HYC-N4006-26

4.4~4.9GHz 2x2 MIMO HT-OFDM Radio
PTP Bridge / PTMP Mesh

Hypercable

User Manual

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

Version 1.0.1

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About This Manual

This manual includes install, configuration and trouble shooting for the 4GHz 2x2 MIMO HT-OFDM radio. It can help you in avoiding the unforeseen problems and use the outdoor radio correctly.

Technical Support

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

Table of Contents

Conventions

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

NOTE	This symbol means **_reader take note_**. Notes contain helpful suggestions or references to materials not contained in this manual.

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

WARNING	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) technology, this radio is a high capacity 4GHz radio for Point to point Bridge or Wireless Mesh deployment. It utilizes coordinate and internet map database to show the topology, status even route of the link. Customers can easily figure out the linking situation of the deployed radios.

There are 7 channel BWs (2.5/5/10/15/20/30/40 MHz) options can be selected easily by software. That provides the flexibility of deployment channel plan in high density city area or high capacity wireless bridge in short distance.

This radio supports powerful security mechanism: WPA2-PSK (AES128) with proprietary protocol. It also supports excellent MTBF performance by IP-68 dust & water resistant ratings, integrated surge protection circuit in both radio and POE unit. All these functions make this outdoor radio much more secure and reliable.

1-1 Features and Benefits

■ **Effective spectrum utility / variable capacities with 7 channel BWs**

This radio has 7 channel bandwidths (2.5/5/10/15/20/30/40 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 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.

■ **Self-healing & self-forming Mesh Protocol**

Automatic configuration and routing enables the mesh networks to be self-forming and self-healing.

■ **FETURES**

➢ Provides the easy installation for outdoor PTP bridge / PTMP Mesh applications with high performance.

➢ ±2 ppm Frequency Stability for Mobility & NLOS

➢ 7 Channel BW (2.5/5/10/15/20/30/40 MHz)

➢ 5 bits/s/Hz amazing spectral efficiency

➢ Network Architecture:
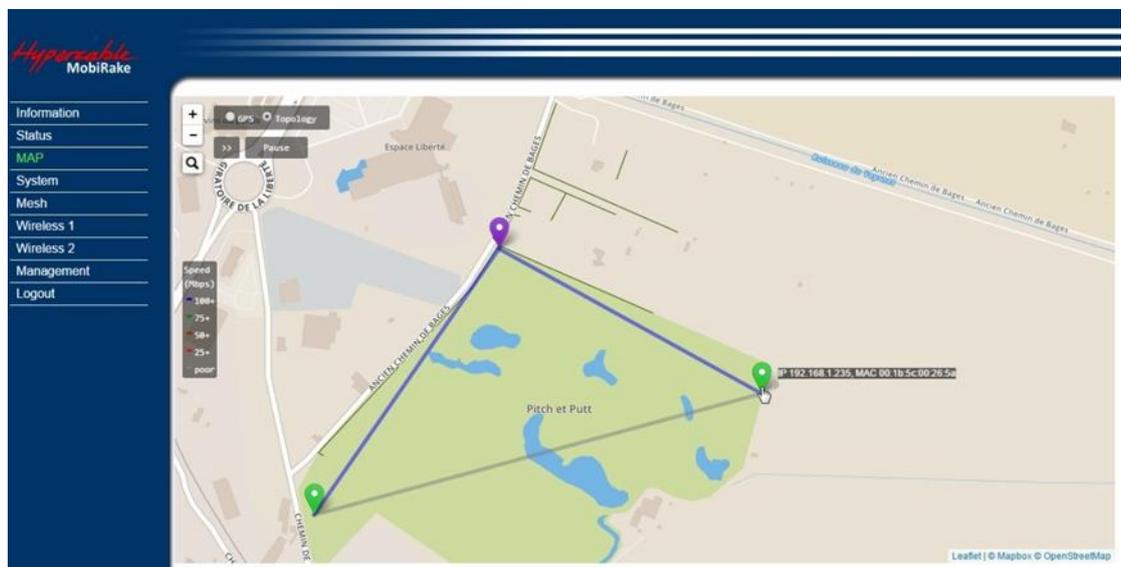 - ■ P-T-P Bridge
  - ■ Mesh - Peer to peer

➢ Transmit Power Control :

Supports settable transmit power levels to adjust coverage cell size, ranging from max.(100%) to 30% of max., the adjustment step is 1dB.

➢ Fast Seamless Roaming

➢ GPS Coordinates and Internet map database

➢ IEC61000-4-5 Surge Protection

➢ IP-68 Water & Dust Resistant

Chapter 2 Hardware Installation

This chapter describes initial setup of the 4GHz 2x2 MIMO Radio

Warnings

WARNING	**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.**
WARNING	**Do not work on the system or connect or disconnect cables during periods of lightning activity.**
WARNING	**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.**
WARNING	**Ultimate disposal of this product should be handled according to all national laws and regulations.**
WARNING	**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).**
WARNING	**Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**
WARNING	**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.**
CAUTION	**The 4GHz 2x2 MIMO HT-OFDM radio 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 4GHz 2x2 MIMO Radio.**

2-1 Product Kit

Before installation, make sure that you have the following items:

◆ **4GHz 2x2 MIMO HT-OFDM Outdoor 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 kits**………………………….…………………………………………..………x 1

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

2-2 System Requirements

Before installing the 4GHz 2x2 MIMO HT-OFDM Outdoor Radio, please make sure that these requirements have been met:

