e-Rake EAH2000 Series

Multi-MIMO OFDM Outdoor Radio
802.11a/b/g/n Multi-MIMO OFDM outdoor radio

Technical Description & Configuration Guide
Product code: HYP2050HBS23 & HYP1050HBS46

e-RAKE

EAH2001-25   EAH2002-25   EAH2003-25

e-Rake FODU Wi3x150 Wireless Outdoor Radio Guide d' Installation
Version 1.0.1

User Manual

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

Copyright

About This Manual

This manual includes install, configuration and trouble shooting for the Eagle Series–Multi-MIMO OFDM outdoor 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 wireless backhaul, Please contact the supplier for support.

Table of Contents

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

3

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

The E-Rake Series are enterprise and carrier-grade 802.11N Outdoor Wireless radio, which offers customer a powerful MIMO-OFDM solution with robust and high performance design in both 2.4GHz and 5GHz ISM bands.

Multi-MIMO OFDM outdoor radio in E-Rake Series offers customers a great solution for PTP / PTMP/ Hot zone applications by integrated multi-radios interfaces (up to 3* Radio modules) and Fast Data Switching technology from E-Rake .

This series is the most ideal solution for Service Providers to deliver carrier-grade wireless services to multiple market segments such as campuses, hospitality, healthcare, warehousing and wider metropolitan area deployments. Even in the NLOS environments, this series shows incredible efficiency on multi-hops repeating – truly throughput $\geqq$ 100Mbps and only $\leqq$ 15 ms total latency after 10 extended hops.

Much different from the traditional Wi-fi that dropped 50% throughput per each extended hop and can't get reply from remote device after 5~6 hops for too long latency.

1-1 Features and Benefits

■ **Integrated Multi-radios interfaces on E-Rake Seriesplatform.**

Multiple radios interfaces were integrated by "Fast Data Switching" technology from E-Rake   inside the E-Rake Seriesplatform. There are 3 models for options: EAH2001 (1*radio) / EAH2002 (2*radios) / EAH2003 (3*radios) and each radio interface can be configured independently to run different wireless connectivity missions.

■ **High efficiency transmission in multi-hops repeating**

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

■ **Flexible wireless backbone deployment options**

Except the Fast data switching and integrated multi-radios interfaces, high output power MIMO-OFDM technology is also a key factor to support Eagle Multi-MIMO OFDM outdoor radio series to be the most Flexible wireless backbone deployment options

■ **Secure and efficient client connectivity**

The nimble QoS (Quality of Service) configuration provides flexible management of user's access bandwidth of wireless connectivity. Perfect integrated with central RADIUS server and data encryption (WEP/WPA/WPA2), the Eagle Multi-MIMO OFDM outdoor radio series provide a secure wireless connectivity for each client device.

■ FEATURES

➢ Provides the easy installation and high performance outdoor PTP / PTMP wireless backhaul up to 80 KM (With high gain external antenna).

➢ 802.11 a/b/g/n MIMO OFDM Radio

➢ Integrated Multi-Radio Interfaces

➢ Fast Data Switching Technology

➢ Real Aggregate TCP Throughput ≧ 320Mbps @ 4x4 & 6x6 Base Station

➢ High Efficiency in Multi-hops Repeating
   ■ Low Throughput dropped (≧ 100 Mbps @ 10 hops)
   ■ Short Latency increased (≦ 15 ms @ 10 hops)

➢ Operate in 2.4GHz / 5GHz ISM Band

➢ IP-68 Water & Dust Resistant

➢ IEC61000-4-5 Surge Protection

➢ Outstanding MTBF

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

6

Chapter 2   Hardware Installation

This chapter describes initial setup of the E-Rake Series– Multi-MIMO OFDM outdoor 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 E-Rake Series– Multi-MIMO OFDM outdoor radio and POE injector can be damaged by incorrect power application. Read and carefully follow the installation instructions before connecting the system to its power source.**

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

7

2-1 Product Kit

Before installation, make sure that you the following items:

◆ **E-Rake Series– Multi-MIMO 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 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. |

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: Microsoft IE 5.0 or later, or Netscape Navigator 5.0 or later version.

■ Installing TCP/IP protocol to the computer.

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

8

2-3 Mechanical Description

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

ODU: (External antenna)

RF1- Secondary Reset button RF1- Primary
                RJ-45 Port

Bottom Side

Grounding stud   Membrane Vent   Grounding stud

RF3- Secondary   RF3- Primary

Top Side

RF2- Secondary   RF2- Primary
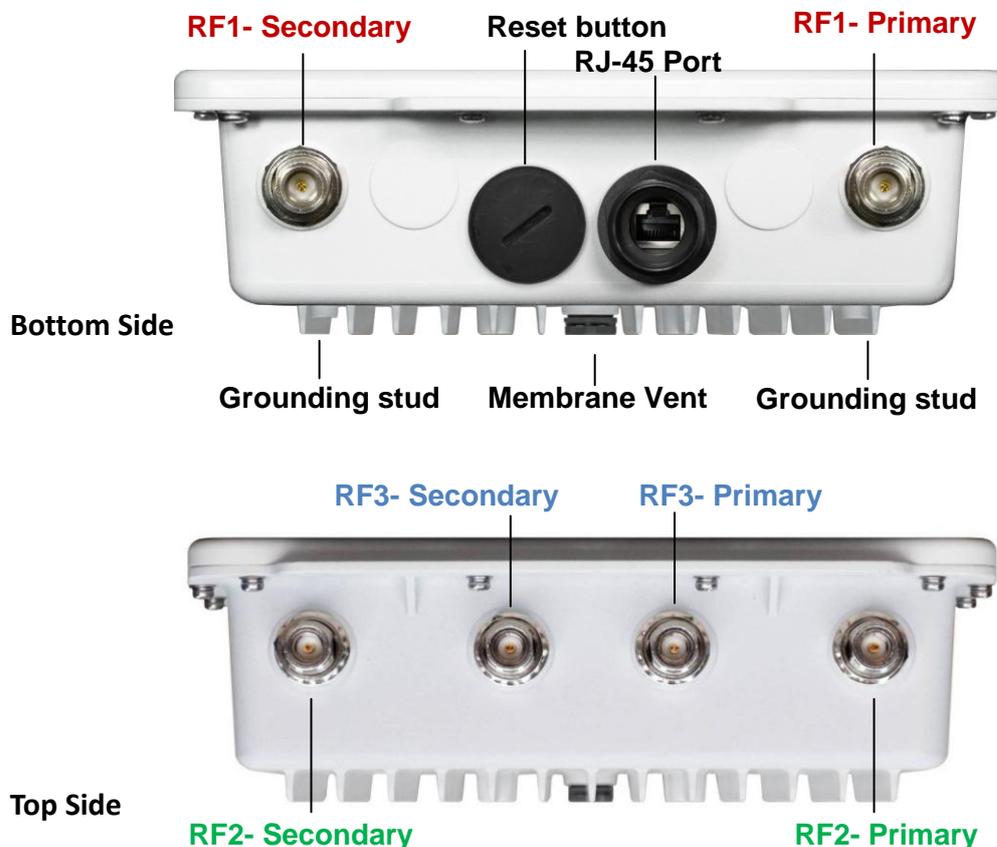
Outdoor Multi-MIMO OFDM Radio Figure

