



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

SkyMesh HYCNL1051B-37

Lite 5GHz 2x2 MIMO HT-OFDM Radio PTP Bridge / PTMP CPE



User Manual

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



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$



Recommandations Générales à la gamme Sky-Mesh

ATTENTION NE PAS METTRE SOUS TENSION SANS QUE L'EQUIPEMENT NE SOIT RACCORDE A UNE ANTENNE VERIFIEE OU A UNE CHARGE FICTIVE DE 0.5 à 5 WATTS 50 OHMS SELON LE TYPE DE MODEM.

ATTENTION A LA POLARITE DU 48 VDC NE PAS UTILISER DE POE AUTRE QUE CELUI FOURNI.

Attention, vérifiez en vous connectant aux antennes préinstallées, avec l'aide d'un analyseur de spectre à mémoire que le canal radio que vous allez choisir dans la bande utilisée (445-505 MHz , 2.4-2.5 GHz, 4.8-6.2 GHz) n'est pas occupé par une porteuse d'un niveau supérieur à -70 dBm (par exemple -60 dBm est un niveau supérieur à -70 dBm) dans tous les cas choisir la zone de votre canal ou les niveaux parasites mesurés sont les plus faibles.

Manuel du Montage de l'antenne et du modem radio :

- Attention, le modem radio ayant changé le montage du modem est légèrement différent le support du modem est devenu aussi un capot protecteur.
- Impératifs techniques de pose [ICI](#)
- Montage antenne [ICI](#)
- Montage cablage réglages Modems [ICI](#)



- **Attention** certains modèles ont pour le pointage et a la place des écouteurs un Barled indiquant sur la CPE le niveau auquel est reçu le CPE par la station de base distante, si le pointage est fait par une seule personne qui doit se déplacer d'un point a un autre il faudra inverser les fonctions base station et CPE lors du pointage afin de bénéficier du visuel du barled sans avoir a se déplacer du côté opposé. Si le pointage est fait par deux personnes en liaison radio la personne coté "base sation" demandera a la personne coté CPE quel est l'affichage obtenu selon le pointage azimutal en cours.
- **Attention** de ne pas pointer sur un lobe secondaire de l'antenne.

- Notice de montage des modems sur les antennes [ICI](#)
- Vérifiez le contenu des cartons associés aux Modems et ne pas jeter les cartons sans les ouvrir entièrement. Conserver les cartons emballages pour les retours sous garantie, les CD et manuels sont dans chaque Modem radio en cas de doute téléphoner au 06 82 82 38 73 ou ayez recours a un spécialiste [installateur certifié](#) pour la pose et configuration des radio Hypercable.



WARNING ATTENTION selon le découplage des antennes et la largeur du canal en version 4x4 le canal CH1 2x2 doit être éloigné du canal Ch2 2x2 de 200 Mhz à 400 Mhz par exemple CH1 sur 5700 MHz et Ch2 sur 5300 MHz pour des antennes omnidirectionnelles découplées dans le plan vertical afin d'éviter interférences et désensibilisation. En cas d'impossibilité des filtres de bande doivent être prévus.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Copyright

Copyright © 2015 all rights reserved. No part of this publication may be reproduced, adapted, stored in a retrieval system, translated into any language, or transmitted in any form or by any means without the written permission of the supplier.

About This Manual

This manual includes install, configuration and trouble shooting for the 5GHz 4x4 MIMO HT-OFDM MESH 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.

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.



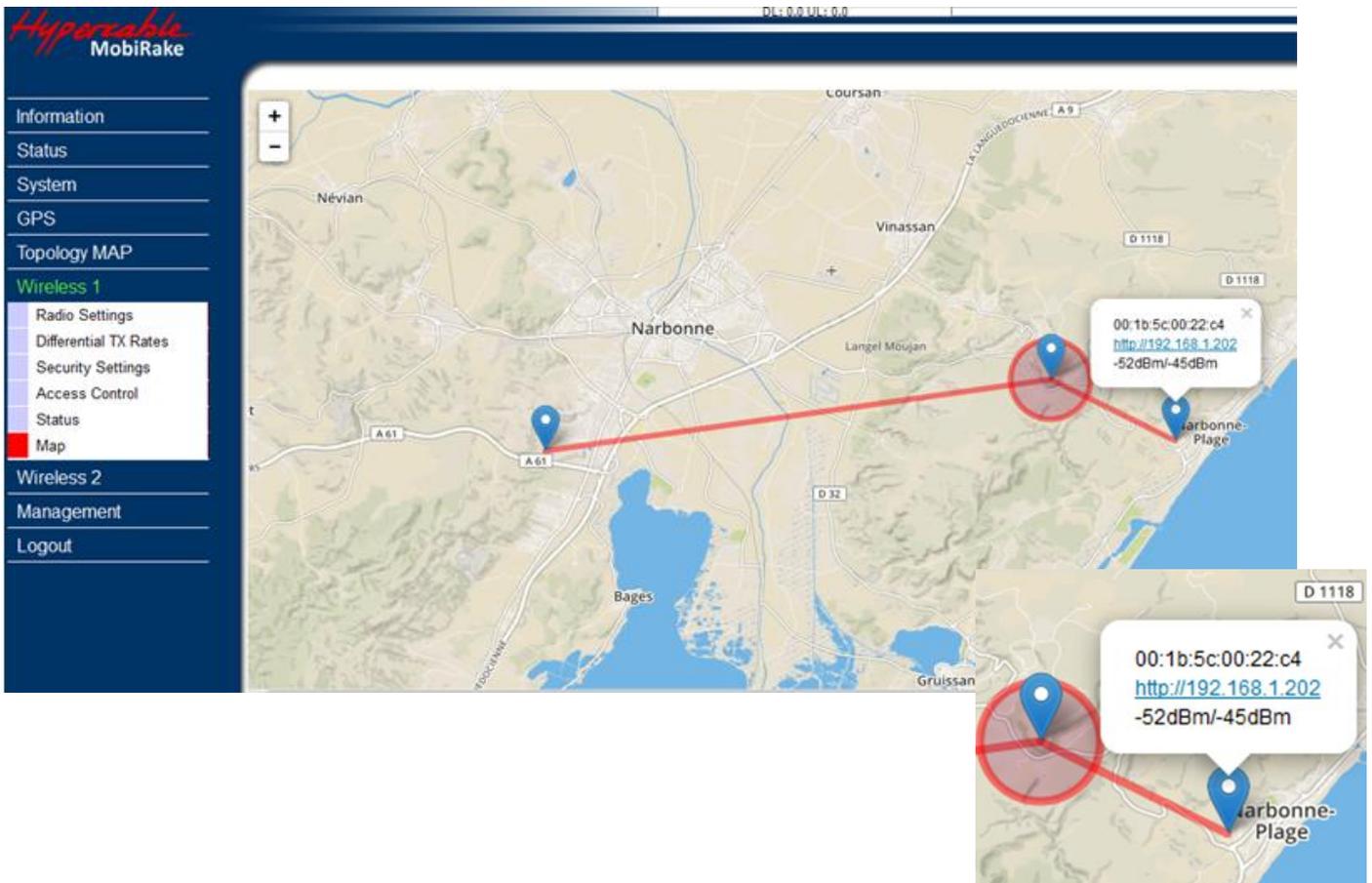
This warning symbol means **danger**. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Table of Contents