■ A 10/100/1000 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)
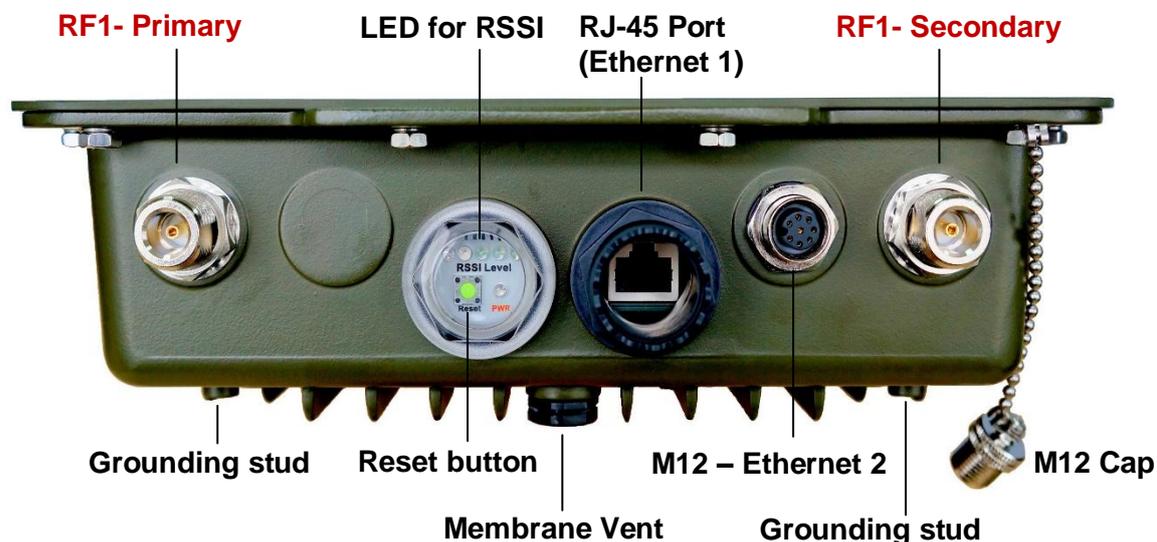
4GHz 2x2 MIMO HT-OFDM Outdoor Radio Figure

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 – Ethernet 1	Ethernet with DC current by POE, Use the SFTP cat.5 cable with weatherproof connector to connect to the "To ODU" side of the POE injector.
2	M12 – Ethernet 2	Ethernet Only by Ethernet cable with M12 connector.
3	N- Jack Antenna connector	Here you can attach the N-type external antenna to the 4GHz 2x2 MIMO Radio. In order to improve the RF signal radiation of your antenna, proper antenna installation is necessary.
4	RSSI level via LED	RSSI level via LED indicator, more LED represent stronger RSSI.
5	Reset button	Revolve the plastic cap, you will see the reset button. Press it and hold for 5~10 seconds, the radio will back to factory default settings.
6	Grounding stud	Connect to the ground conductor with the ground wire.
7	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.

⚠ **WARNING** **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.**
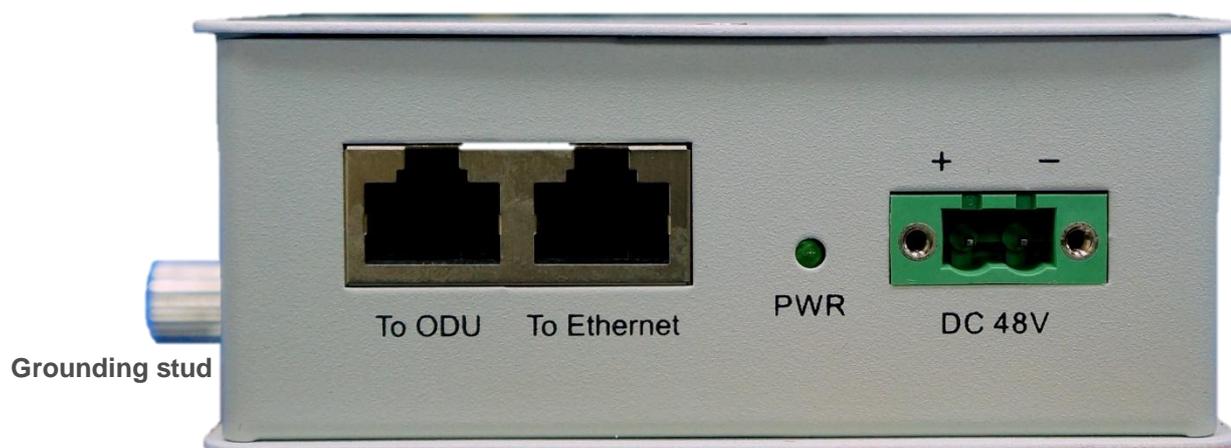
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Antenna location definition:

GPS Ant

N/A

RF1- Secondary

RF1- Primary

※ **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.**

+/- 48VDC POE

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 is used to connect to the ODU. (Ethernet signal with passive 48VDC)
3	**DC Input**	Connect to the 48VDC Power adaptor for DC input.
4	**LED Indicator (PWR)**	Power LED
5	**Grounding stud**	Connect to the ground conductor with the ground wire.

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

2-4 Hardware Installation

The 4GHz 2x2 MIMO 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 4GHz RF device deployed around the outdoor radio, try to set the channel to the non-overlapping one.
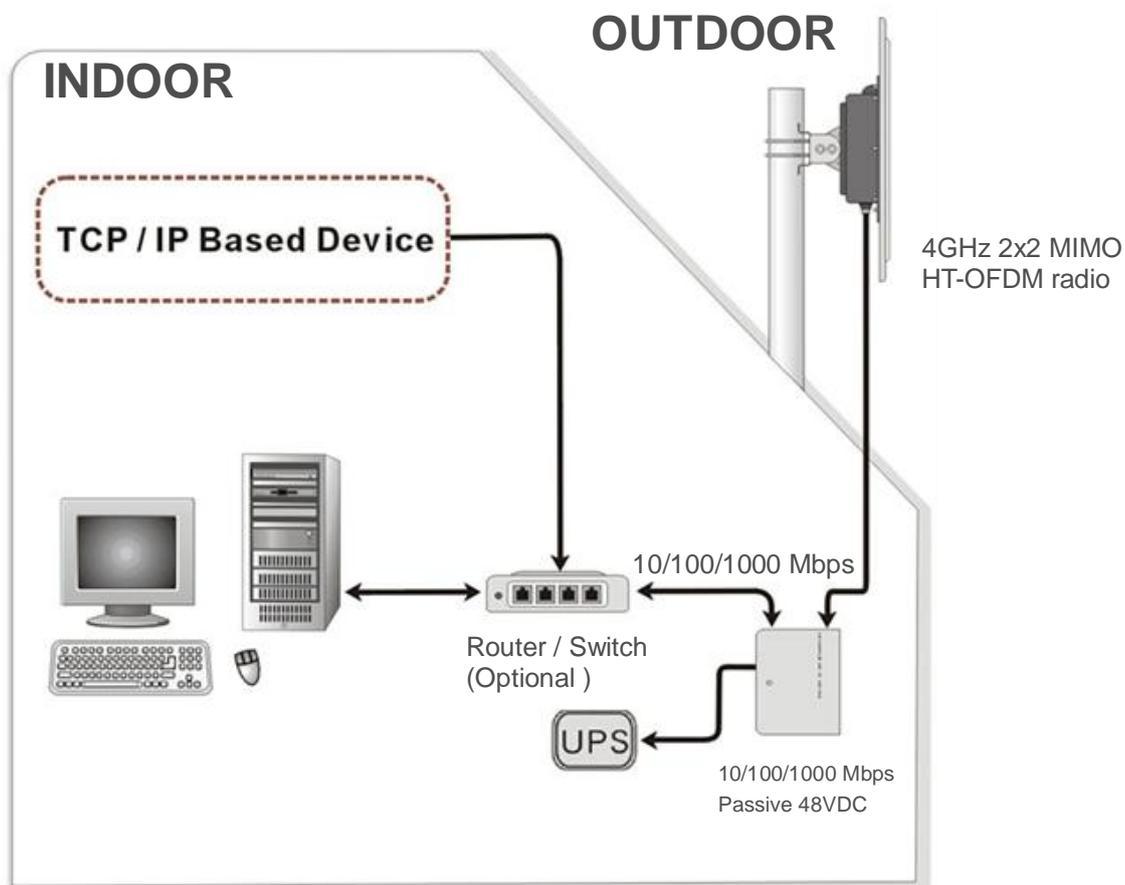
Hardware Installation Figure