※ **Note: When you set the RF to 1x1 instead of 2x2 MIMO, only Primary port works.**

1	RJ-45 Port (10/ 100/ 1000)	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 MIMO antenna to the Multi-MIMO OFDM outdoor radio. In order to improve the RF signal radiation of your antenna, proper antenna installation is necessary. Please refer to the above picture for the primary and secondary port of each RF module. (up to 3 RF modules.)
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.**

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

DC Input

LED Indicator (Power)

To Ethernet

To Radio
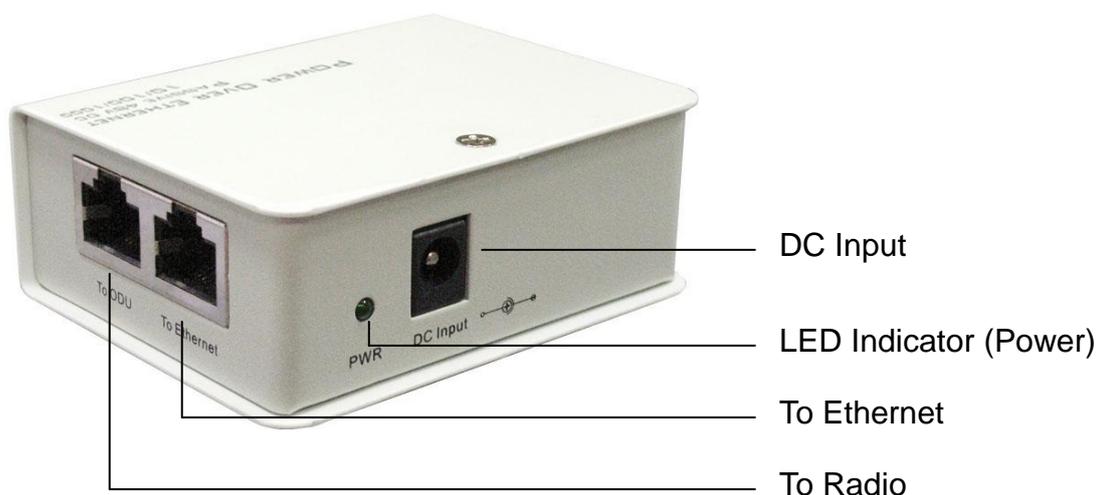
Power Over Ethernet Injector Figure

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

2-4 Hardware Installation

The E-Rake Series– Multi-MIMO OFDM outdoor 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 2.4 / 5GHz RF device deployed around the outdoor radio, try to set the channel to the non-overlapping one.

➤ 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.
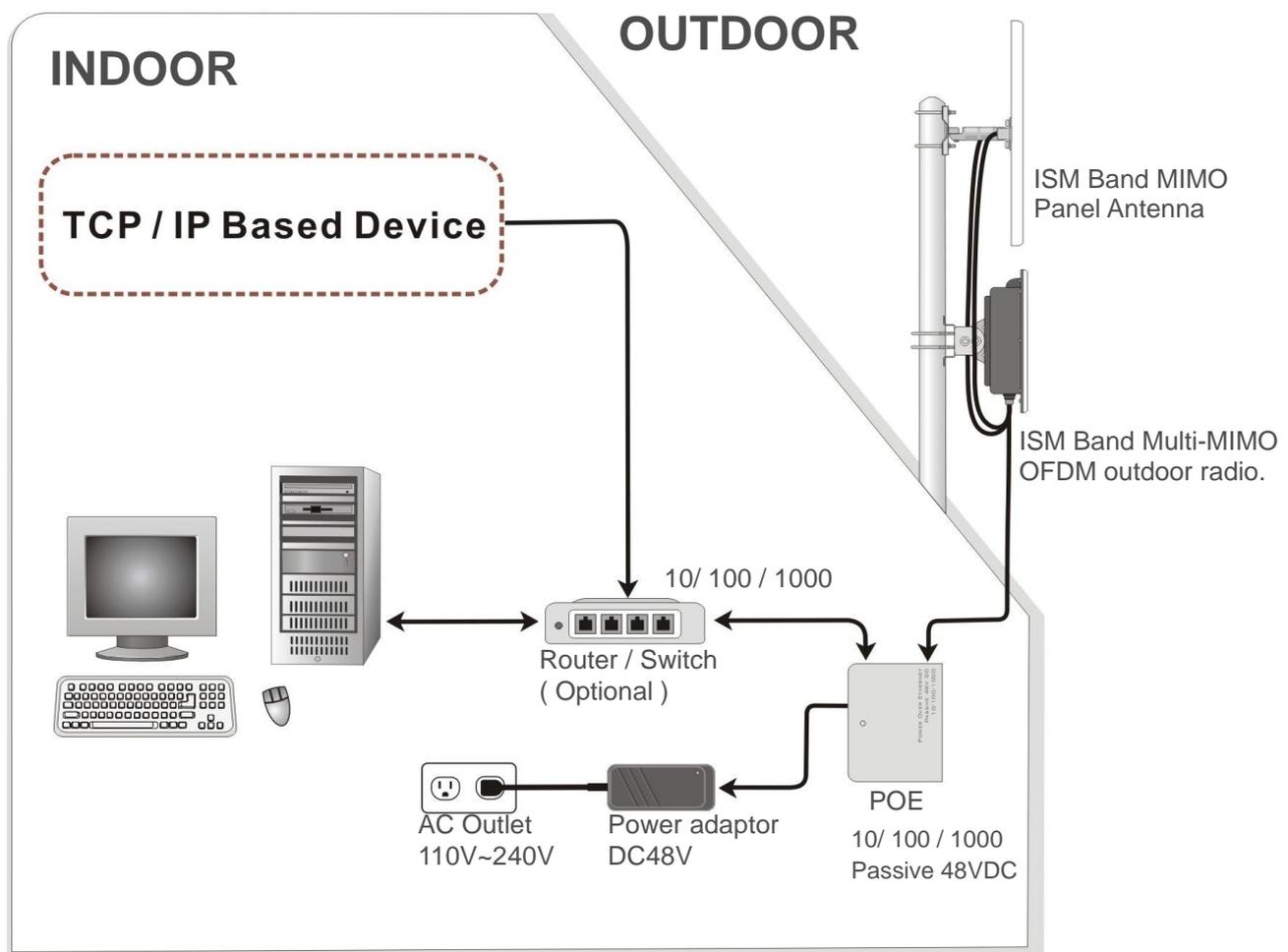
Hardware Installation Figure