- CONVENTIONS3**
- CHAPTER 1 INTRODUCTION.....5**
 - 1-1 FEATURES AND BENEFITS 5
- CHAPTER 2 HARDWARE INSTALLATION.....7**
 - 2-1 PRODUCT KIT 8
 - 2-2 SYSTEM REQUIREMENTS 8
 - 2-3 MECHANICAL DESCRIPTION 9
 - 2-4 HARDWARE INSTALLATION..... 10
- CHAPTER 3 CONFIGURATION..... 16**
 - 3-1 START-UP AND LOG IN 16
 - 3-2 WIRELESS SETUP 23
 - 3-3 MANAGEMENT 29
 - 3-4 LES AVANTAGES DU CONCEPT DE CANALISATION 33





$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

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. It utilizes coordinate and internet map database to show the environment and status of the link. Customers can easily figure out the linking situation of the deployed radios.

There are 14 channel BW (3.5/4/5/6/7/8/10/12/14/15/20/30/40/52 MHz) options can be selected easily by software. This feature provides the flexibility of deployment channel plan in high density city area or high capacity wireless bridge in short distance -- throughput up to 170 Mbps.

This Lite 5GHz 2x2 MIMO HT-OFDM Radio has powerful security mechanism such as: WPA-PSK (TKIP) / WPA2-PSK (AES128) plus the proprietary protocol. The adjustable TDMA polling protocol makes the performance of PTMP more efficiency and reliable.

1-1 Features and Benefits

● Effective spectrum utility / variable capacities with 14 channel BWs

This radio has 14 channel bandwidths (3.5/4/5/6/7/8/10/12/14/15/20/30/40/52 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.

● Proprietary Security

This radio uses proprietary protocol, which means other standard wifi products can't connect to this radio. It also provides WPA-PSK (TKIP) / WPA2-PSK (AES128) and unique channel frequency to build the highest security mechanism to prevent the malicious attacking from the internet.

● TDMA Polling protocol

The adjustable polling parameters of TDMA polling protocol allow customer to fine tune the performance of PTMP application base on the wireless environment. That improved the reliability of the PTMP system.

● FEATURES

- Provides the easy installation and high performance outdoor PTP / PTMP wireless Ethernet Network (With integrated antenna).
- Transmit Power Control :



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

max
75% of max (-1dB)
60% of max (-2dB)
50% of max (-3dB)
40% of max (-4dB)
30% of max (-5dB)
25% of max (-6dB)
20% of max (-7dB)
16% of max (-8dB)
12% of max (-9dB)
10% of max (-10dB)
min

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

- Built-in NMS with GPS Coordinates and Internet map database 5 bits/s/Hz amazing spectral efficiency.
- Network Architecture:
 - P-T-P Bridge
 - P-T-MP CPE
- Fast Seamless Roaming
- IEC61000-4-5 Surge Protection
- IP-68 Water & Dust Resistant

This radio has 14 channel bandwidths (3.5/4/5/6/7/8/10/12/14/15/20/30/40/52 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)	2.5	3	3.5	4	5	6	7	8	10	15	20	30	40	52
Real TCP throughput (Mbps)	12	14	17	20	25	30	35	40	51	77	104	158	215	268
Application area	Valuable spectrum				Crowded urban						Rural			



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Chapter 2 Hardware Installation

This chapter describes initial setup of the 5GHz 4x4 MIMO HT-OFDM MESH Radio

Warnings



In order to comply with international radio frequency (RF) exposure limits, dish antennas should be placed 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.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$



The Lite 5GHz 2x2 MIMO HT-OFDM 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.



Follow the guidelines in this chapter to ensure correct operation and safe use of the 5GHz 2x2 MIMO HT-OFDM Radio.

2-1 Product Kit

Before installation, make sure that you the following items:

- Lite 5GHz 2x2 MIMO HT-OFDM 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 kitx 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 Lite 5GHz 2x2 MIMO HT-OFDM 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 SFTP or SFTP networking cable. (From the radio to POE)
- A Web browser for configuration: Google Chrome or Microsoft IE 10.0 or later.
- Installing TCP/IP protocol to the computer.