➢ 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.

📝 NOTE	**Configure and verify the 4GHz 2x2 MIMO Radio operations first before you mount the radio in a remote location.**

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

Chapter 3   Configuration

3-1 Start-up and Log in

In order to configure the 4GHz 2x2 MIMO Radio, 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 **Information, Status, MAP, System, Mesh, Wireless, Management** and **Logout** buttons will be shown in left part. The main menu provides links to the whole sections of the web configuration interface.

Information

This page shows most of the product information briefly, that includes **General Information**, **Network Information, MESH, Wireless and Wired Network**

Information -1

Information -2

Status

This page shows all the status of the radio in one page, such as **System**, **mesh**, **wireless** and **port statistics**.

Status 1

Status -2

Map

The MAP page shows the **location / IP address / MAC address** of your radio, **GPS coordinates info**, **Topology Status and Mesh route** of PTP/PTMP & Mesh Network. It also allows you to drag the radio location mark to the place wherever you want. And in topology mode, you can also monitor the **RF settings** and the **link quality** among the radios.
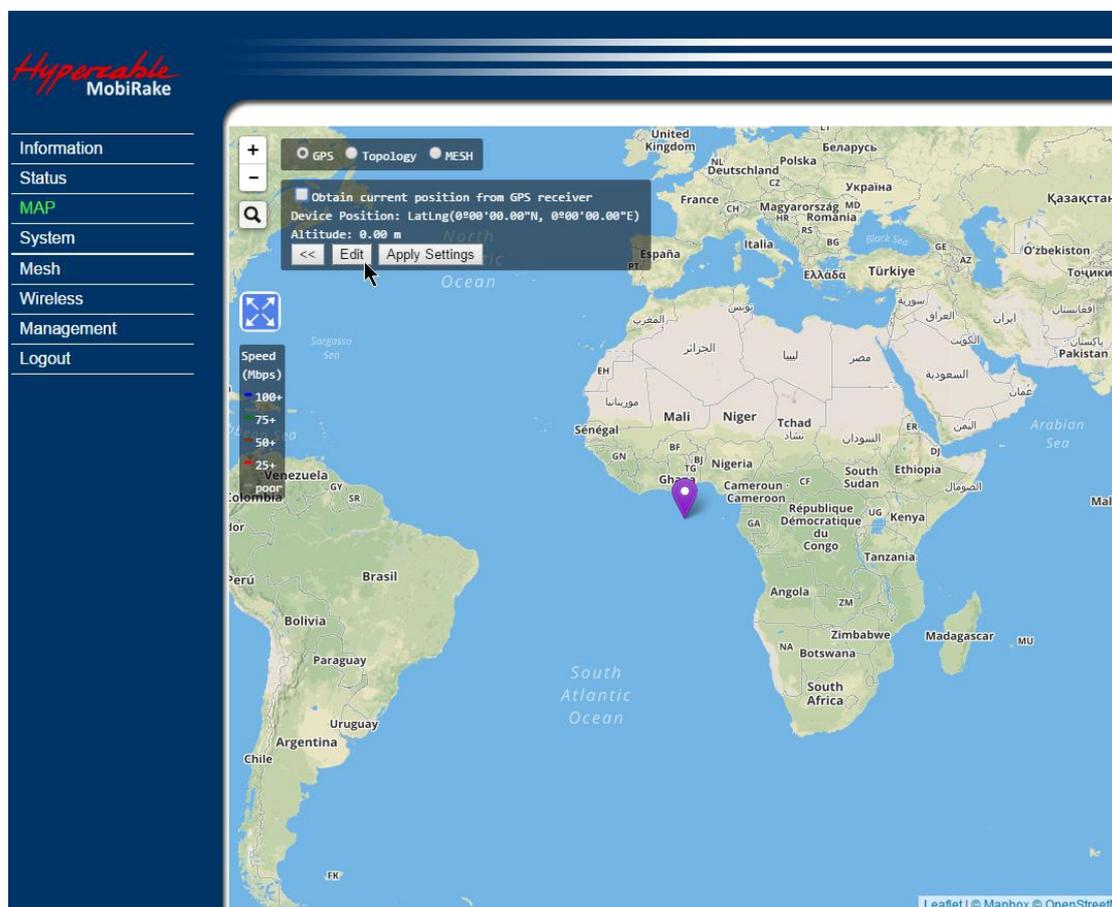
There are 3 ways to set the location of the radio.