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

11

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.**

NOTE	**Configure and verify the E-Rake Series– Multi-MIMO OFDM outdoor 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 Multi-MIMO OFDM outdoor radio, use the web browser and please do the following:

1. Type the IP address **https://192.168.1.1** of this radio in the Location (for IE) or Address field and press Enter.

2. The default administrator's ID is **"admin"** and password is **"admin"** too. For normal user's login ID is **"user"** and password is **"user"** as well. Configuration will be not available for user account.

3. Click on the **"Login"** button.

The configuration page was vertically divided into right and left part. Items in the left part show the concurrent configuration corresponds to the items in right part.

Please do remember to click the **Apply** button on the very bottom of every page to make your configuration changes effected; otherwise the changes you just made will be ignored once you leave the current page. You can also click the **Cancel** button to regret the changes.

3-2 System Setup

A **System Setup** includes device related elements, such as system time and IP setting.

System Setup > Basic Setup

Language The Multi-MIMO OFDM outdoor radio WEB GUI is designed to support English language in display. Users can choose the proper language in language list.

Device Name User can give a name for identifying a particular outdoor access point

System Date Set the date manually.

System Time Set the time manually.

System Time Sync System time will synchronize with the PC which is connecting web GUI via http.

Time Synchronization Time synchronization setting will decide the duration to next time synchronization. When any NTP server is available in network, user can enable the NTP and system will automatically synchronize system time with NTP server.

GMT Time zone Set a Greenwich Mean Time setup for time synchronization.

Time Server User can insert an available IP address of NTP server in Internet for time synchronization.

System Setup > Network Setup

Home | System Setup | Wireless | Administration | Utility | Status | Logout(admin)

Basic Setup | Network Setup |

System Operation Mode

| Mode : | Bridge | Mode : | Bridge ▾ |

IP Setup

IP Address :	192.168.1.1	IP Address :	192.168.1.1
Subnet Mask :	255.255.255.0	Subnet Mask :	255.255.255.0
Default Gateway :	0.0.0.0	Default Gateway :	0.0.0.0
DNS 1 :	0.0.0.0	DNS 1 :	0.0.0.0
DNS 2 :	0.0.0.0	DNS 2 :	0.0.0.0

Spanning Tree Protocol

| STP : | Off | STP : | Off ◉ On ◯ Rapid ◯ |

System Operation Mode

Bridge Mode In Wi-Fi networking, bridging mode allows two or more wireless access points (APs) to communicate with each other for the purpose of joining multiple LANs.
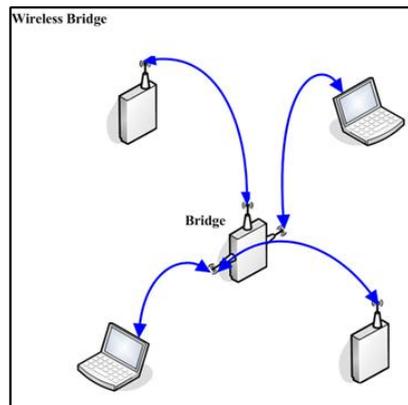
Router Mode The router is connected to at least two networks and decides which way to send each information packet based on its current understanding of the state of the networks it is connecting to. System allows user to define either a **wireless station mode radio** or **Ethernet** interface to be a WAN link for router.

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

15
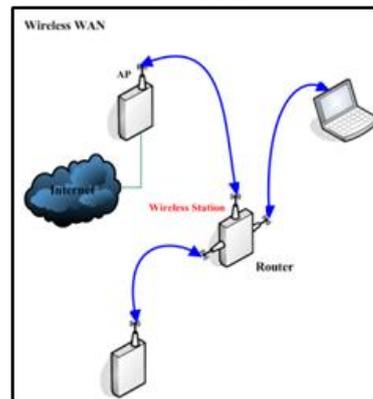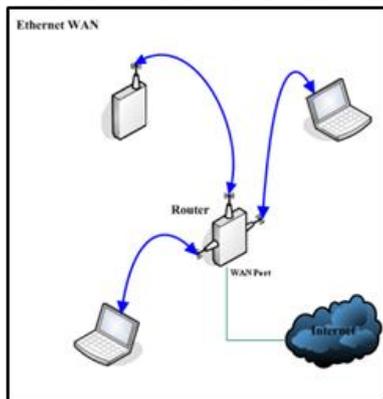
IP Setup (Bridge Mode)

IP Address :	192.168.1.1
Subnet Mask :	255.255.255.0
Default Gateway :	0.0.0.0
DNS 1 :	0.0.0.0
DNS 2 :	0.0.0.0

IP Assignment System allows user to assign the device IP address dynamically from existing DHCP server or set a static IP address manually.

IP Address Once **Static IP** was selected, the IP Address field will allow you to set the bridge device IP address manually. This IP address of the bridge is used as the base for all of your local network settings.

Subnet Mask This is the subnet mask address for your bridge device. Set the IP subnet mask manually.

Default Gateway Set the default gateway IP address manually.

DNS 1 & 2 The Domain Name System (DNS) is how the Internet translates domain or website names into Internet addresses or URLs. Your ISP will provide you with at least one DNS Server IP Address. If you wish to use another, enter that IP Address in **DNS 2** fields.

WAN Setup (Router Mode)

Port :	Ethernet
IP Address :	192.168.0.1
Subnet Mask :	255.255.255.0
Default Gateway :	0.0.0.0
DNS 1 :	0.0.0.0
DNS 2 :	0.0.0.0

Port To define either a **wireless station mode radio** or **Ethernet** interface to be a WAN link for router.

IP Address WAN interface IP address, system only supports setting WAN IP address manually.

Subnet Mask A subnet mask that correspond to the WAN IP address.

Default Gateway A WAN default gateway setting.

DNS 1 & 2 The Domain Name System (DNS) is how the Internet translates domain or website names into Internet addresses or URLs. Your ISP will provide you with at least one DNS Server IP Address. If you wish to use another, enter that IP Address in **DNS 2** fields.