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

2-3 Mechanical Description

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



Lite 5GHz 2x2 MIMO HT-OFDM Radio Figure

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	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.
3	Grounding stud	Connect to the ground conductor with the ground wire.
4	LED Indicator	LED indicators of the RSSI Strength information.



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.

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

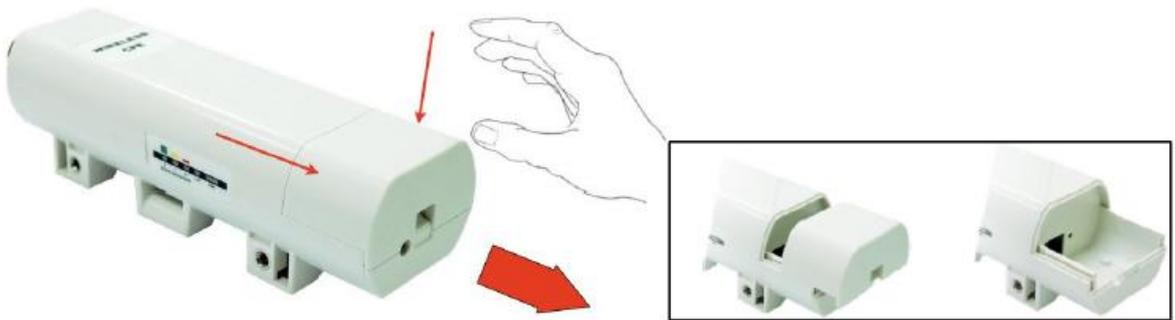
2-4 Hardware Installation

The Lite 5GHz 2x2 MIMO HT-OFDM 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.
- 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.



Move the Cover



Slide the cover back to seal the bottom of the CPE.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

The Lite 5GHz 2x2 MIMO HT-OFDM Radio is equipped with a grounding wire. It is important that the Radio, cables, and PoE Injector must be properly connected to earth ground during normal use against surges or ESD.



Put the grounding wire on the grounding point at the bottom of the Lite 5GHz 2x2 MIMO HT-OFDM Radio. Then screw the grounding wire to tighten up and connect it to the earth ground.

Power Up

1. Connect power cord to the PoE injector as the following right picture shows.



2. Connect the Ethernet cable that connects the Lite 5GHz 2x2 MIMO HT-OFDM Radio to the “POE” port of the PoE injector as figured below.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$



3. Connect the power plug to a power socket. The Lite 5GHz 2x2 MIMO HT-OFDM Radio will be powered up immediately.



Configure and verify the 5GHz 4x4 MIMO HT-OFDM 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.

Connect to the Lite 5GHz 2x2 MIMO HT-OFDM Radio

To be able to configure and manage the Lite 5GHz 2x2 MIMO HT-OFDM Radio, please do the followings:

1. Open the ferrite core by unsnapping the connector latches. The core will open, revealing a concave surface



2. Lay the Ethernet cable into the core, usually within 2 to 3 inches of the connector. You may have to experiment with the final location depending on the effectiveness of the high frequency abatement.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$



3. Loop the cable around and through the core. This helps "lock" the core in place, and may be required in circumstances with severe interference.



4. Close the core and snap the halves back together.



5. Connect the Ethernet cable with suppression core to the "Data In" port of the PoE injector.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$



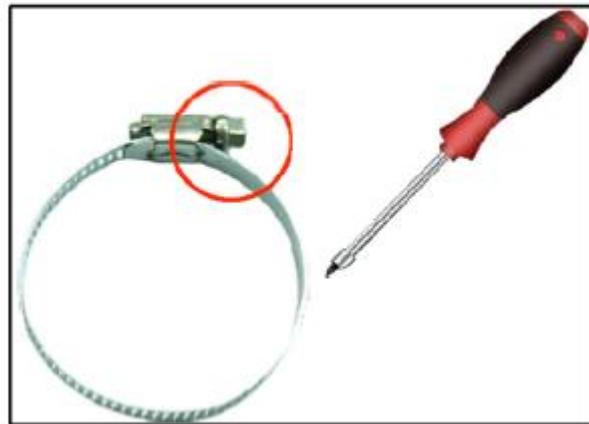
6. Connect the other end of Ethernet cable to a PC or a switch hub. The hardware installation is complete.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Mount the AP on a Pole

1. Turn the Lite 5GHz 2x2 MIMO HT-OFDM Radio over. Put the pole mounting ring through the middle hole of it. Note that you should unlock the pole mounting ring with a screw driver before putting it through the device as the following right picture shows.



2. Mount the Lite 5GHz 2x2 MIMO HT-OFDM Radio steadily to the pole by locking the pole mounting ring tightly.





$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Chapter 3 Configuration

3-1 Start-up and Log in

In order to configure lite 5GHz 2x2 MIMO HT-OFDM 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.

The image shows a login interface with a dark blue background. There are two input fields: 'Name' with the text 'admin' and 'Password' with a masked password '.....'. Below the fields are two buttons: 'Login' and 'Reset'.

