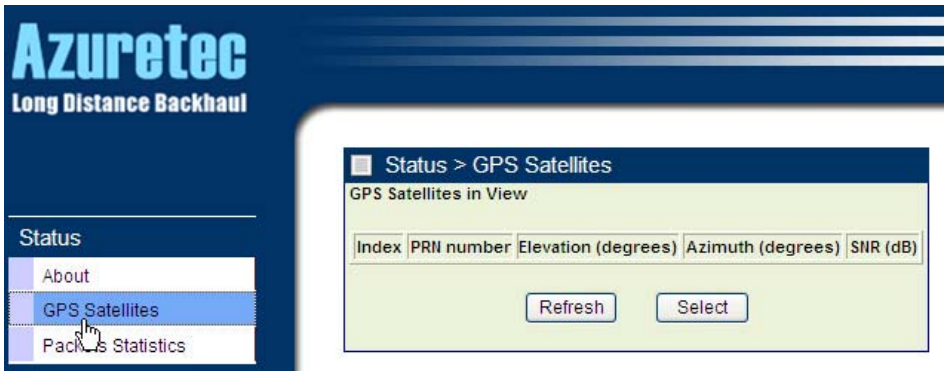
About

The About screen describes the product information briefly. Information of the radio includes **General information**, **Network Information, Wireless Network 1, Wireless Network 2** and **Wired Network information**.



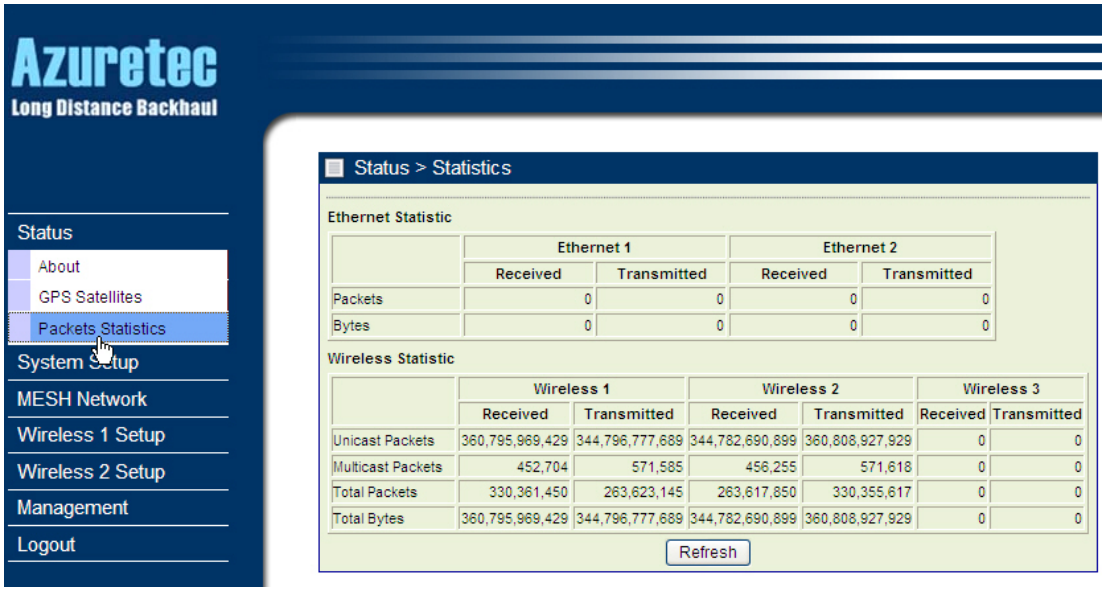
Status / GPS Satellites

Note available in this version.

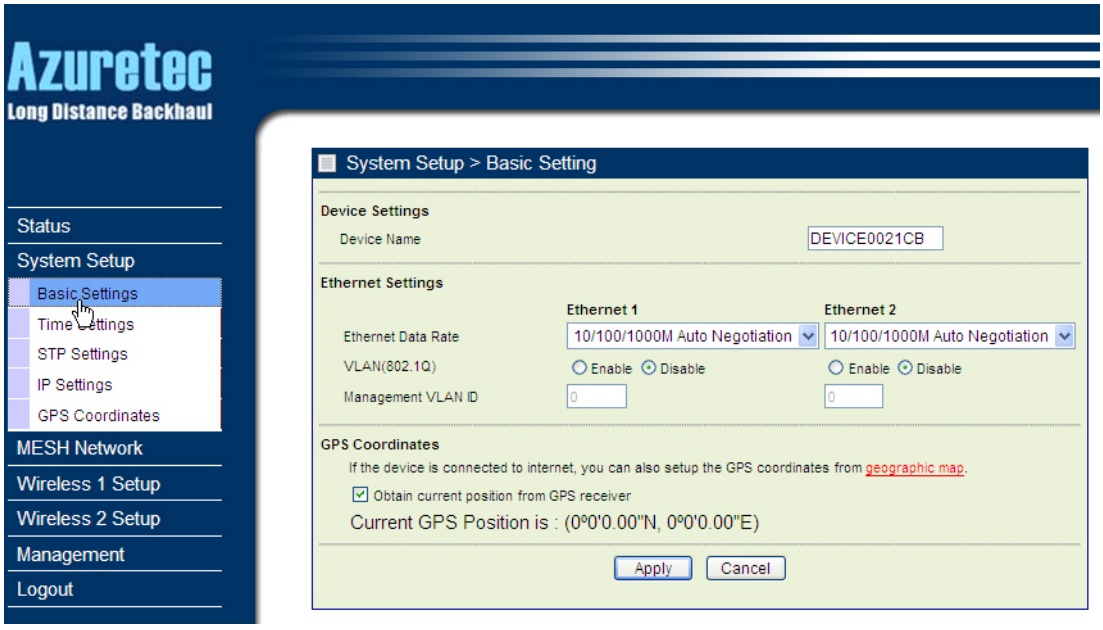


Status / Packets Satistics

The Statistics screen provides various Ethernet and Wireless TX / RX packet statistics. Click the **Refresh** button to update the statistics on this screen.



System Setup / Basic Setup



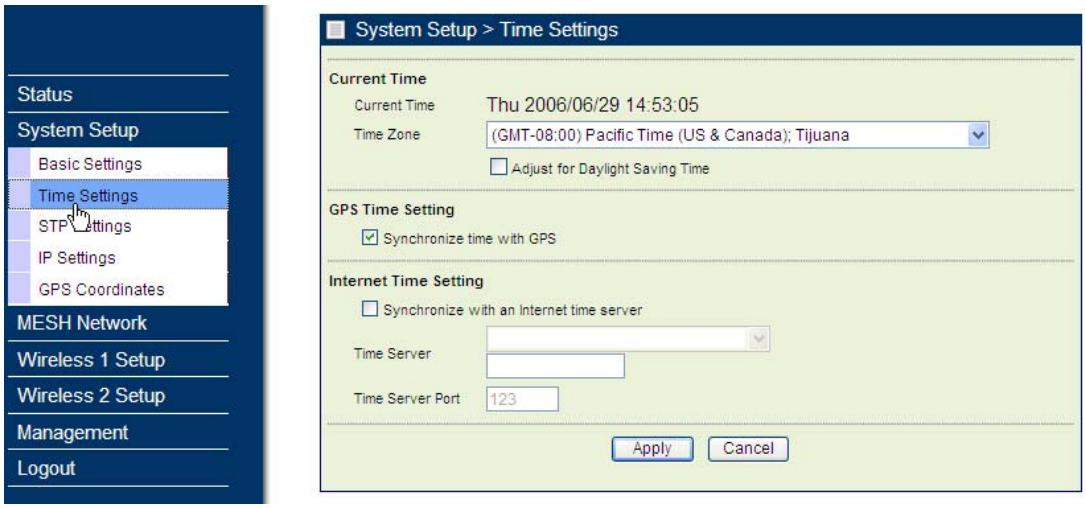
The **Device Name** is used to give a name to your 5GHz dual 2x2 MIMO MESH Radio This will enable you to manage your radio more easily if there is many radios in your network.