1. You can select "Obtain current position from GPS receiver" with the radio type that integrated GPS module.
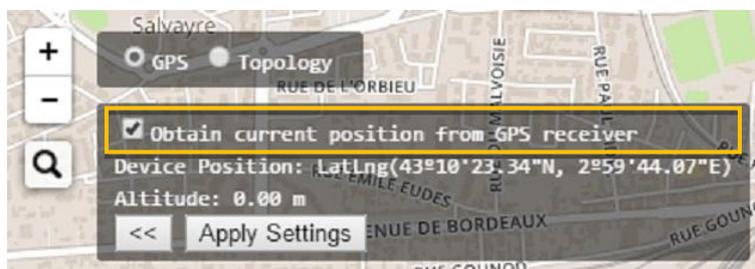
Attach an external GPS active antenna to the GPS port, you can see the received list of the GPS satellites.
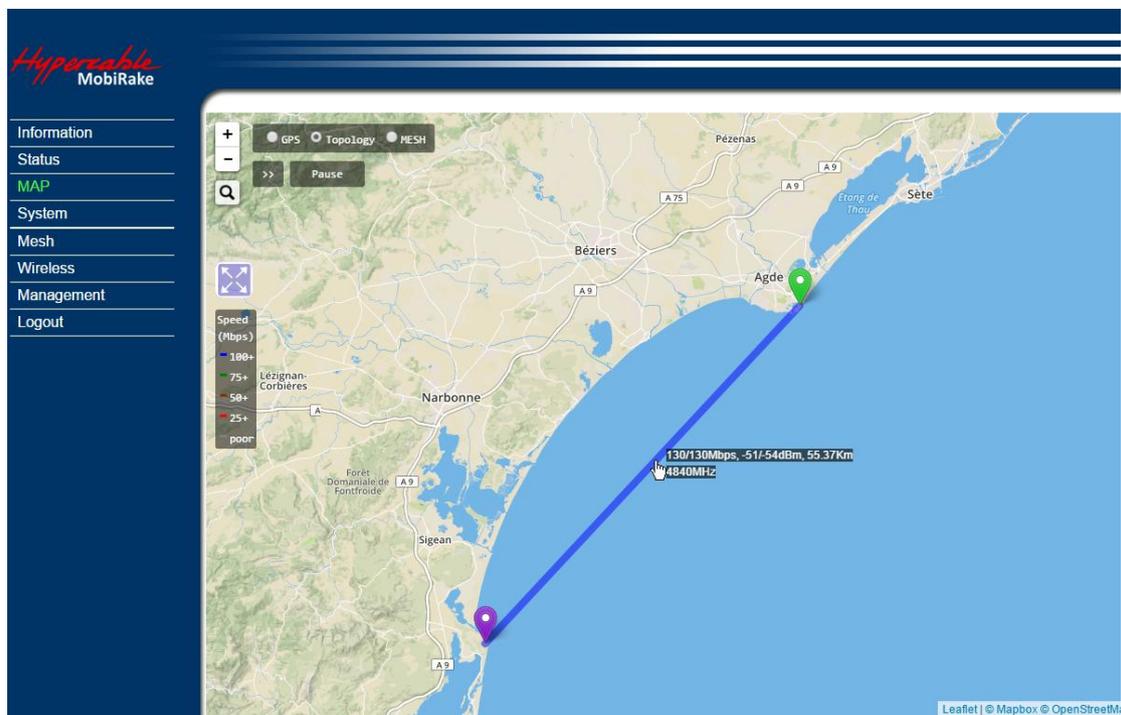
2. Enter the coordinates manually (this can also be done in **System / Basic Setup**) or

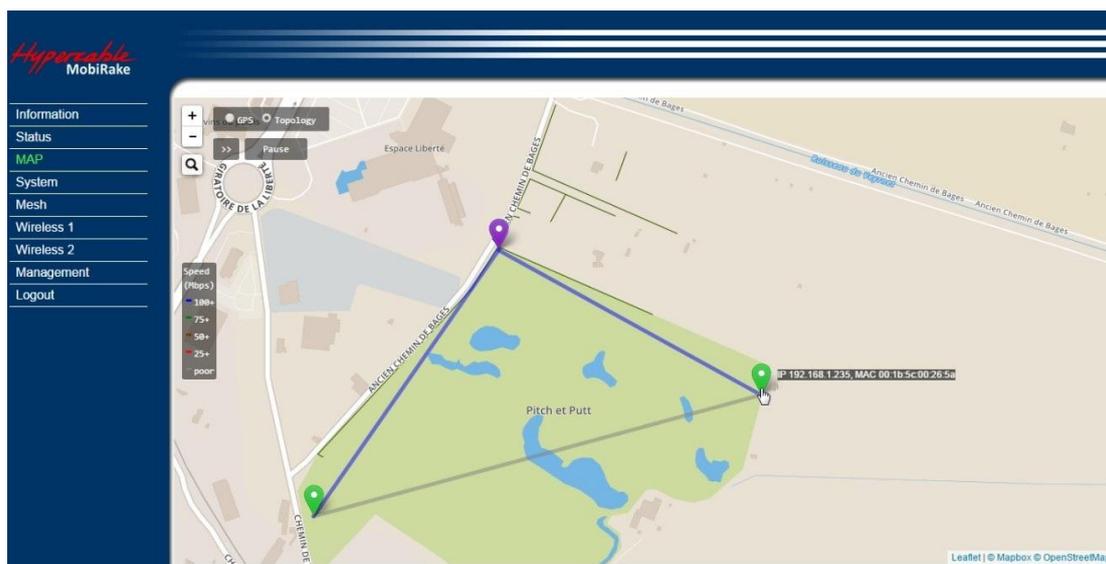3. Drag the location mark of the radio to anywhere in the map you want.