LAN Setup (Router Mode)

IP Address (Router Mode) An IP address of device when running wireless router mode. This IP address will be the default gateway IP address for all client devices which connects from LAN network.

Subnet Mask (Router Mode) An IP mask defines the LAN IP scope.
Spanning Tree Protocol

STP The Spanning Tree Protocol (STP) is a network protocol that ensures a loop-free topology for any bridged Ethernet local area network. The basic function of STP is to prevent bridge loops and ensuing broadcast radiation. Spanning tree also allows a network design to include spare (redundant) links to provide automatic backup paths if an active link fails, without the danger of bridge loops, or the need for manual enabling/disabling of these backup links.

Ethernet Link Speed

Link The link speed of Ethernet port can be changed manually into 10 / 100 Half / Full duplex. When you set it to "Auto", it's auto negotiation for 10 / 100 / 1000 and half / full.

DHCP Server Setting
The Multi-MIMO OFDM outdoor radio can be configured as a DHCP server for a LAN network. Once the DHCP Server is chose as on, the DHCP server setting elements will spread out on the page.

DHCP Server Allows you to enable or disable the DHCP server function in system.

IP Start / End The IP Start and End Address specify the range of addresses assigned by your device when it functions as a DHCP server.

Primary & Secondary DNS Set the primary and secondary DNS server IP address which DHCP server is going to assign for DHCP client devices.

Default Gateway Default gateways IP address assign for DHCP client devices.

Management VLAN

Management VLAN Management VLAN is a secure VLAN which divides Internet users from device IP access. Administrators can management network devices under the Management LAN network without betrayal of secrets.

RIP Setting (Router Mode)

RIP The Routing Information Protocol is a distance-vector routing protocol, which employs the hop count as a routing metric. RIP prevents routing loops by implementing a limit on the number of hops allowed in a path from the source to a destination.

Both WAN and LAN interfaces support unidirectional and bidirectional routing information update. When RIP "IN" was selected, routing table will be updated by connecting router device but won't update the routing table itself to connecting router device. Otherwise, when RIP in "OUT" status; system will update its own

routing table to connecting router devices but update itself.

3-3 Wireless

Wireless > Radio Setup

Wireless Band Choose a radio frequency for signal transmission. The frequency and channel bandwidth match to selection is showed as following table:

Selection	Frequency	Channel Band Width
802.11G	2.412 GHz - 2.462 GHz	20 MHz
802.11NG HT20	2.412 GHz - 2.462 GHz	20 MHz
802.11NG HT40 Plus	2.412 GHz - 2.442 GHz	40 MHz
802.11NG HT40 Minus	2.432 GHz - 2.462 GHz	40 MHz
802.11A	5.18 GHz - 5.32 GHz 5.50 GHz - 5.58 GHz 5.66 GHz - 5.70 GHz 5.745 GHz - 5.825 GHz	20 MHz
802.11NA HT20	5.18 GHz - 5.32 GHz 5.50 GHz - 5.58 GHz 5.66 GHz - 5.70 GHz 5.745 GHz - 5.825 GHz	20 MHz
802.11NA HT40 Plus	5.18 GHz - 5.30 GHz 5.50 GHz - 5.54 GHz 5.66 GHz 5.745 GHz - 5.785 GHz	40 MHz
802.11NA HT40 Minus	5.20 GHz - 5.32 GHz 5.52 GHz - 5.56 GHz 5.68 GHz 5.765 GHz - 5.805 GHz	40 MHz

Channel Available channel will relate to what wireless band is chosen.

Transmission Power Control the transmit power of a radio by selection of Transmission Power.

Antenna Number THE MULTI-MIMO OFDM outdoor radio.   series complete 802.11n 1x1 1-steram and 2x2 2-stream for antenna attached. The maximum data link rate at 1-steram and 2-stream will be 130Mbps and 300Mbps.

Short Guard Interval 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 800 ns. A short guard interval will short the time between symbol transmissions into 400 ns to enhance the efficiency of data transmission.

Aggregation Frame aggregation is a feature of the 802.11n wireless LAN standards that increases throughput by sending two or more data frames in a single transmission.

Distance To assign a distance between nodes in a point to point transmission will improve the success rate of data transmit.

Wireless > WLAN Setup

Each physical radio interface supports up to 16 virtual WLAN AP setting. User can add or delete a virtual AP by click the "+" or "-" button on top of the very right side of setting block.

SSID A service set identifier (SSID) is a name that identifies a particular 802.11 wireless LAN. A client device receives beacon messages from all access points within range advertising their SSIDs. The client device can then either manually or automatically select the network with which to associate.

Broadcast Network administrator can choose broadcast beacon messages of a virtual AP by checking the broadcast block.

Enable Network administrator can also decide functioning of virtual AP or let it idle.

WLAN Mode Radios support "Access Point", "Wireless Station", "Access Point (WDS Support)", "Wireless Station (WDS Support)", "MESH Mode" and "Mobility Mode" mode to meet various network scenarios.

※**Note: ("MESH Mode" and "Mobility Mode" are available in the advance license purchase)**

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

21

RTS "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 AC side only because the hidden station problem does not exit from the perspective of the AP. RTS Threshold can be set between 1 and 2312 bytes.

Fragmentation Set the packet size to activate fragmentation. Fragmentation threshold can be set between 1 and 2312 bytes.

aggregation is enabled.

Limited Data Rate Limit the wireless data link rate in small range referring to the real RSSI of the wireless link to enhance the stability of data transmission.

VLAN ID In order to create a wireless VLAN environment, each virtual AP can conform to an 802.1q VLAN tag ID.

VLAN Priority Each VLAN ID can be gave a priority number (from 0 to 7) for data process priority.

Client Numbers Limit the maximum number of associate client devices.

Client Isolation Client isolation will protect the privacy of each connecting client from searching in a wireless LAN.

Bandwidth Profile Choose a bandwidth control profile for virtual AP interface. (About the detail of bandwidth profile, please refer to the bandwidth control setup in coming pages.)

Home	System Setup	Wireless	Administration	Utility	Status	Logout(admin)

Radio Setup | WLAN Setup | Wireless Security | WMM Setup | Bandwidth Control | Advanced Setup |

Bandwidth Control Profile Setup

Profile ID :	1	Profile ID :	1 ▼
Mode :	Disable	Mode :	Disable ▼
			Disable
Both(Kbps) :		Both(Kbps) :	Both
			UL/DL
Up Stream(Kbps) :		Up Stream(Kbps) :	
Down Stream(Kbps) :		Down Stream(Kbps) :	

Cancel   Apply

Wireless > Wireless Security

SSID User can choose a specific virtual AP to assign a security type of wireless link.