Ethernet Data Rate: you can choose the Ethernet data rate of this radio. This radio supports Ethernet 1 only.

VLAN (802.1Q): enable this feature and assign a management Vlan ID to the radio. Those PC without same Vlan ID will not be allowed to connect this radio and configure it.

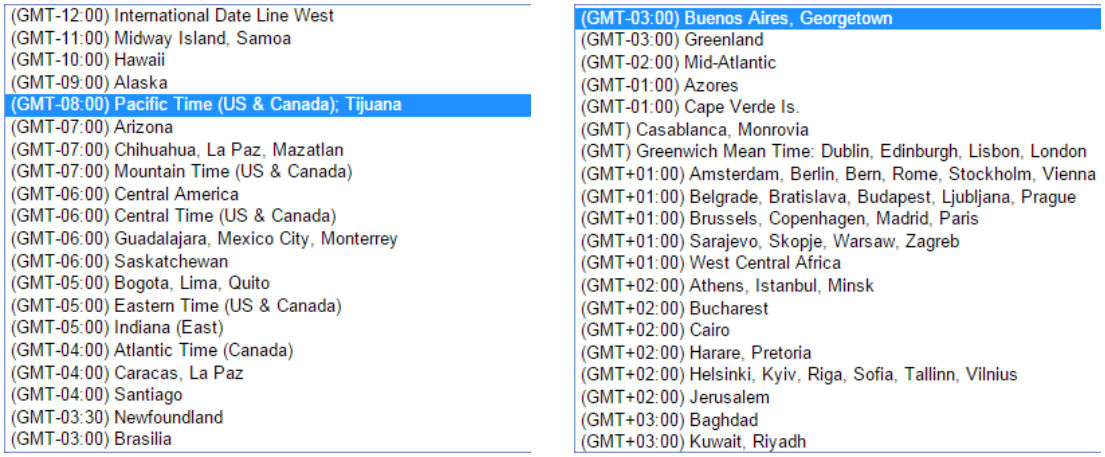
GPS Coordinates: Input the Latitude and Longitude info of the dual 2x2 MIMO Mesh radio's location, and click apply, radio will get the map from internet automatically. Click the geographic map link, you will see the map then.

System Setup / Time Setting



Current Time: While you connect this Wireless backhaul to Internet, it could automatically synchronize the current time with the Time Server that you have set.

Time Zone: You may select the appropriate local time zone for your radio from a list of all available time zones. Such as below list:

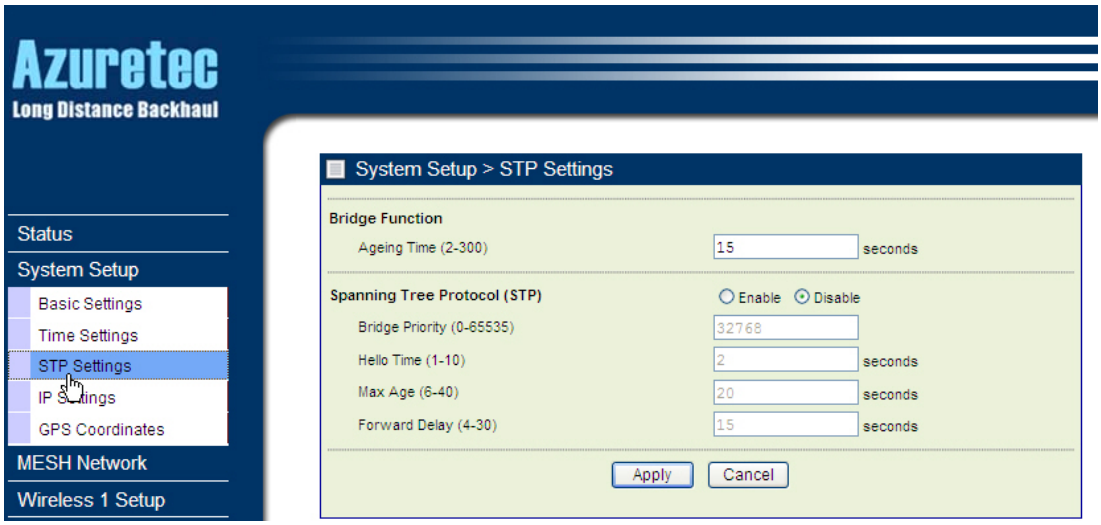


GPS time settings: Sync the time with GPS module.

Time Server: the central time of the Time Server.

Time Server Port: the port of the Time Server.

System Setup / STP Settings



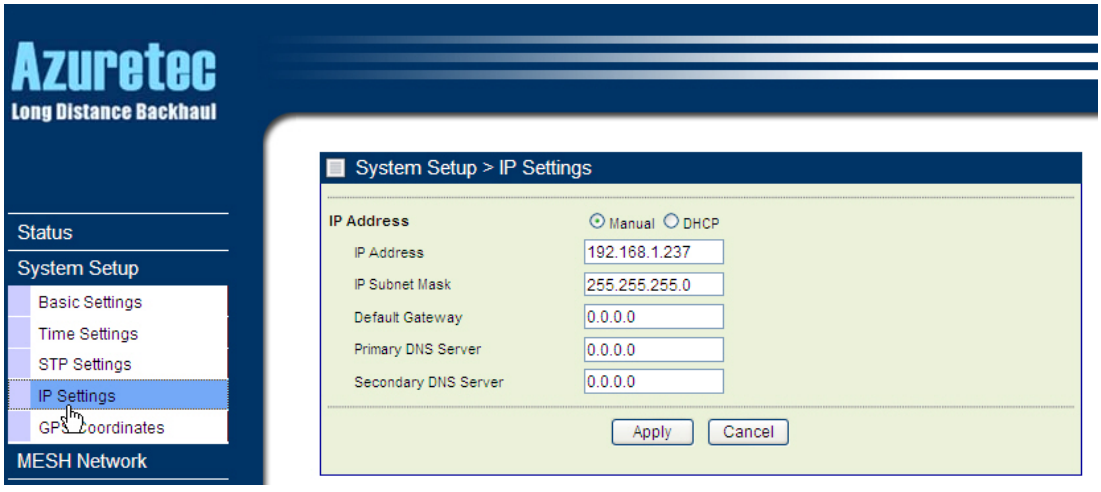
Ageing Time: Configure the length of time that a dynamic entry can remain in the bridge table from the time the entry is created or last updated.

Spanning tree protocol (STP): You may Enable or Disable the Spanning Tree Protocol used in this radio.