After you have logged-in the main page, the **Information, Status, MAP, System, Mesh, Wireless 1&2, 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 Network 1, Wireless Network 2 and Wired Network**



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Long Distance Backhaul

Information

Status

MAP

System

Wireless

Management

Logout

Information

General Information

Device Name	DEVICE010B6C
Device Uptime	11:31:59
Firmware Version	MiniOS v1.3.1RC10
Firmware Build Time	Sep 7 2016 13:48:58
Product Key	LP0XE-DL11L-ATEDQ-YBFZ0
License	Level 2
Hardware Version	G7

Network Information

IP Address	192.168.1.247
Subnet Mask	255.255.255.0
Gateway Address	192.168.1.254

Wireless Network

MAC Address	00:22:c3:01:0b:6c
Frequency Band	5380.000 MHz ~ 5900.000 MHz
Operation Mode	CPE
Network Name	Wireless
Frame Schedule Policy	Managed
Channel Bandwidth	20MHz
Channel Frequency	Auto
TX Data Rate(SS)	SS BPSK 1/2 ~ SS 64QAM 5/6
TX Data Rate(DS)	SS BPSK 1/2 ~ DS 64QAM 5/6
Coverage Range	Auto

Wired Network

MAC Address	00:22:c3:01:0b:6d
Speed	100.0 Mbps

Long Distance Backhaul

Information

Status

MAP

System

Wireless

Management

Logout

Status

System

Current time: Wed 2016/09/07 17:18:07
Coordinates: LatLng(0°0'0.00"N, 0°0'0.00"E), Altitude:0.00 m

Wireless

Status: CPE mode enabled
Channel: 5400.000MHz
Bit Rate: 130 Mbps
Associated: 1

N	MAC Address	IP Address	Local RSSI	Remote RSSI	TX Rate	RX Rate	TX Modulation	RX Modulation
1	00:1b:5c:00:28:5d	192.168.1.246	-44/-44	-48/-45	129.96Mbps	130.00Mbps	DS 64QAM 5/6	DS 64QAM 5/6

Port Statistic

Wireless: 130 Mbps, Half Duplex

	Total bytes	Total packets	Unicast packets	Multicast	Errors	Dropped
Sent	7,297,490	76,263	76,263	0	0	0
Received	12,682,686	138,461	57,641	80,820	0	0

Ethernet: 100 Mbps, Full Duplex

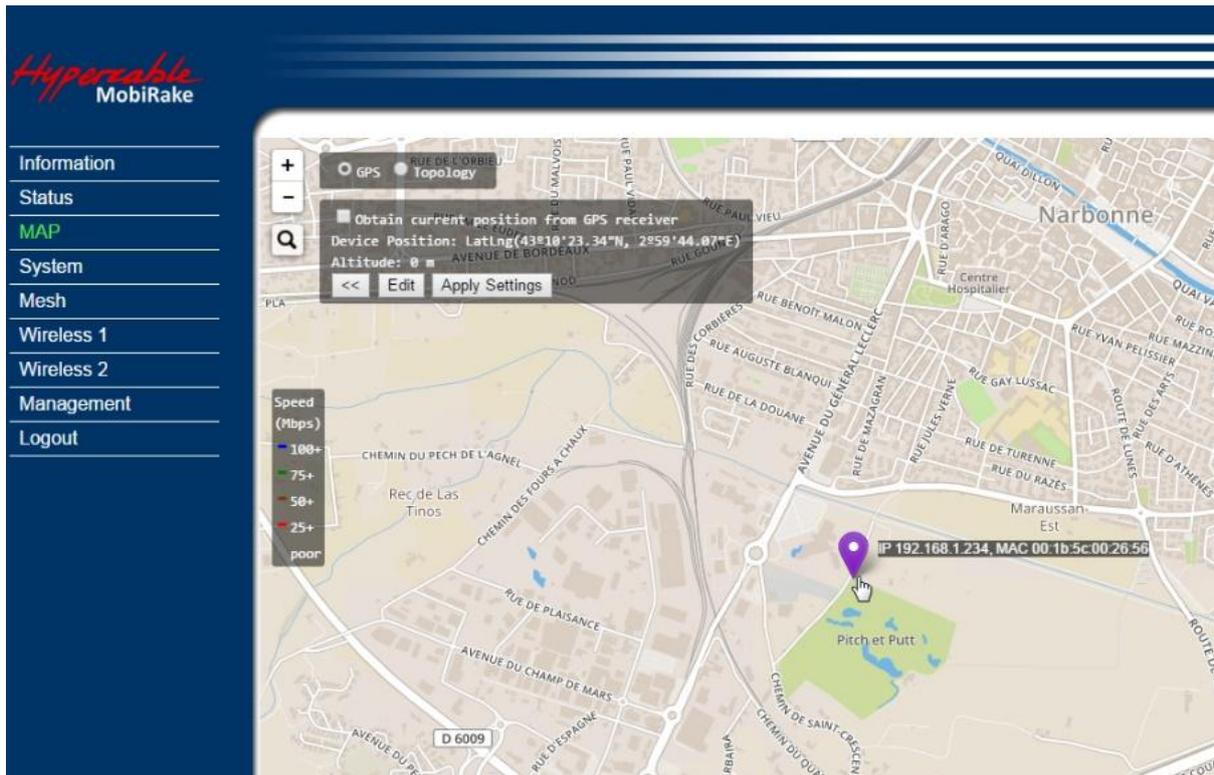
	Total bytes	Total packets	Unicast packets	Multicast	Errors	Dropped
Sent	10,448,244	124,599	42,701	81,898	0	0
Received	3,973,446	48,599	42,681	5,918	0	0

Status

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Map

The MAP page shows the **location / IP address / MAC address** of your radio, **GPS coordinates info**, and **Topology Status** of PTP/PTMP. 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.