MAC Filter MAC filter provides allow or deny MAC table for administrator to access control of AP by insert a MAC address of client device. When running allow mode, only the MAC address which showing on the table will be accept for wireless connectivity. When running deny mode, MAC address which showing on the table will be blocked from wireless connectivity. The table can be configured 32 MAC address at most of each virtual AP interface.

Security Comprehensive security settings are available on system in this menu. These include WEP Keys and WPA+WPA2-PSK. Details of each type of security are in appendix. The security settings are independent between each virtual AP interface.

WEP System supports 64-bit, 128-bit and 152-bit WEP key in both ASCII and HEX format. Do make sure the correctly number of digits/characters and format of WEP key as shown in the table are entered. Note that in HEX format, HEX number cannot start with "0".

Number of digit/character	ASCII	HEX
64-bit	5	10
128-bit	13	26
152-bit	16	32

WPA+WPA2-PSK THE MULTI-MIMO OFDM OUTDOOR RADIO series support WPA+WPA2-PSK (WPA-Personal) in security. WPA+WPA2-PSK (Pre-shared key) mode is designed for home and small office networks and doesn't require an authentication server. Each wireless network device authenticates with the access point using the same 256-bit key.

TKIP Temporal Key Integrity Protocol: A 128-bit per-packet key is used, meaning that it dynamically generates a new key for each packet. Used by WPA.

CCMP An AES-based encryption mechanism that is stronger than TKIP. Sometimes referred to as AES instead of CCMP. Used by WPA2.

Both TKIP and CCMP encryption are available for WPA+WPA2-PSK. Pre-shared key of 8 to 63 characters are required. Group Rekey Interval can be set up to 65536 seconds.

Wireless > WMM Setup

Wi-Fi Multimedia (WMM) is a Wi-Fi Alliance interoperability certification, based on the IEEE 802.11e standard. It provides basic Quality of service (QoS) features to IEEE 802.11 networks. WMM prioritizes traffic according to four Access Categories (AC) - voice, video, best effort, and background. It is suitable for simple applications that require QoS, such as Voice over IP (VoIP) on Wi-Fi phones (VoWLAN).

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

24

※Note: only trained and professional person can adjust the parameters in WMM Step.

Wireless > Bandwidth Control

Profile ID There are 20 bandwidth control profiles can be configured for administration.

Mode Downstream and upstream data rates for subscriber or the client devices connecting to AP can be defined here. There are two bandwidth limit types in system. Both mode (UL+DL Limit Rate) consolidates download and upload rate of each single client connection. UL/DL mode (UL/DL Limit Rate) specifies download and upload rate of client connections. Once the bandwidth limit is enabled, the limitation applies to all clients that connect to the AP.

Wireless > Advance Setup

CPE Setup system allow user to assign **one wireless station interface to be a CPE device of AP interface (including 3rd party AP device)**

Secondary AP Link Setup

When a radio running wireless station mode, user can set secondary AP link to be a backup of main link.

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

26

3-4 Administration

THE MULTI-MIMO OFDM OUTDOOR RADIO series provide system management in menu partition: Administration, Which includes configuration file management, password maintaining and SNMP setup.

Administration > Management
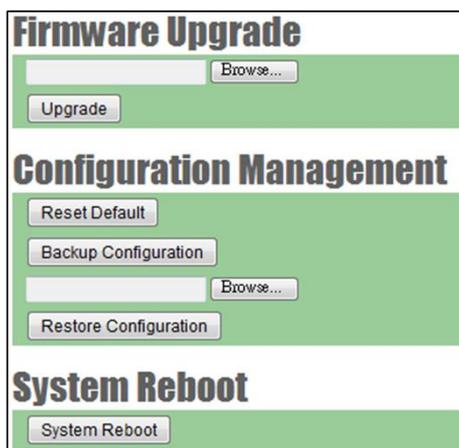
Firmware Upgrade Upload a new firmware file to device to keep system running by the latest bug fixed version of firmware.

Configuration Management user would like to save the configuration of device to local PC by click "Backup Configuration". Once hardware damage happened, administrator can restore a saved configuration file to a new hardware without any reconfiguration. "Reset Default" allows administrator to reload the system to factory default.

System Restart Click the "System Reboot" button will help to warm start the system.

Administration > Login Password
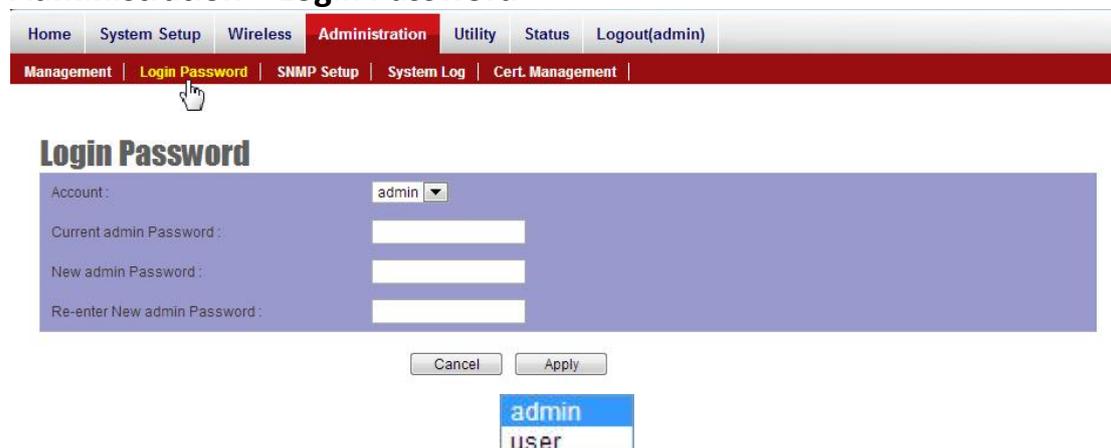
System allows administrator to change the "admin" and "user" login password in menu partition: "Login Password".

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

27

Administration > SNMP Setup

THE MULTI-MIMO OFDM OUTDOOR RADIO series support both SNMP V2 and V3. The configurable items show below:

System Location A description notes the device location.

System Contact A description notes the device maintaining information.

System Name A description notes the given name of device.

SNMP V3

RW User Name Read and write authority login ID.

RW User Password Read and write authority login password.

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

28

RO User Name Read only authority login ID.

RO User Password Read only authority login password.

AUTH method Choose the user authentication method.