Bridge Priority	Specifies the bridge STP priority
Hello Time	Specifies the interval between the hello BPDUs
Max Age	Specifies the interval that the bridge waits to hear BPDUs from the spanning tree root
Forward Delay	Specifies a forward delay interval on the bridge

Note: If you complete the settings, please click on “Apply” for changes to take effect.

System Setup / TCP/IP Settings



IP Address: Type the IP address you want to set to your dual 2x2 MIMO MESH On Ground (Default: 192.168.1.1).

IP Subnet Mask: The Wireless backhaul’s Subnet Mask must be the same as your Ethernet network. We recommended that you do NOT change the value. (Default:

255.255.255.0).

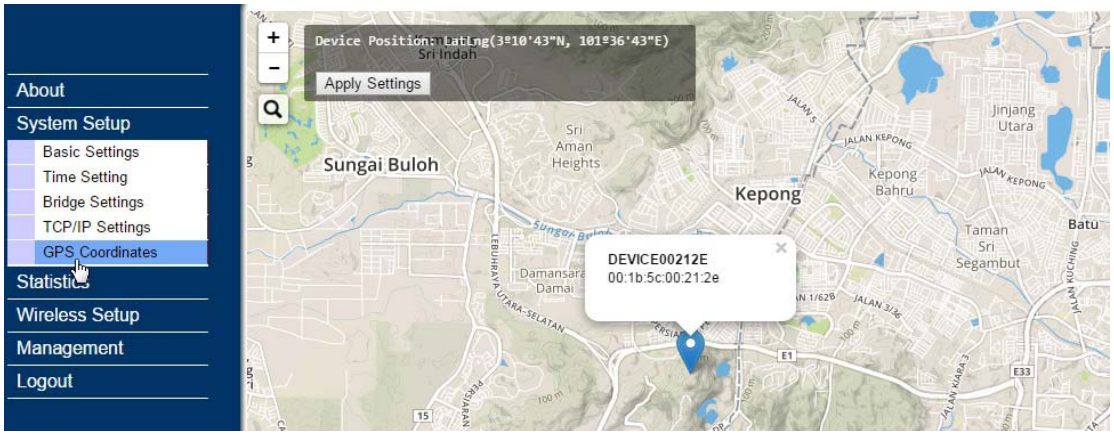
Default Gateway: The Wireless backhaul will use this value for default Gateway.

Primary DNS Server: The Wireless backhaul will use this value for primary Domain Name Server.

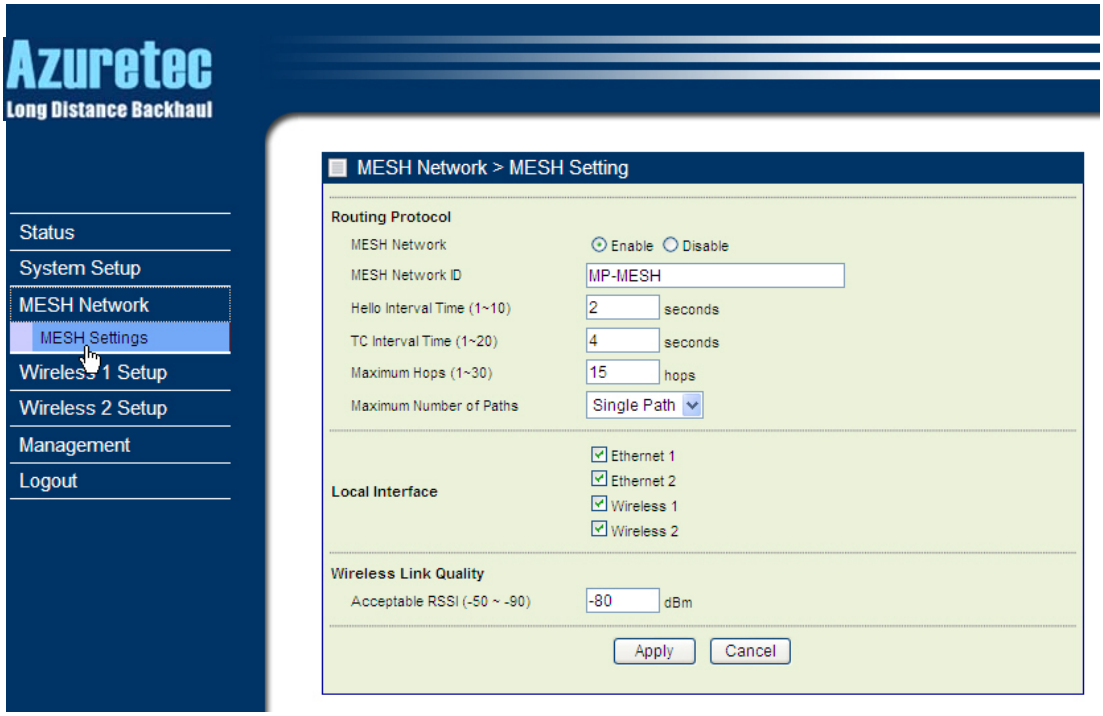
Secondary DNS Server: The Wireless backhaul will use this value for secondary Domain Name Server.

System Setup / TCP/IP Settings

In this page, you can press the blue mark on the map and move it to the location you want, then click the apply setting to decide the Device's Position.



3-2 Mesh Network



Routing Protocol: Define the parameters of the Mesh Routing protocol.

Mesh Network: Enable Mesh Network

Mesh Network ID: All mesh nodes in the same network must have the same ID.

Hello interval time (1~10s): Time between Hello packets sent by the router on this interface. This value should be same for all interfaces connected to common network. The default value is 2 seconds.

TC interval Time (1~20s): Topology Control message interval time. Topology control protocols are designed to exploit node density in the network to extend the network lifetime and provide connectivity. The following criteria have been identified as the key concepts for designing topology control protocols for wireless sensor networks.

1. Sensor nodes should be able to self-configure to accommodate changing network dynamics.
2. Selection of redundant nodes should be done based on distributed localized algorithms.
3. Topology control protocols must ensure minimum connectivity in the network, so that the network is not partitioned.
4. Topology control protocols should take advantage of the high node density in large-scale wireless sensor networks to reduce the energy dissipated in the network.