3. select the purple land mark and drag it to the location you want to install.
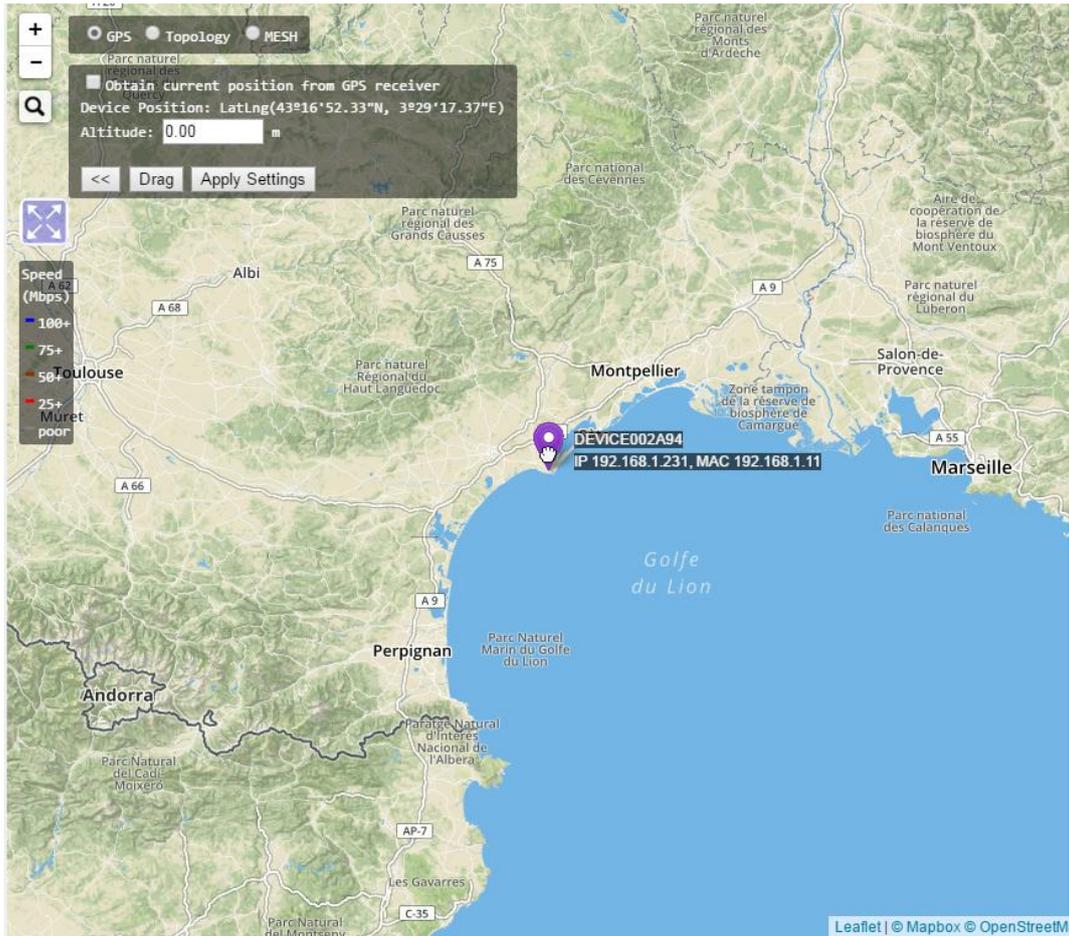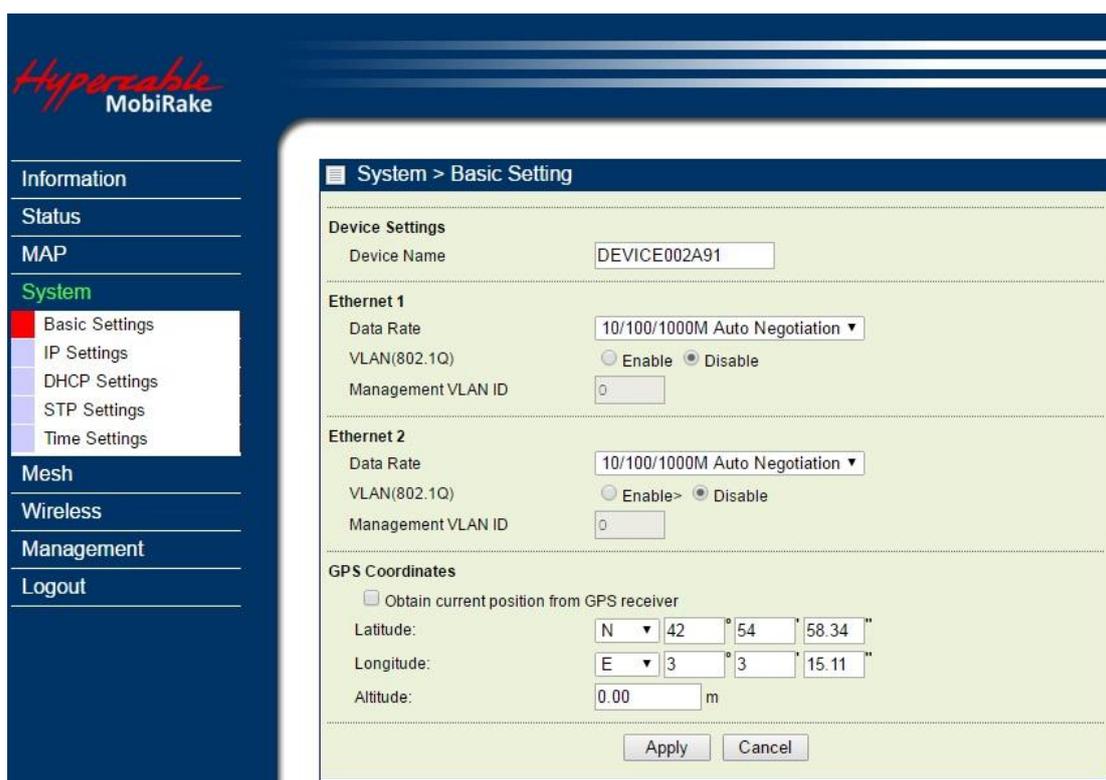
MAP – Topology

PTP Topology Map – Data rate / RSSI / Distance / Frequency

Mesh Topology Map – Radio info (IP address/ MAC)

System / Basic Setup

The **Device Name** is used to give a name to your 4GHz 2x2 MIMO Radio. This will enable you to manage your radio more easily if there are many radios in your network.

Ethernet Data Rate: you can choose the Ethernet data rate of this radio.

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 4GHz 2x2 MIMO Radio's location, and click apply. Connect the radio to internet, then it will get the map from internet

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automatically.

If your radio type support integrated GPS module, all you need to do to mark this radio on the correct position of the internet map is check the select box **"Obtain current position from GPS receiver"**.

System / IP Settings

IP Address: Type the IP address you want to set to your 4GHz 2x2 MIMO Radio(Default: 192.168.1.1).

IP Subnet Mask: The 4GHz 2x2 MIMO Radio'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 4GHz 2x2 MIMO Radio will use this value for default Gateway.

Primary DNS Server: The 4GHz 2x2 MIMO Radio will use this value for primary Domain Name Server.

Secondary DNS Server: The 4GHz 2x2 MIMO Radio will use this value for secondary Domain Name Server.

System /DHCP Setting

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In this page you can configure the **IP pool Starting address / IP Pool Size / Lease Time / Primary DNS server / Secondary DNS server / Static DHCP (**Assign a static IP address to a specific MAC address).