ENC method Choose the SNMP data encryption method.
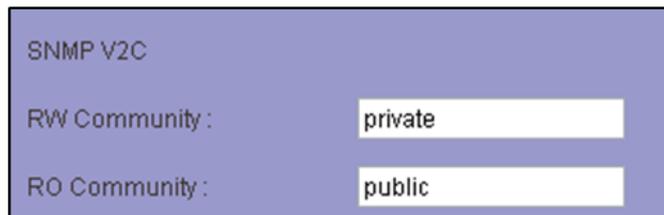
SNMP V2C

RW Community Read and write authority community stream.

RO Community Read only authority community stream.

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

29

3-5 Utility

THE MULTI-MIMO OFDM OUTDOOR RADIO series provide various software utilities helping administrator to do the network status survey.

Utility > Ping

Graphical display helps administrator to get the responding time changes of target IP address. Insert the remote host IP address, packet size and number in field than press **Ping**, system will show the result on page. The result presenting can be adjusted by different choosing of graphic scale.

Utility > RSSI Calculator
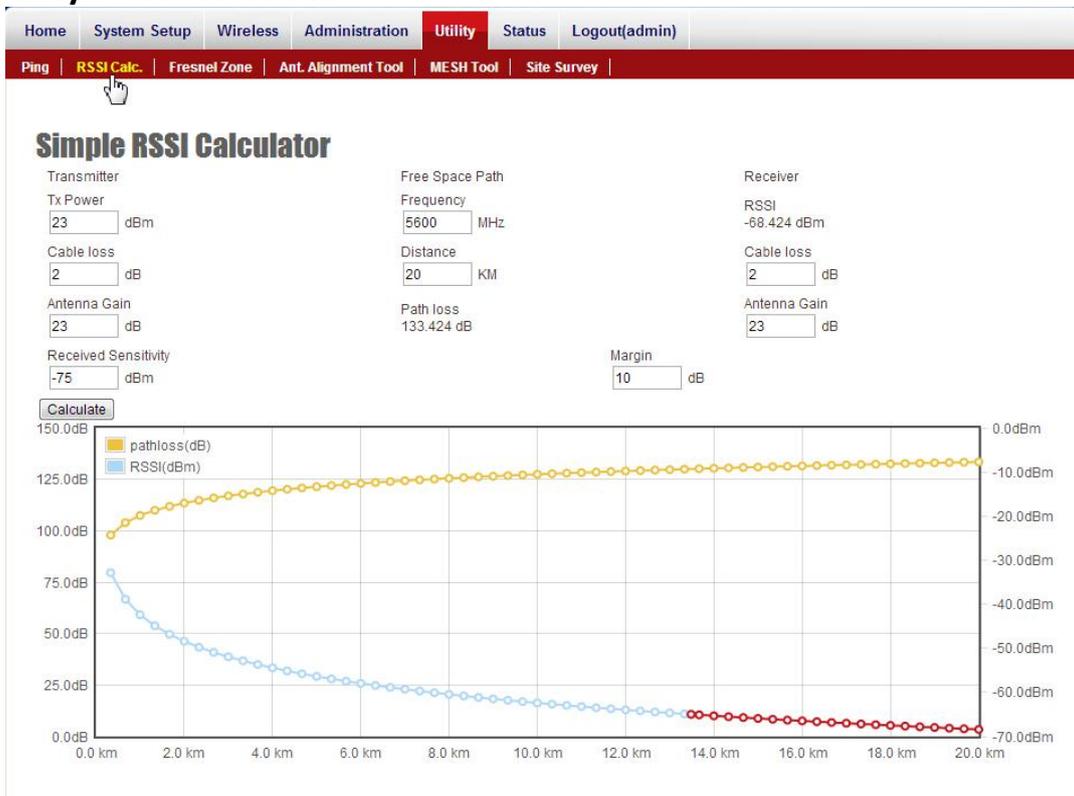
Simple RSSI Calculator helps to estimate a possible RSSI and path loss by known device Tx power (transmission power), cable loss, antenna gain and frequency both transmitting and receiving side. Graphic displaying shows changes of path loss and RSSI.

Utility > Fresnel Zone
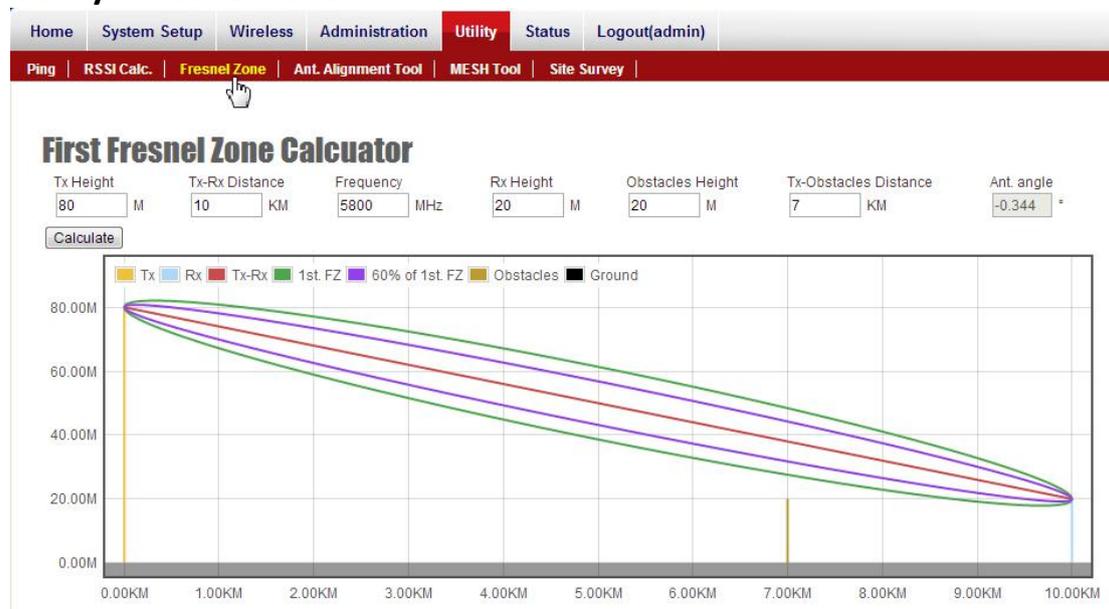
The First Fresnel Zone Calculator is a tool that helps you to estimate the possible obstruction from existing object between two devices before the wireless installation. An *antenna angle* calculation can also help you to aligning the vertical angle of the directional antenna.

Utility > Antenna Alignment Tool

In order to lift efficiency of antenna aligning, THE MULTI-MIMO OFDM OUTDOOR RADIO series provide a software alignment tool helping the installers to align and check the antenna directions. It will require triggering the function both access point and wireless station (AP Client) side. It means that both access point and wireless station (AP Client) side should be The Multi-MIMO OFDM outdoor radio product, otherwise, the function doesn't get properly use.