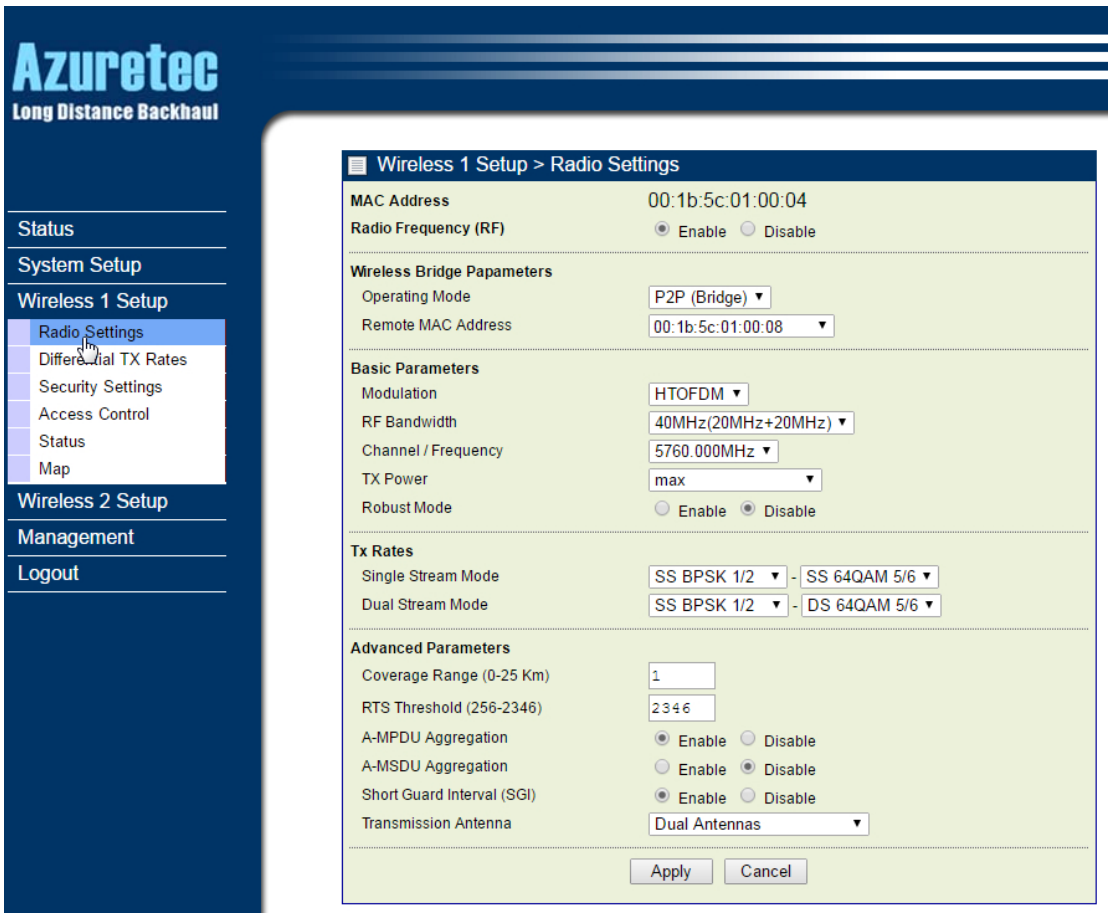
Maximum Hops (1~30): Define the max repeating hops in the mesh network.

Maximum Number of Paths: Define the max. path number of the mesh links between neighboring mesh points.

Acceptable RSSI (-50~-90dBm): This RSSI threshold is an important reference parameter to decide to hold the link between the Mesh nodes or change to other better optional path.

3-3 Wireless Setup

Wireless Setup / Radio



Radio Frequency (RF): You can enable/disable the RF interface.

Operating Mode:

Base Station：The default mode is Base Station.

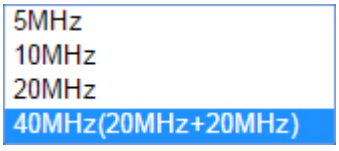
CPE：Perform as a client station associated to other APs. Be sure that they share the same SSID when connected.

MESH：Perform as a mesh node in the mesh network.

Wireless Network Name (SSID): Base station and CPEs in same network must have the same network name.

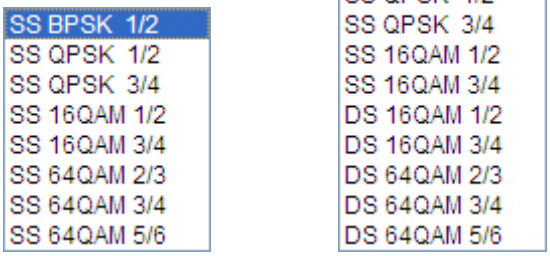
Modulation: HT-OFDM, high throughput OFDM modulation.

RF Bandwidth: Decide bandwidth of Radio Frequency. Including 5 / 10 / 20 / 40 MHz, default is 20MHz.

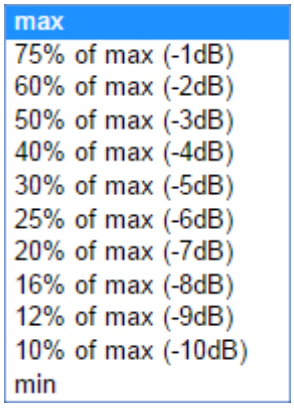


Channel / Frequency: Set the operation frequency of the radio.

TX Rate Range: Normally choice transmission rate as “Best”, system will adapt best rate for real environment.



TX Power: Setting power of TX, default is Max.



Coverage Range: The max. coverage range value will be changed by the channel BW, less channel BW can transmit longer distance. Set the proper coverage range parameters is helpful to get the stable link.

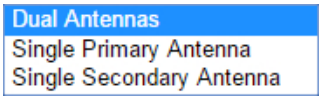
RTS Threshold: “Request to send” is the optional mechanism used by the 802.11 wireless networking protocol to reduce frame collisions introduced by the hidden node problem. Set the packet size to trigger RTS/CTS enable. This is normally set in base station side only because the hidden station problem does not exit from the perspective of the AP. RTS Threshold can be set between 256 - 2346 bytes.

A-MPDU Aggregation: Aggregate MAC Service Data Unit. The concept of A-MPDU aggregation is to join Multiple MPDU sub frames with a single leading PHY header. A key difference from A-MSDU aggregation is that A-MPDU functions after the MAC header encapsulation process. This method offer higher MAC throughput compare to A-MSDU.

A-MSDU Aggregation: Aggregate MAC Protocol Data Unit. The concept of A-MSDU is to allow multiple MSDUs to be sent to the same receiver concatenated in a single MPDU. This supporting function for A-MSDU within 802.11n is mandatory at the receiver. Due to Destination Address (DA) and sender Address (SA) in the sub-frame header must match to same receiver address (RA) and the transmitter address (TA) in the MAC header, A-MSDU cannot be used for broadcast & multicast.

Short Guard Interval (SGI): The guard interval is the space between symbols (characters) being transmitted. Adding time between symbol transmissions allows these echoes and reflections to settle in before the next symbol is transmitted. In normal 802.11 operations, the guard interval is 800ns. In good link condition without interferences, enable the short guard interval will short the time between symbol transmissions into 400ns to enhance the efficiency of data transmission.

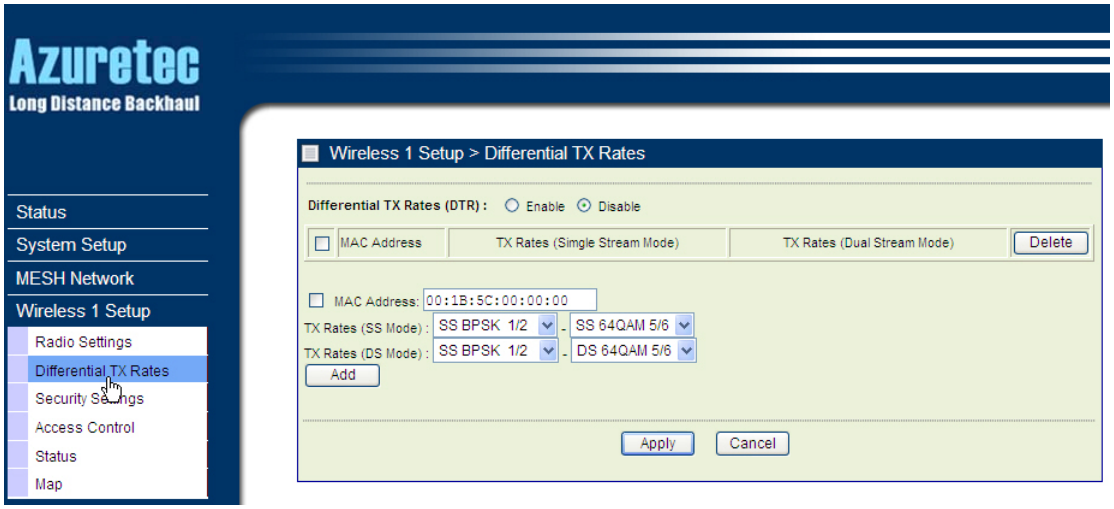
Transmission Antenna: There are 3 antenna options for selection



Receiving Antenna: Same as Transmission Antenna, there are 3 antenna options for selection too.