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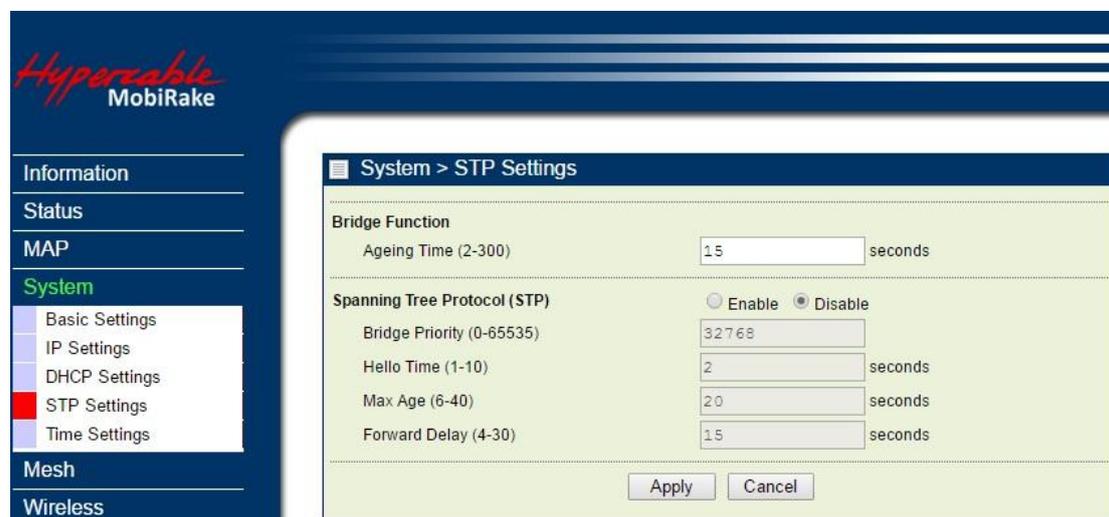
Ageing Time: Configure the length of time that a dynamic entry can remain in the bridge table from the time the entry is created or last updated.

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 / Time Setting
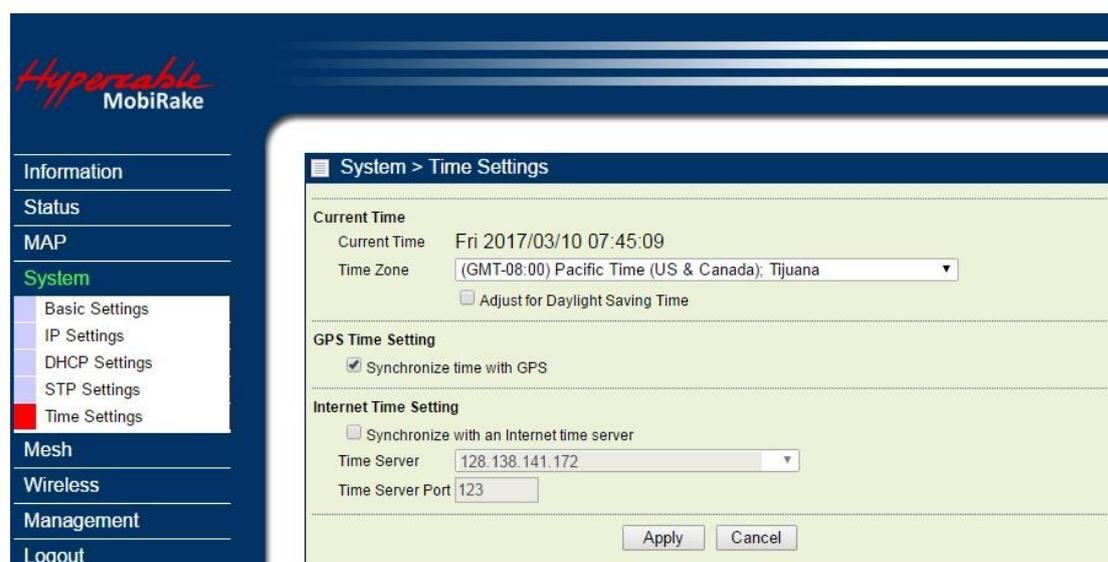
Current Time: While you connect this 4GHz 2x2 MIMO Radio to Internet, it could automatically synchronize the current time with the Time Server that you have set.

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:
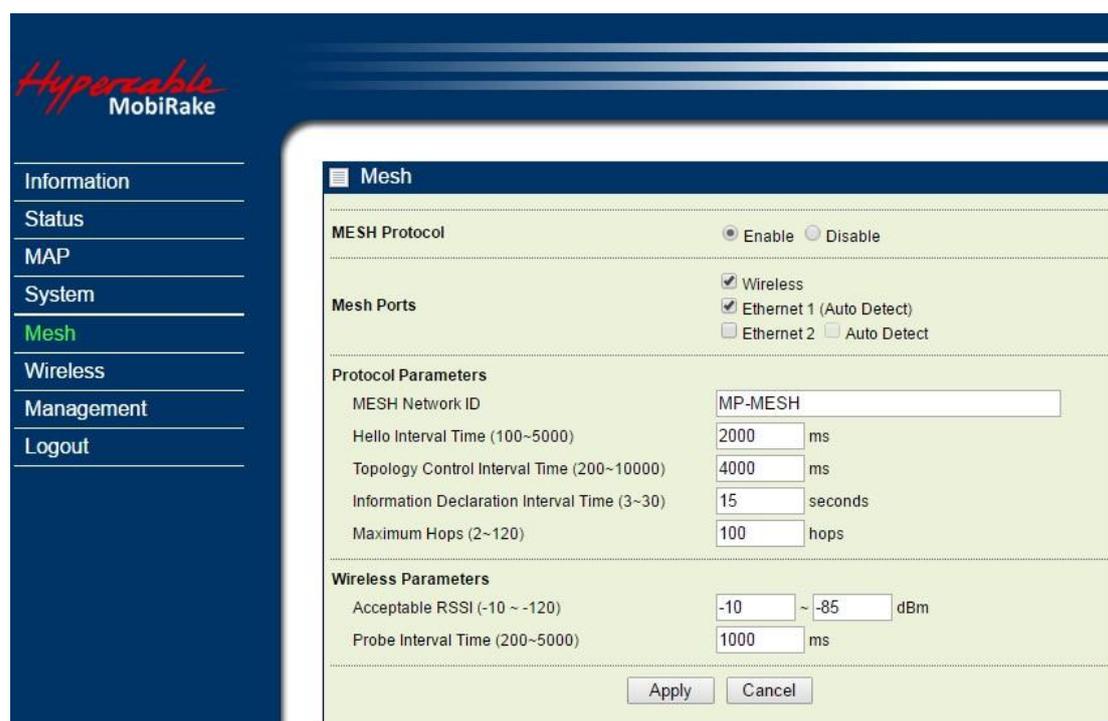

GPS time settings: Sync the time with GPS module.

Time Server: the central time of the Time Server.

Time Server Port: the port of the Time Server.

3-2 Mesh Protocol Configuration

Mesh Protocol: You can Enable or Disable Mesh Routing protocol here.

Mesh Ports: Enable Mesh Protocol per interfaces. When the interfaced been checked, it has to connect to the other port with same mesh protocol. Otherwise, the connection will be failed. But the Ethernet port with Auto Detect can auto detect the protocol and get link automatically.

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.