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

31
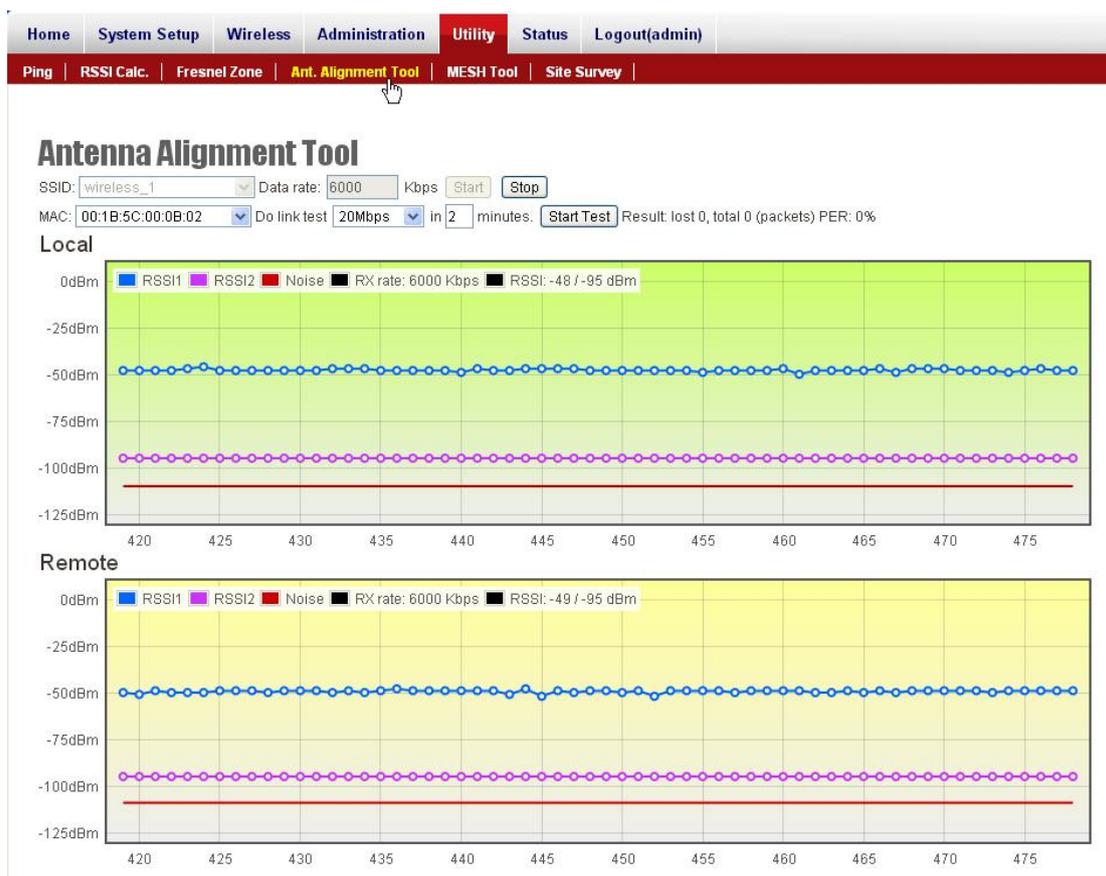
Choose the SSID which you are going to do the antenna aligning and click the **Start** button both access point and wireless station (AP Client) side to start the antenna alignment. You will able to see the RSSI changes in figure. Try to adjust the directional antenna's horizontal and vertical angle to get the best RSSI level.

Link Test

A **Link Test** is additional tool base on Antenna Alignment Tool active status. When you start the Antenna Alignment Tool, you may set a target throughput to active the **Link Test** to estimate the packet error rate.

Choose a target throughput and test duration than click Start Test button. System will generate a test data transmission to calculate the packet error rate.

An **Rx rate** shows the best data rate you can reach under the current RSSI level.
Link Test Tool can also help you to do the fine tuning of your antenna direction.

Utility > Site Survey
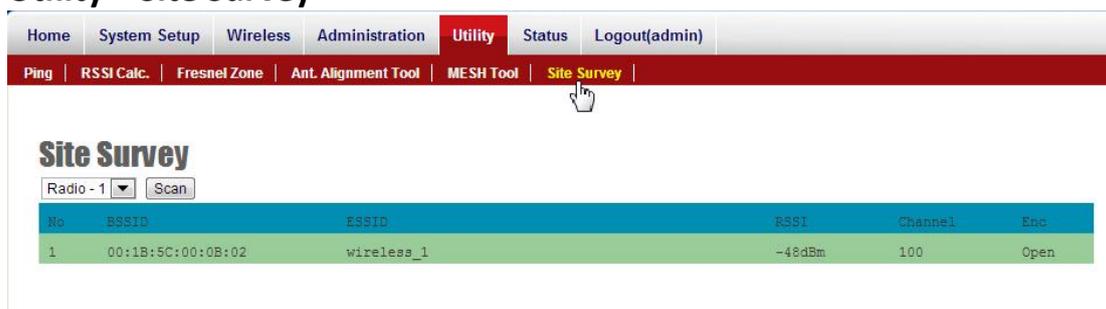
In wireless site survey, system provides a signal scan function to detect any available wireless signal around the AP. It will help AP installer to clarify the environment. Choose a radio interface which you are going to do the survey on device and click *Scan* button. After few seconds, system will show the APs around the device.

3-6 Status

Status > System Information

System Information summarizes all the configuration and hardware information of the device.

Status > System Status

Real-time link statuses of all interfaces are shown in the menu.

System Up Time Display how long THE MULTI-MIMO OFDM OUTDOOR RADIO has been operating since last boot-up.

Interface Status Indicate the interface is ENABLE or DISABLE.

Link Rate Data Link Rate here indicates the maximum transmission rate available, and can be used as an indication of link quality.

Link Quality A Calculation of RSSI, signal and noise level to indicate the quality of the communication link in percentage.

Channel The channel used by the wireless interface.

Signal Level A -70 ~ -50dBm signal level is recommended for a good connection. Too low a signal, the wireless link between AP and AC cannot be established. Too high a signal level, the power amplifier at the receiver might be forced to operate in saturation region and distorts the signal waveform.

In order to help user's reading of the changes, system also provide a graphic interface to trace the items' changes. Click the ***Graphic Display*** button on the top left of the

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

34

page, graphic mode will show on your browser.