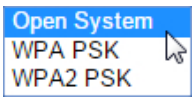
Wireless Setup / Differential Tx Rates

In this page, you can set the Differential Tx rates at fixed range.

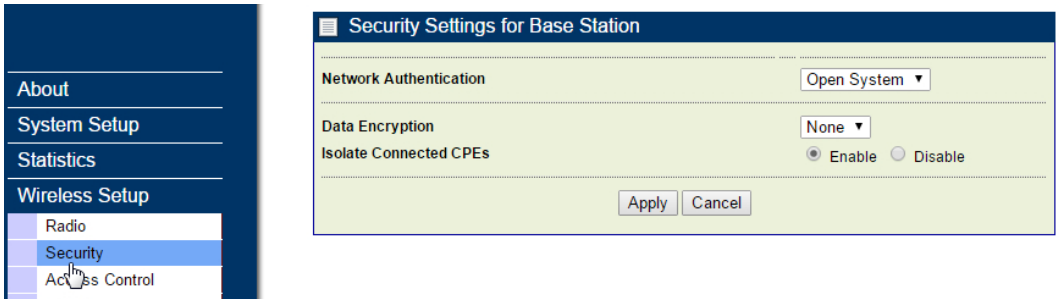


Wireless Setup / Security ***(This is NOT Available in Mesh mode)***

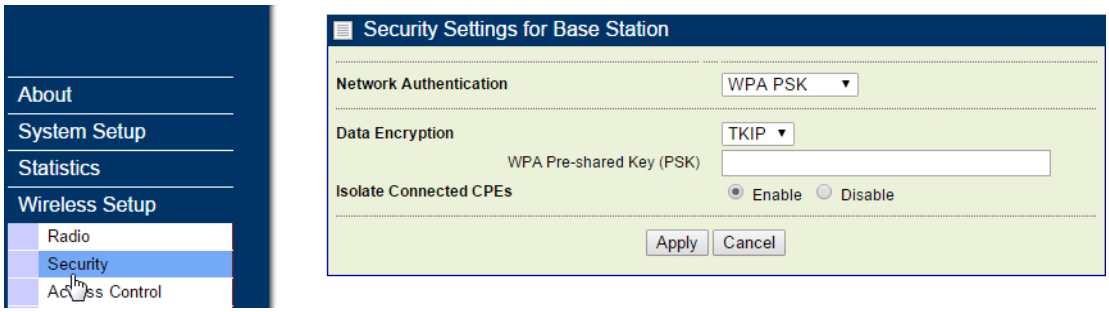
Security/Cipher To prevent unauthorized radios from accessing data transmitted over the link, the Encryption Settings window offers WPA / WPA2 PSK features, making your data transmission over air more secure and allows you to specify Encryption Key(s) if you enable encryption for the radio. There are three degrees of encryption could be selected:



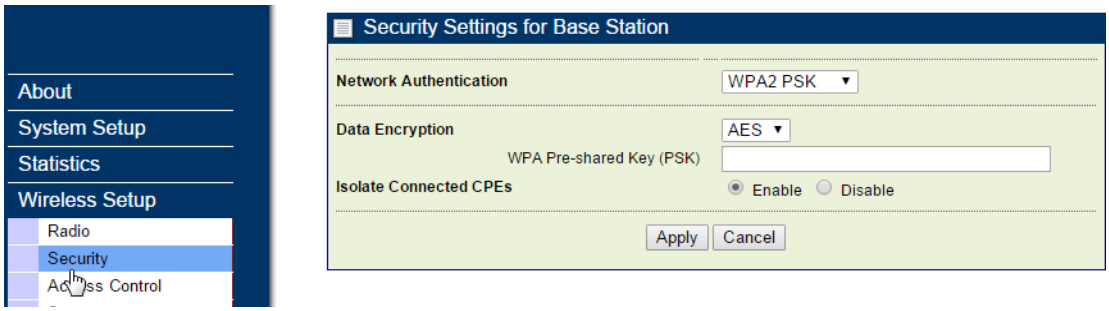
Open System – without encryption



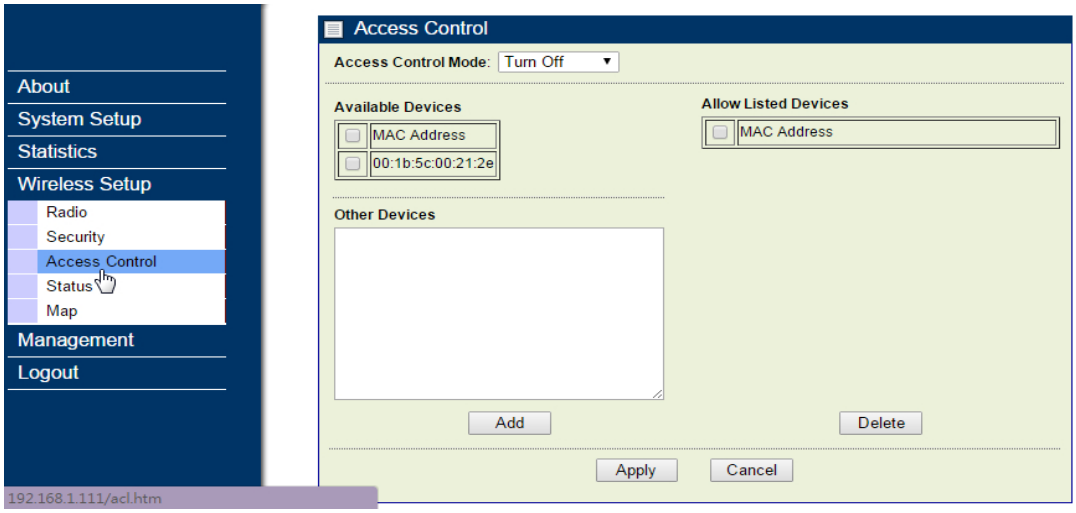
WPA PSK – TKIP encryption



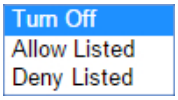
WPA2 PSK – AES encryption



Wireless Setup / Access control ***(This is NOT Available in Mesh mode)***

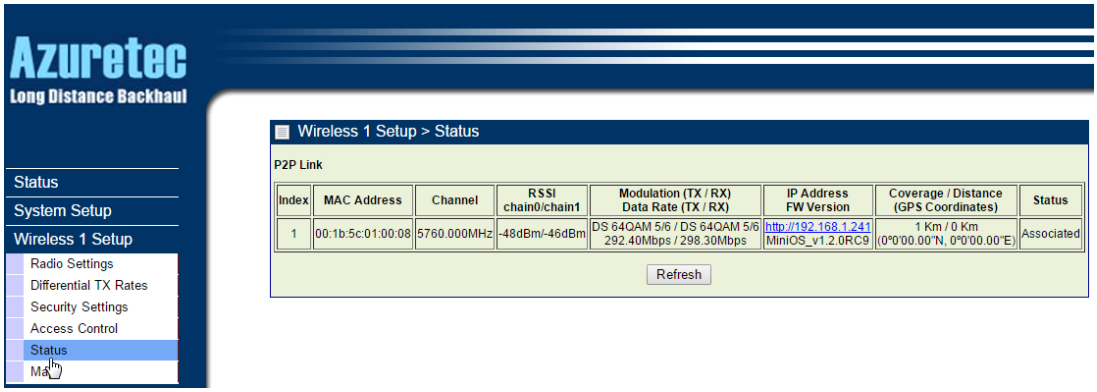


You can enable the MAC address Access control feature and decide which mode you want to control, Allow or Deny.