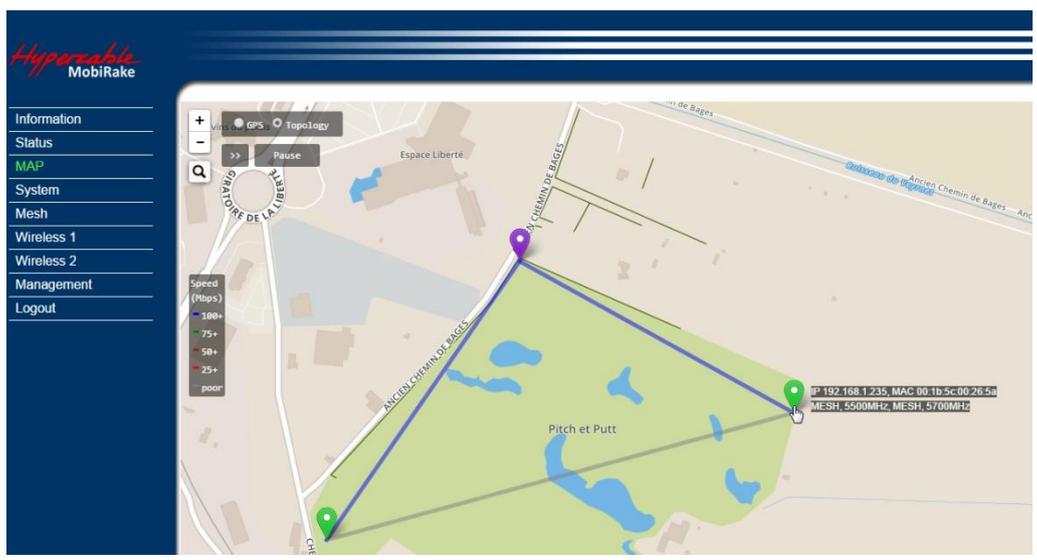
There are 2 ways to set the location of the radio.

- 1 Enter the coordinates manually (this can also be done in **System / Basic Setup**) or
- 2 Drag the location mark of the radio to anywhere in the map you want..

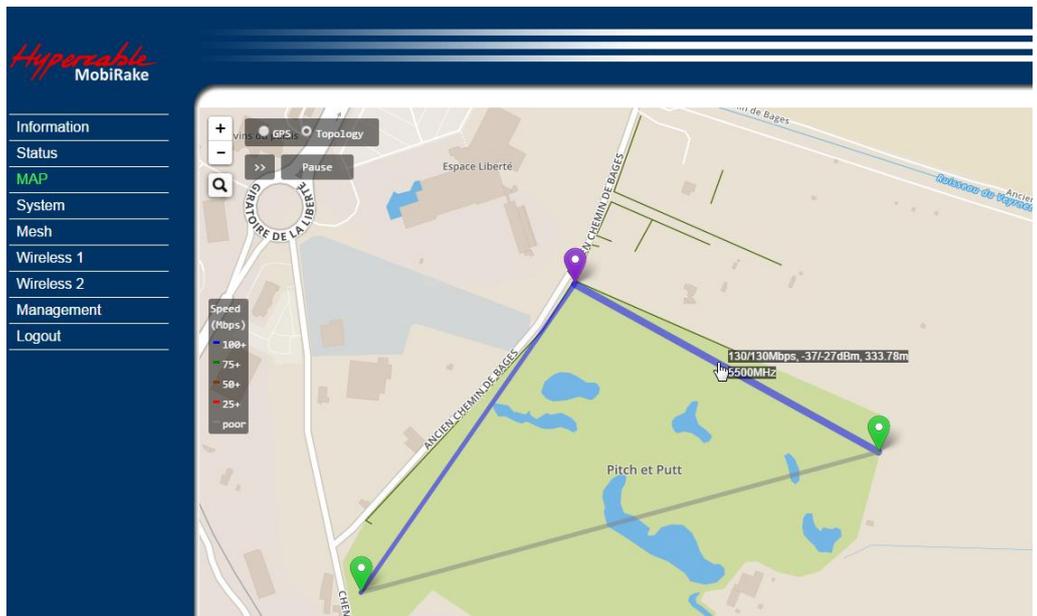


$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

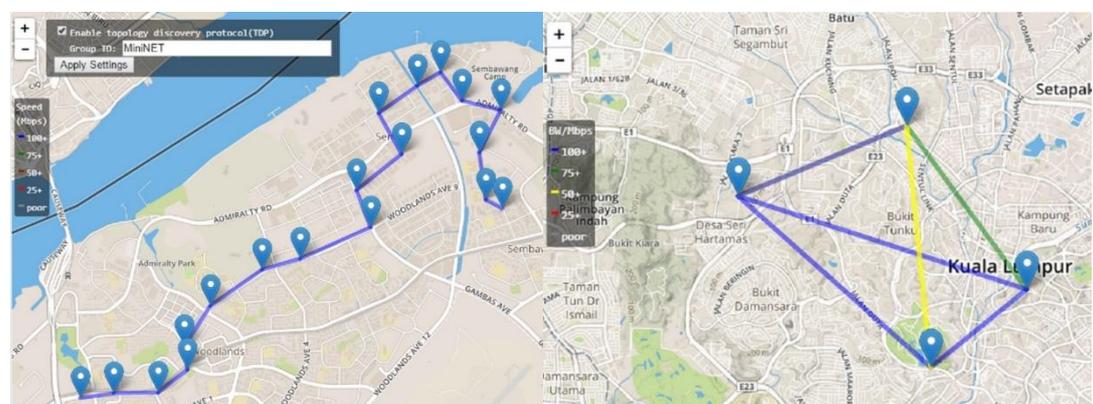
MAP – Topology



Topology Map – Radio info (IP address/ MAC / operating mode & Frequency)



Topology Map – Link status (Data rate / RSSI / Distance / Frequency)