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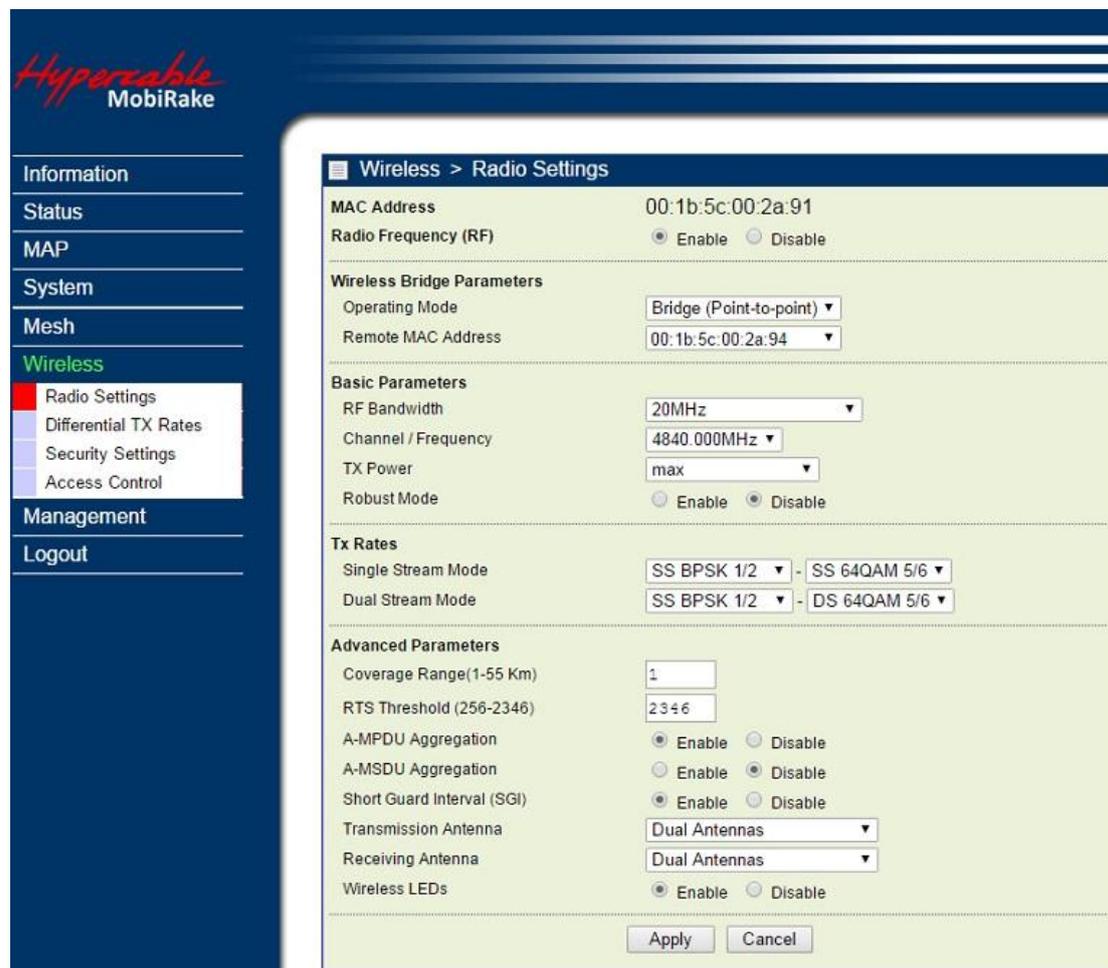
Maximum Hops (1~30): Define the max repeating hops in the mesh network.

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.

Probe interval time: Configuring the Time Interval between Probes.

3-3 Wireless Setup

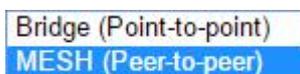## *Wireless Setup / Radio*

PTP Bridge mode

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

Operating Mode:

Bridge (Point-to-point)

Perform as a point to point bridge, enter the MAC address of the remote radio that you want to connect.

MESH (Peer-to-peer)

Perform as a mesh node in the mesh network.
model: Server mode and Unstructured peer to peer mode.

Wireless Network Name (SSID):

Mesh nodes, 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 2.5 / 5 / 10 / 15 / 20 / 30 / 40 MHz.

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

TX Rate Range: Here you can setup the min. Rate and max. Rate of the Tx Rate range.

SS BPSK 1/2	SS BPSK 1/2
SS QPSK 1/2	SS QPSK 1/2
SS QPSK 3/4	SS QPSK 3/4
SS 16QAM 1/2	SS 16QAM 1/2
SS 16QAM 3/4	SS 16QAM 3/4
SS 64QAM 2/3	DS 16QAM 1/2
SS 64QAM 3/4	DS 16QAM 3/4
SS 64QAM 5/6	DS 64QAM 2/3
	DS 64QAM 3/4
	DS 64QAM 5/6

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

max
75% of max (-1dB)
60% of max (-2dB)
50% of max (-3dB)
40% of max (-4dB)
30% of max (-5dB)

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.

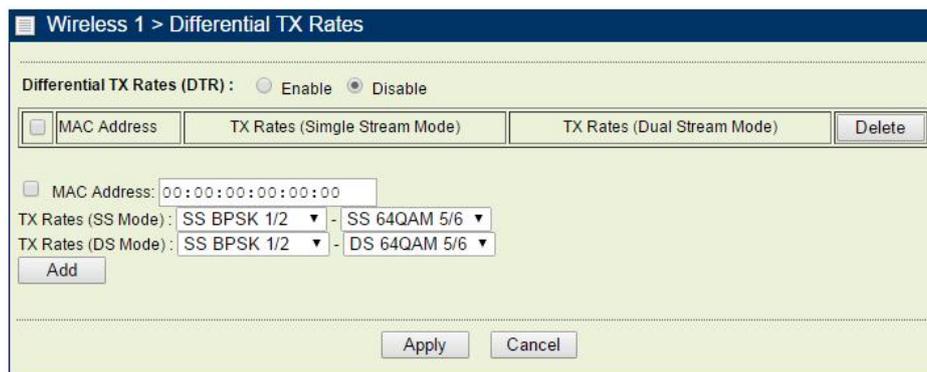**Transmission Antenna:** There are 3 antenna options for selection
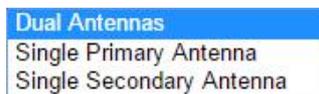
Receiving Antenna: Same as Transmission Antenna, there are 3 antenna options for selection too.
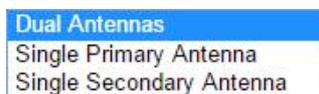
Wireless Setup / Differential Tx Rates