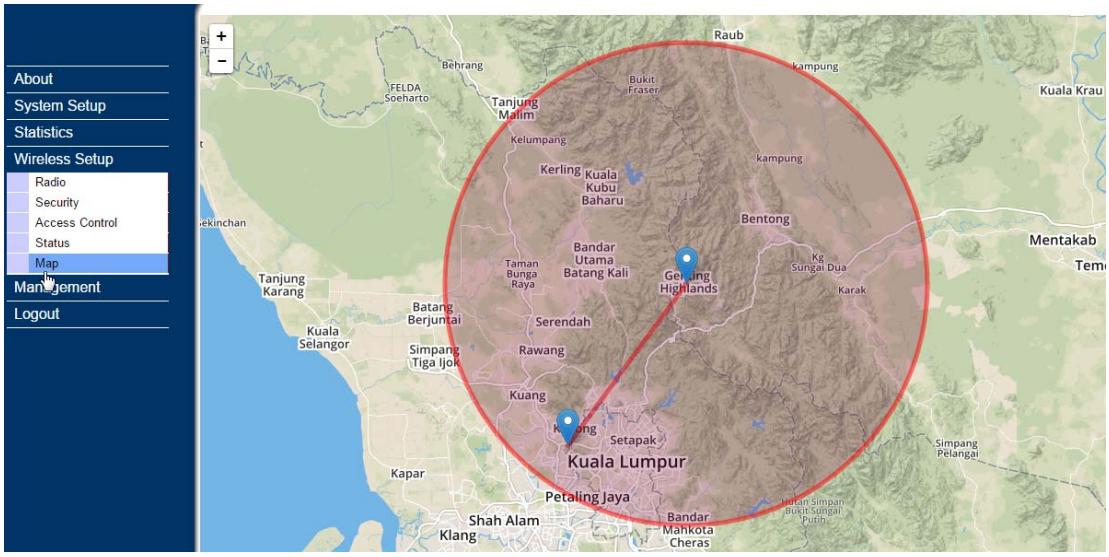
Wireless Setup / Status

The connections page provides below information: **MAC Address** (remote radio), **channel** (operating frequency), **RSSI (chain 0/chain 1)**, **Modulation** (TX/RX), **Data Rate** (TX/RX), **IP Address / FW version**, **Coverage/Distance** and **Status**.

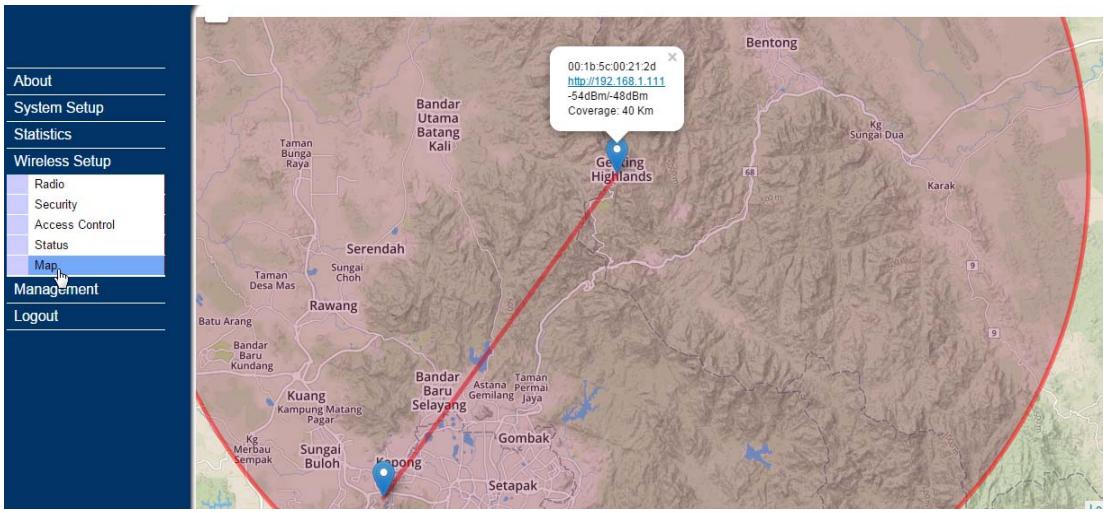


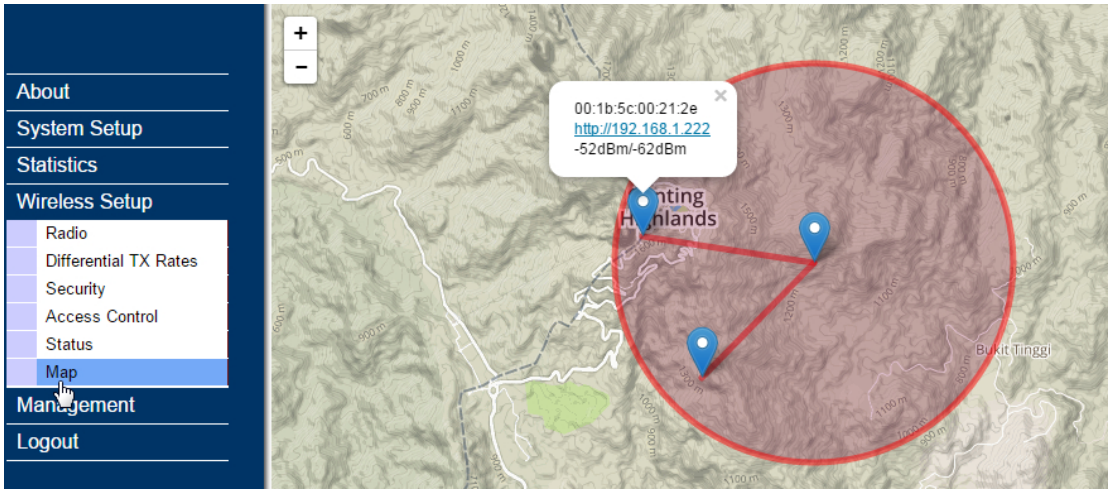
Wireless Setup / Map

The MAP page shows the coverage range you set in Wireless Setup / Radio configuration page by the pink circle area, then you can compare it to the real link position and see if it's in the coverage range. You can also



When you move the cursor to the radio location icon, you will see information popped out like the MAC address, IP address, RSSI and coverage distance.