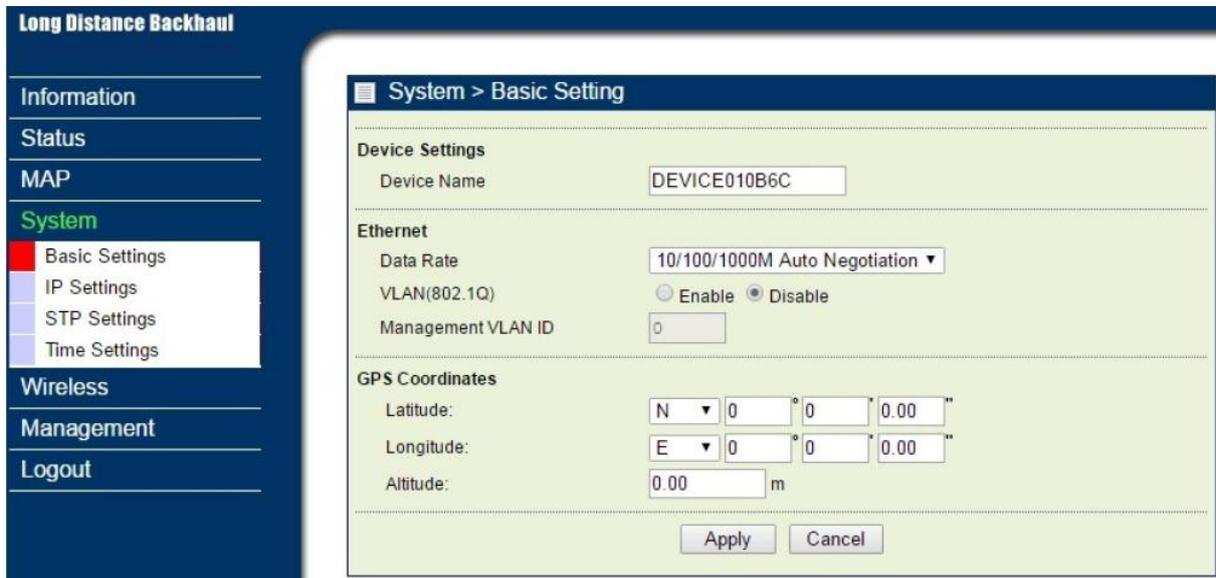


Topology Map – Multi-hops repeating Topology Map – Mesh Network



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

System / Basic Setup



The **Device Name** is used to give a name to your 5GHz 4x4 MIMO HT-OFDM MESH Radio. This will enable you to manage your radio more easily if there are many radios in your network.

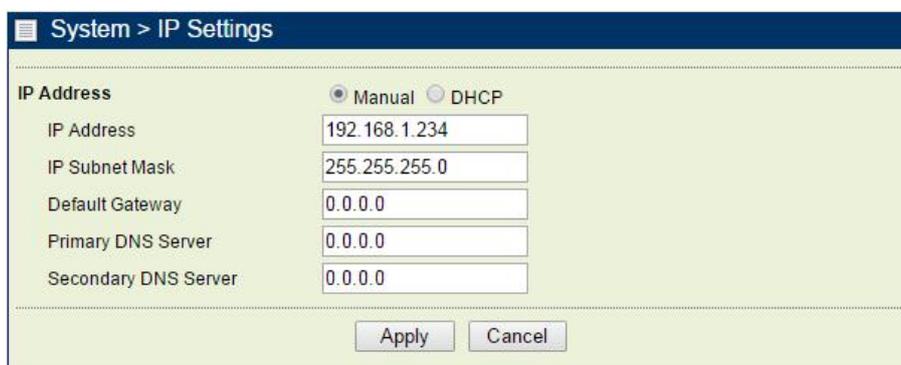
Ethernet Data Rate: you can choose the Ethernet data rate of this radio.

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 5GHz 4x4 MIMO HT-OFDM MESH Radio's location, and click apply, radio will get the map from internet automatically.

If your radio type support integrated GPS module, you can 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 Lite 5GHz MIMO HT-OFDM Outdoor radio (Default: 192.168.1.1).



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

IP Subnet Mask: The Lite 5GHz 2x2 MIMO HT-OFDM 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 Lite 5GHz 2x2 MIMO HT-OFDM Radio will use this value for default Gateway.

Primary DNS Server: The Lite 5GHz 2x2 MIMO HT-OFDM Radio will use this value for primary Domain Name Server.

Secondary DNS Server: The Lite 5GHz 2x2 MIMO HT-OFDM Radio will use this value for secondary Domain Name Server.

System / STP Settings

The screenshot shows a configuration window titled "System > STP Settings". It is divided into two main sections: "Bridge Function" and "Spanning Tree Protocol (STP)".

- Bridge Function:**
 - Ageing Time (2-300): 15 seconds
- Spanning Tree Protocol (STP):**
 - Enable (checked) / Disable (unchecked)
 - Bridge Priority (0-65535): 32768
 - Hello Time (1-10): 2 seconds
 - Max Age (6-40): 20 seconds
 - Forward Delay (4-30): 15 seconds

At the bottom of the window are "Apply" and "Cancel" buttons.

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.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

System / 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:

- | | |
|--|---|
| (GMT-12:00) International Date Line West | (GMT-03:00) Buenos Aires, Georgetown |
| (GMT-11:00) Midway Island, Samoa | (GMT-03:00) Greenland |
| (GMT-10:00) Hawaii | (GMT-02:00) Mid-Atlantic |
| (GMT-09:00) Alaska | (GMT-01:00) Azores |
| (GMT-08:00) Pacific Time (US & Canada); Tijuana | (GMT-01:00) Cape Verde Is. |
| (GMT-07:00) Arizona | (GMT) Casablanca, Monrovia |
| (GMT-07:00) Chihuahua, La Paz, Mazatlan | (GMT) Greenwich Mean Time: Dublin, Edinburgh, Lisbon, London |
| (GMT-07:00) Mountain Time (US & Canada) | (GMT+01:00) Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna |
| (GMT-06:00) Central America | (GMT+01:00) Belgrade, Bratislava, Budapest, Ljubljana, Prague |
| (GMT-06:00) Central Time (US & Canada) | (GMT+01:00) Brussels, Copenhagen, Madrid, Paris |
| (GMT-06:00) Guadalajara, Mexico City, Monterrey | (GMT+01:00) Sarajevo, Skopje, Warsaw, Zagreb |
| (GMT-06:00) Saskatchewan | (GMT+01:00) West Central Africa |
| (GMT-05:00) Bogota, Lima, Quito | (GMT+02:00) Athens, Istanbul, Minsk |
| (GMT-05:00) Eastern Time (US & Canada) | (GMT+02:00) Bucharest |
| (GMT-05:00) Indiana (East) | (GMT+02:00) Cairo |
| (GMT-04:00) Atlantic Time (Canada) | (GMT+02:00) Harare, Pretoria |
| (GMT-04:00) Caracas, La Paz | (GMT+02:00) Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius |
| (GMT-04:00) Santiago | (GMT+02:00) Jerusalem |
| (GMT-03:30) Newfoundland | (GMT+03:00) Baghdad |
| (GMT-03:00) Brasilia | (GMT+03:00) Kuwait, Riyadh |

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.

Time server for a Lan connection to an Orange ADSL router is 192.168.1.1



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

3-2 Wireless Setup

Wireless Setup / Radio

- Information
- Status
- MAP
- System
 - Wireless 1
 - Radio Settings**
 - Differential TX Rates
 - Security Settings
 - Access Control
 - Wireless 2
- Management
- Logout

Wireless 1 > Radio Settings

MAC Address: 00:22:c3:01:00:00

Radio Frequency (RF): Enable Disable

Wireless Bridge Parameters

Operating Mode: Bridge (Point-to-point) ▼

Remote MAC Address: 00:00:00:00:00:00 ▼

Basic Parameters

Modulation: HTOFDM ▼

RF Bandwidth: 40MHz(20MHz+20MHz) ▼

Channel / Frequency: 5010.000MHz ▼

TX Power: max ▼

Robust Mode: Enable Disable

Tx Rates

Single Stream Mode: SS BPSK 1/2 ▼ - SS 64QAM 5/6 ▼

Dual Stream Mode: SS BPSK 1/2 ▼ - DS 64QAM 5/6 ▼

Advanced Parameters

Coverage Range (0-25 Km): 1

RTS Threshold (256-2346): 2346

A-MPDU Aggregation: Enable Disable

A-MSDU Aggregation: Enable Disable

Short Guard Interval (SGI): Enable Disable

Transmission Antenna: Dual Antennas ▼

Apply Cancel

Bridge mode

Long Distance Backhaul

- Information
- Status
- MAP
- System
 - Wireless
 - Radio Settings**
 - Differential TX Rates
 - Security Settings
 - Access Control
- Management
- Logout

Wireless > Radio Settings

MAC Address: 00:22:c3:01:0b:6c

Radio Frequency (RF): Enable Disable

Wireless Bridge Parameters

Operating Mode: CPE ▼

Wireless Network Name: Wireless

Only Base Station Site Survey

Basic Parameters

RF Bandwidth: 20MHz ▼

TX Power: max ▼

Robust Mode: Enable Disable

Roaming

Roaming Mechanism: Enable Disable

Roaming RSSI Threshold (-10 ~ -120): -68 dBm

Roaming RSSI Delta (1 ~ 30): 4 dB

Background Scan Policy: No background scan ▼

Background Scan Period (2 ~ 3600): 10 seconds

BgScan RSSI Changes Threshold (1 ~ 30): 4 dB

BgScan RSSI Threshold (-10 ~ -120): -70 dBm

BgScan Idle Time (0 ~ 15000): 0 ms

BgScan Rest Time (100 ~ 15000): 2000 ms

CPE mode - 1



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Long Distance Backhaul

- Information
- Status
- MAP
- System
- Wireless
 - Radio Settings
 - Differential TX Rates
 - Security Settings
 - Access Control
- Management
- Logout

Channel / Frequency

Active Channels (25)	Inactive Channels (0)
5400.000MHz	
5420.000MHz	
5440.000MHz	
5460.000MHz	
5480.000MHz	
5500.000MHz	
5520.000MHz	
5540.000MHz	
5560.000MHz	
5580.000MHz	

Tx Rates

Single Stream Mode: SS BPSK 1/2 - SS 64QAM 5/6

Dual Stream Mode: SS BPSK 1/2 - DS 64QAM 5/6

Advanced Parameters

Coverage Range(1-55 Km): Auto

RTS Threshold (256-2346): 2346

A-MPDU Aggregation: Enable Disable

A-MSDU Aggregation: Enable Disable

Short Guard Interval (SGI): Enable Disable

Transmission Antenna: Dual Antennas

Receiving Antenna: Dual Antennas

Wireless LEDs: Enable Disable

Apply Cancel

CPE mode - 2

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

Operating Mode:

CPE

Bridge (Point-to-point)

CPE

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

Bridge (Point-to-point)

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

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 3.5 / 4 / 5 / 6 / 7 / 8 / 10 / 12 / 14 / 15 / 20 / 30 / 40 / 52 MHz, default is 20MHz.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

- 3.5MHz
- 4MHz
- 5MHz
- 6MHz
- 7MHz
- 8MHz
- 10MHz
- 12MHz
- 14MHz
- 15MHz
- 20MHz**
- 30MHz
- 40MHz(20MHz+20MHz)
- 52MHz(26MHz+26MHz)

HYCN2051-45: 5 / 10 / 15 / 20 / 30 / 40 / 52 MHz

HYCN1051B-37: 3.5 / 4 / 5 / 6 / 7 / 8 / 10 / 12 / 14 / 15 / 20 / 30 / 40 / 52 MHz

HYCN2051C-45: 2.5 / 3 / 3.5 / 4 / 5 / 6 / 7 / 8 / 10 / 15 / 20 / 30 / 40 / 52 MHz

Roaming Mechanism: Enable/disable the roaming Mechanism

Roaming RSSI Threshold: Trigger of roaming to next BS when the RSSI < than this threshold. But CPE needs to compare the RSSI Delta as well before it jumps to next BS.