Status > Connecting Nodes Information

All the connecting clients' MAC address will be display in Connecting Nodes Information, including signal and data rate. The result shows information only when WLAN was configured as Access Point mode.

Graphic display is also available for observing the changes.

Status > Connecting AP Information

In the "Connecting AP Information" page, RSSI, Rx rate, Tx rate and etc. are provided for verification of wireless link status.
Graphic display is also available for observing the changes.
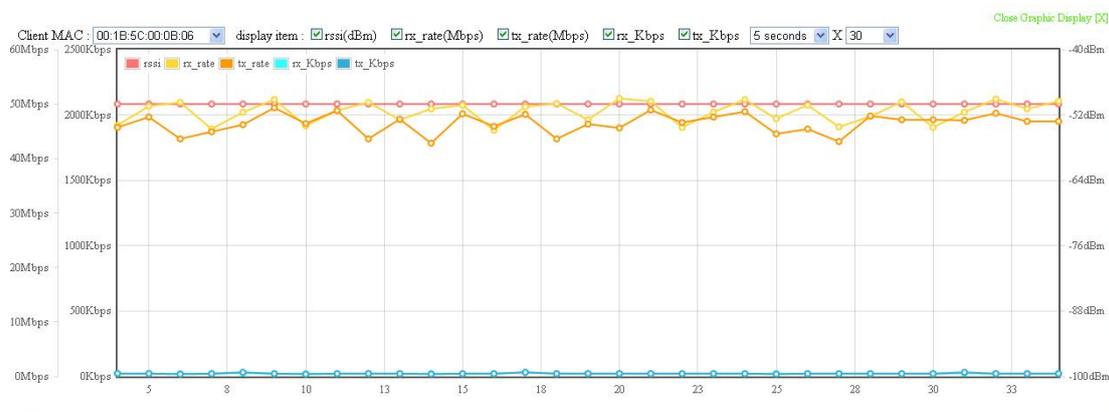
Hardware reset

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. 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

Reset button of the radio

Appendix A: Trouble shooting

This Appendix helps you to isolate and solve the problems with the E-Rake Series– Multi-MIMO OFDM outdoor radio. Before you start troubleshooting, it is important that you have checked the details in the product user manual and QIG.

In some cases, rebooting the unit clears the problem. If the radio still can't work well, please try to contact your local vendor or supplier.

General Descriptions

To successfully use the radios, engineers must be able to troubleshoot the system effectively. This section will show you how an E-Rake Series– Multi-MIMO OFDM outdoor radio could be analyzed in the case of "no link," usually, we thinks that the link is down because there is no traffic being passed. The four main reasons that a link may not work are list as below:

- ■ Configuration
- ■ Path issues (such as distance, obstacles, RF reflection…)
- ■ Personal reasons (careless mounting or the incorrectly connection.)
- ■ Hardware (includes the radio, cable and connectors…etc. In few cases, the radio will conflict with the laptop or PC)
- ■ Environment (anything that is outside the equipment and not part of the path itself)

After verified the correct configuration, double-checked the path terms, ensure no personal reasons and the hardware works well in the office, but the user still report that the link does not work. Most likely, the problem reported is caused by the environment or by improper tests to verify the connection. Assumes that the test method, cabling, antennas, and antenna alignment have been checked, (Always ensure this before checking the environment.) then you can do the follow to check the environment.

General Check

Two general checks are recommended before taking any action:

- ■ Check whether the software version at both sides is the most current
- ■ Check for any reported alarm messages in the Event Log

Analyzing the Spectrum

The best way to discover if there is a source of interference is to use the spectrum analyzer. By turning the antenna 360 degrees, you can find out which direction is the interference coming from. it will also show the frequencies and the level of signal is detected.

Avoiding Interference

When a source of interference is identified and when the level and frequencies are known, the next step is to avoid the interference. Some of the following actions can be tried:

- ■ Change the RF channel to the one away from the interference source
- ■ Change the polarization of the antenna; try to change to a polarization different

HYPERCABLE sarl   74 Avenue Paul Sabatier ZA de la Coupe 11.100 Narbonne   Tel : +33 (0) 4 68 70 91 75 - Fax : 04 68 70 91 76
Mail : info@hypercable.fr - N° SIRET : 384 007 894 00023 – Code TVA CEE: FR90384007894 - www.hypercable.fr

37

from the interferer.

- A small beam antenna may helps. (Such as some grid or dish antenna, align the antenna in to the particular direction will reduce the affects from the interference source) This solution cannot help when the source of interference is right behind the remote site.

Before checking for interference, ensure all the hardware works well and configurations are correct. The path analysis, cabling and antennas should be checked as well.

Connection Issues

This section describes several common troubles the customer might have while setting the radios.

Radio Does Not Boot

When the Radio does not Boot, do the following steps to check your whole system:

1. Ensure that the power supply is properly working and correctly connected.

2. Ensure that all cables are workable and connected correctly.

3. Check the power source.

Cannot use the Web Interface

If the radio boot, but can't enter it via the Web site.

1. Open a command prompt window and enter **ping <ip address unit>** (for example: **ping 192.168.1.1**). If there is no response from the radio, make sure that you the IP address is correct. If there is response, the Ethernet connection is working properly, do the next step.

2. Make sure that you are using one of the following Web browsers:

- Microsoft Internet Explorer version 5.0 or later

3. Ensure that you are not using a proxy server for the connection with your Web browser.

Double-check the physical network connections (includes the cables and the connectors). Use a well-known unit to ensure the network connection is properly functioning.

Configuration Issues

The following problems relate to setup and configuration problems.

Some basic configurations might make the link fail, below are the major ones:

- RF Channel
- Group name
- IP address
- Rule of MAC address filter
- Rule of security settings (such as WEP or WPA)

If the links of the two radios works within close distance of each other, then there are two

possible reasons why wireless connectivity is not possible while the E-Rake Series–
Multi-MIMO OFDM outdoor radio are at their desired locations:

- RF path, for example, a bad antenna alignment, the tower is not tall enough when the radios are installed in a long distance or the connector do not attachment well...etc (these are the most common problems in installations)

- Interference problem caused by a high signal level from another unit. The interference can be checked by changing the frequency and then see if another channel works better. Or you can change the polarization of the antenna as a way of avoiding the interfering signal. To know in advance how much interference is present in a given environment, a Spectrum Analyzer can be attached to a (temporary) antenna for measuring the signal levels on all available Channels.

If the link still not works after resetting the configurations, checking the connectors and cables, double-check the path and environment issues, then the problem is possible a hardware problem. Acquiring a third radio and then testing it amongst the existing units will help to find out the broken unit.

Please contact your local vendor for advance technical support.