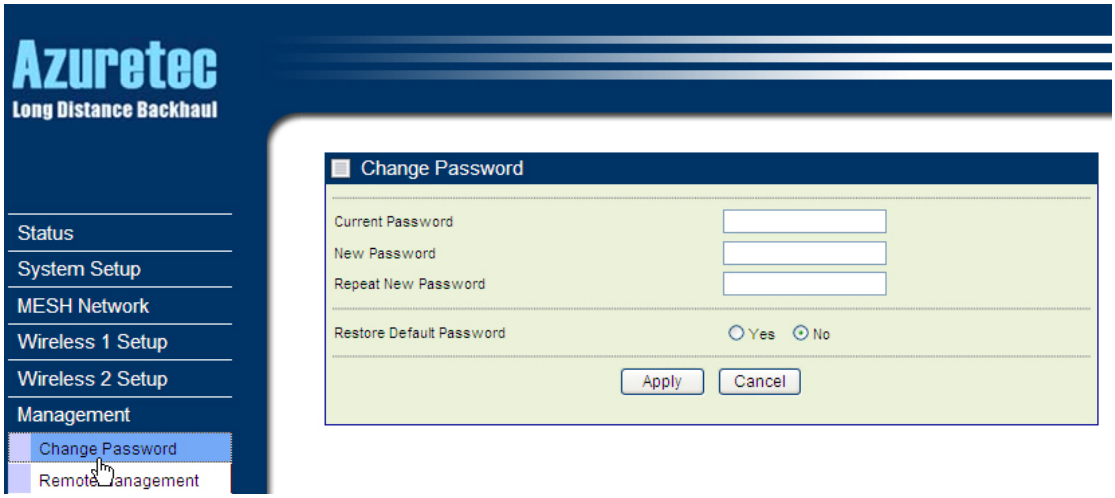

About
System Setup
Statistics
Wireless Setup
Radio
Security
Access Control
Status
Map
Management
Logout
00:1b:5c:00:21:2d
http://192.168.1.111
-54dBm/-48dBm
Coverage: 40 Km
Bentong
Bandar Utama Batang Kali
Taman Bunga Raya
Kg Sungai Dua
Karak
Serendah
Sungai Choh
Taman Desa Mas
Rawang
Batu Arang
Bandar Baru Kundang
Kuang
Kampung Matang Pagar
Bandar Baru Selayang
Astana Gemilang
Taman Permai Jaya
Kg Merbau Sempak
Sungai Buloh
Gombak
Setapak


About
System Setup
Statistics
Wireless Setup
Radio
Differential TX Rates
Security
Access Control
Status
Map
Management
Logout
00:1b:5c:00:21:2e
http://192.168.1.222
-52dBm/-62dBm
Bukit Tinggi

3-4 Management

Management / Change Password

This page allow you to change password of the dual 2x2 MIMO MESH On Ground.

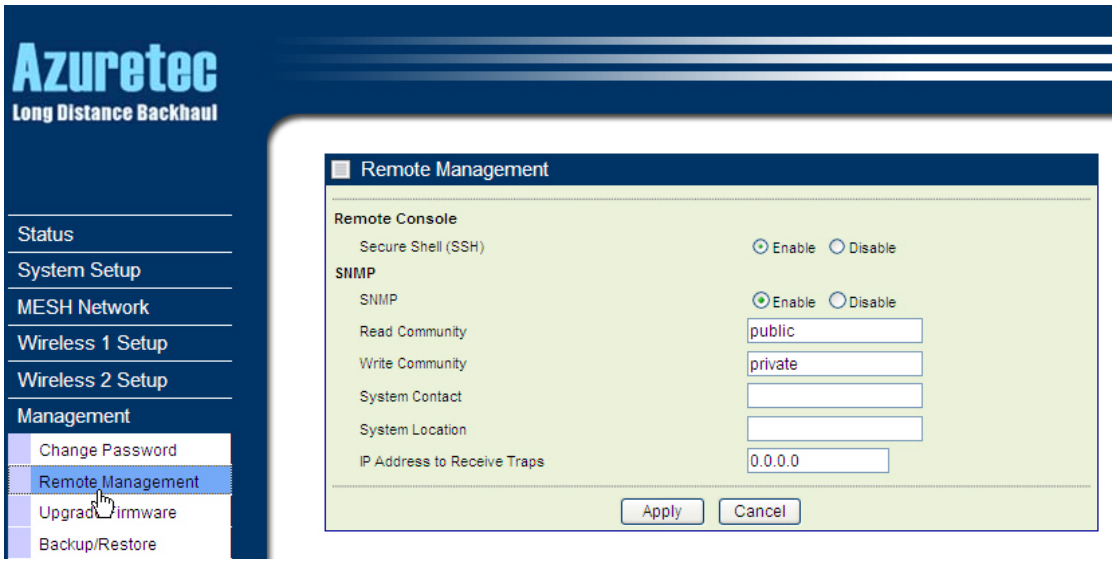


1. Key in the current password in the “Current Password” filed. Default password of this radio is “password”
2. Key in the new password to the New Password field, and then type it again into the Repeat New password field to confirm the new password.
3. Click the “Apply” button to active the settings.
4. You can restore to default password too by check the “yes” option.

Note: After you change password, please take note of your new password. Otherwise, you will not able to access the radio with correct password.

Management / Remote Management

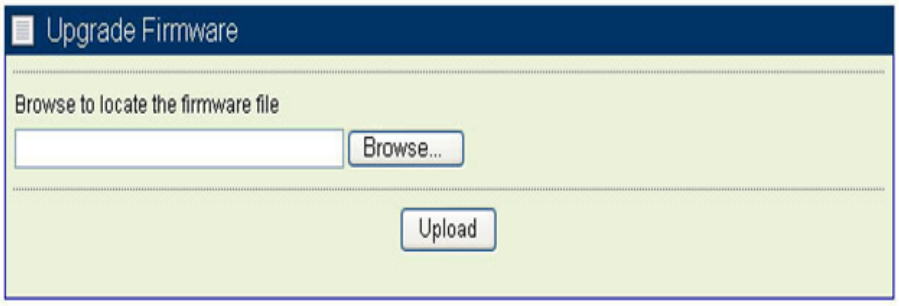
You can doing the remote Management via Secure Shell (SSH) or SNMP by setting the parameters in this page.



Management / Upgrade Firmware

The Upgrade Firmware menu will display the Upgrade Firmware page, you can update the latest firmware to the dual 2x2 MIMO MESH On Ground.

Please make sure that you are using the latest and correct firmware before you doing the upgrade procedure.