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

Wireless Setup / Security

Security/Cipher To prevent unauthorized radios from accessing data transmitted over the link, the Encryption Settings window offers WPA2 PSK features, making your data transmission over air more secure and allows you to specify Encryption Key(s).
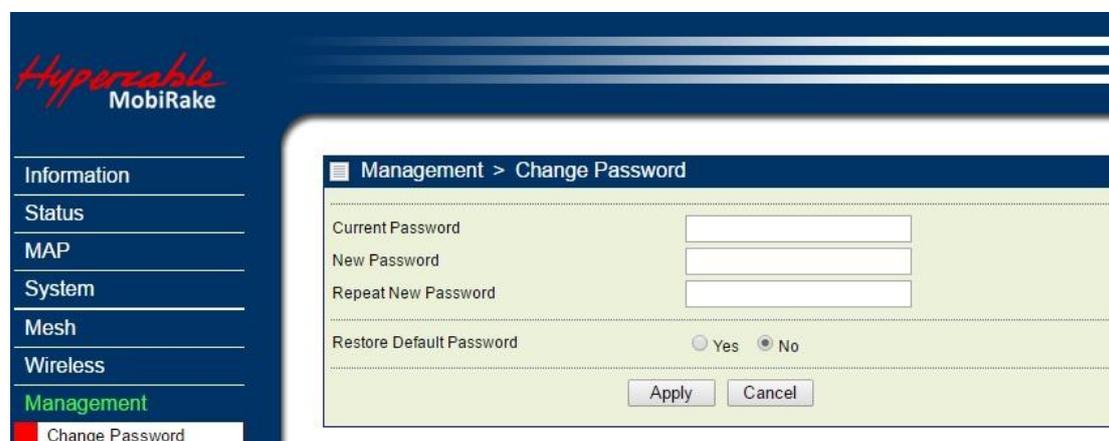

WPA2 PSK – AES encryption

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3-4 Management

Management / Change Password

This page allow you to change password of the 4GHz 2x2 MIMO Radio.

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 configure the remote Management via Secure Shell (SSH) or SNMP by setting the parameters in this page.
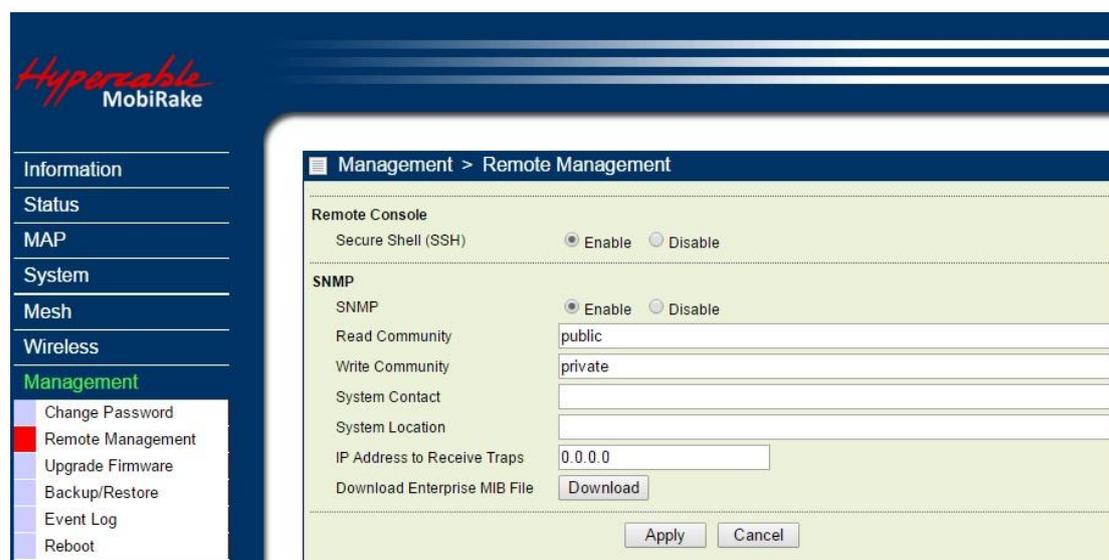
Management / Upgrade Firmware

The Upgrade Firmware menu will display the Upgrade Firmware page, you can update the latest firmware to the 4GHz 2x2 MIMO Radio.

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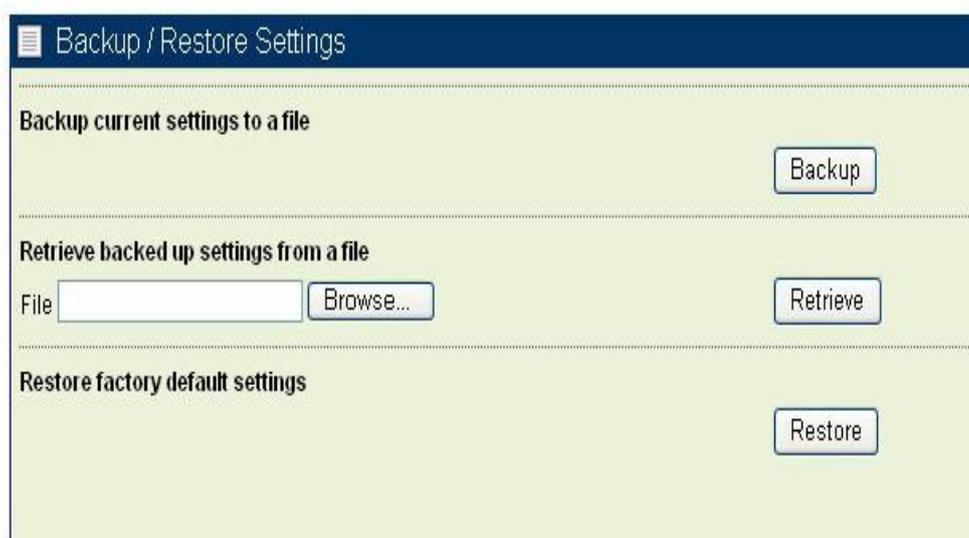

Below are the upgrade procedures:

● Using browser to access the main page of the 4GHz 2x2 MIMO Radio

   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.

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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 4GHz 2x2 MIMO Radio 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 4GHz 2x2 MIMO Radio if any changes are made and you want to refresh the radio, you need to reboot the 4GHz 2x2 MIMO Radio 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 4GHz 2x2 MIMO Radio 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 see-through plastic cap in the radio's bottom. Press in and hold the green 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

Reset button of the radio