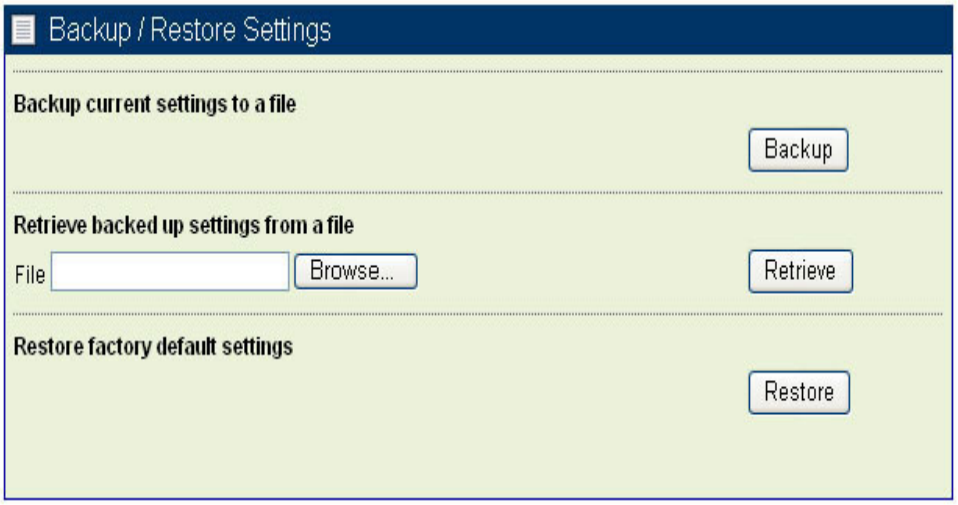
Below are the upgrade procedures:

- Using browser to access the main page of the dual 2x2 MIMO MESH On Ground
  1. Select “Upgrade Firmware” from the **Management** page.
  2. Input the exact file path and name or select the file by clicking **Browse** button, then press **Upload** button to upgrade the firmware.
  3. Please wait for few seconds.
- If download fail, please repeat the step 1~3 to download again.

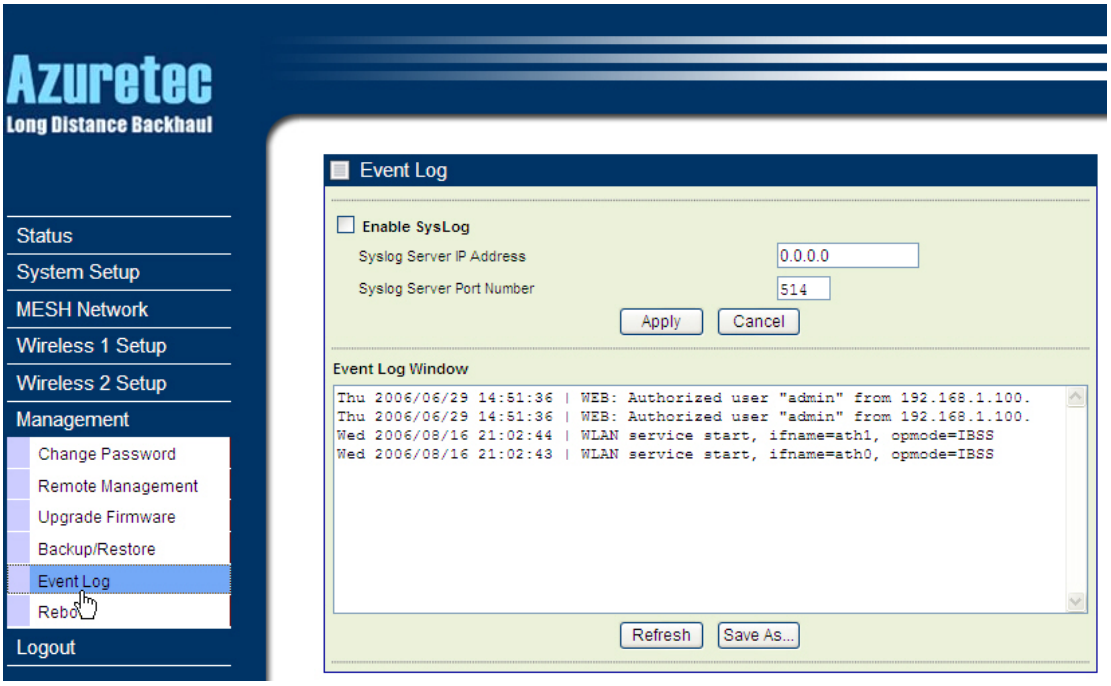
Note! Do not power off the unit when it is being upgraded.

Management / Backup / Restore Settings

The current system settings can be saved into a file as a backup by clicking “**Backup**”. The saved file can be loaded back on the radio by clicking “**Browse**”. When you have selected the settings file, click “**Retrieve**” to begin the process. Furthermore, you may click “**Restore**” to factory default settings.

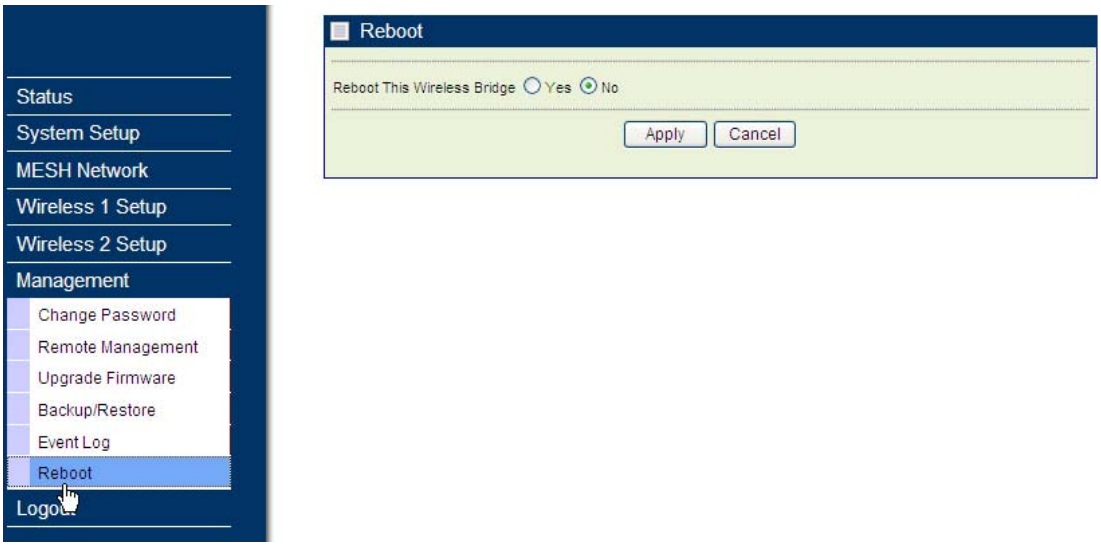


Management / Event Log



Enable SysLog if you have a Syslog Server on your network environment. If enable, you need to input the Syslog Server IP Address (default is 0.0.0.0) and the port number your Syslog Server is configured to use. The default port number is 514. The Event Log Window lists Wireless backhaul events. Click on “Refresh” to update the network events or “Save As…” to save the event into a file on your computer. Click “Apply” if you made any changes.

Management / Reboot



The Reboot screen enables you to reboot your dual 2x2 MIMO MESH On Ground if any changes are made and you want to refresh the radio, you need to reboot the dual 2x2 MIMO MESH On Ground Select the “**Yes**” check box and click “**Apply**”. It will take you about 50 seconds to go through reboot. The Web-browser will not be accessible until the Wireless backhaul has finished its reboot process.

Management / Logout

Click log out when you finished all the configuration, if there is anything missed, you

can selected “login again” to enter the configuration process again.

Hardware reset

If your Web User Interface stops responding, ping the IP address of the radio to check whether “reply” is obtained, or unplug and then plug back in the power supply of the Radio. This will reboot the Radio. If you are still unable to communicate with the Web User Interface, remove the plastic cap in the left of radio’s bottom, Then use a stick to press in and hold the RESET button for 6~9 seconds. This will reset the Radio to the factory default settings. If you applied any personal configuration settings, you will need to make the changes again.

Reset button of the radio