Roaming RSSI Delta: Difference of RSSI between two base stations must be bigger than this Delta value, when the RSSI value meet both of the RSSI threshold and Delta, CPE starts it's roaming mechanism.

Background scan policy:

- No background scan**
- Scan periodically
- Scan only when RSSI changes
- Both periodic and RSSI change

Define a proper policy for the mobility environment.

Active / Inactive channels: there will be hundreds available channels in narrow channel BW, we can define the active channel to short the CPE scan period.

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

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



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

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)
25% of max (-6dB)
20% of max (-7dB)
16% of max (-8dB)
12% of max (-9dB)
10% of max (-10dB)
min

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

Dual Antennas
Single Primary Antenna
Single Secondary Antenna

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



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

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).

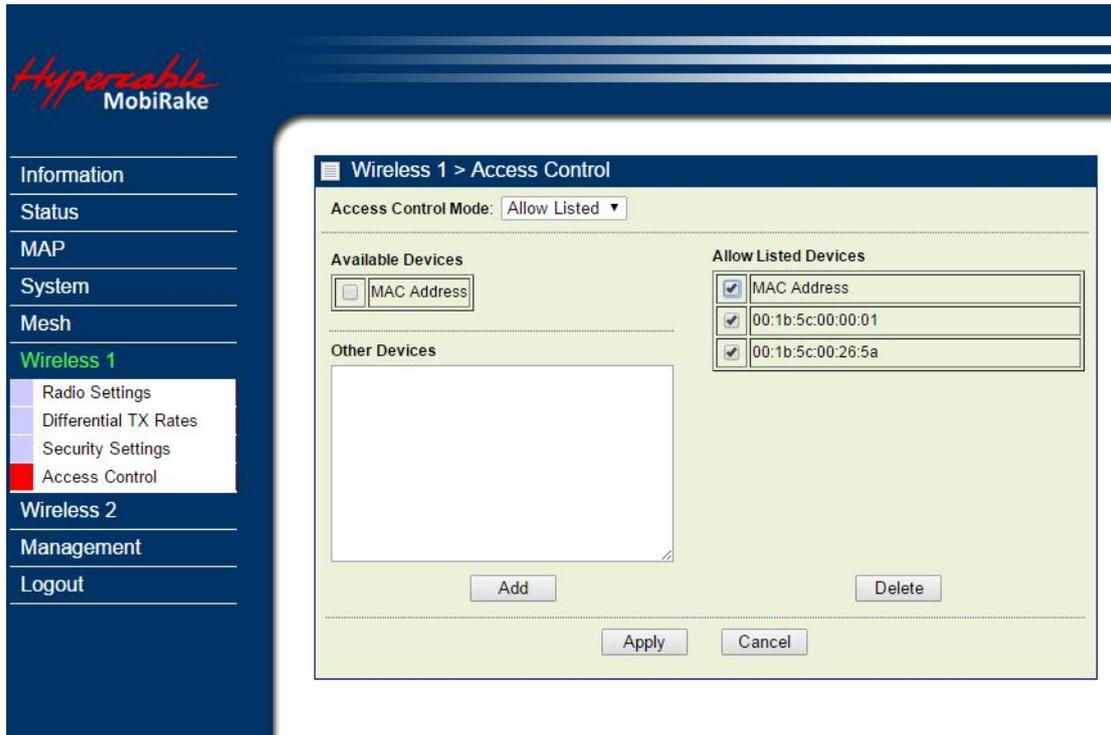
Open System – without encryption

WPA2 PSK – AES encryption



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Wireless Setup / Access control



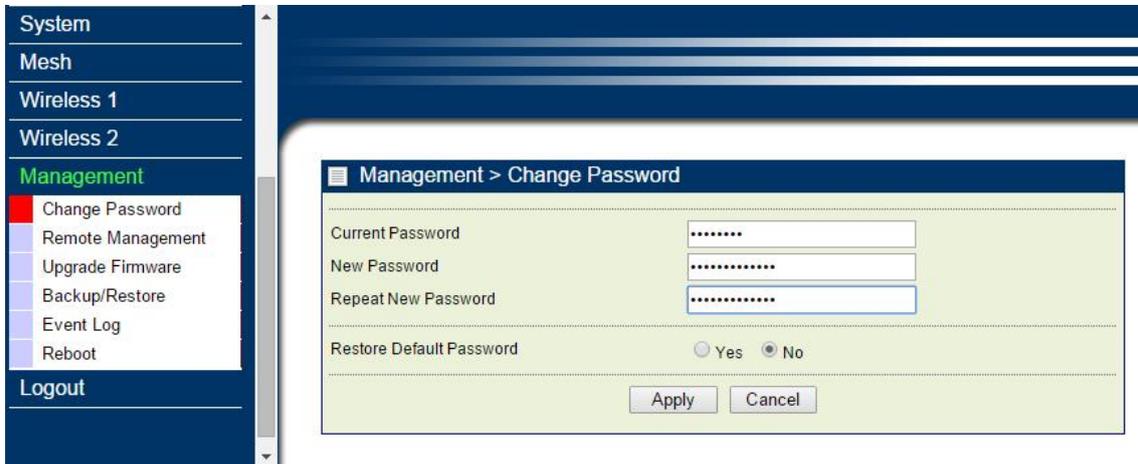
You can enable the MAC address Access control feature and decide which mode you want to control, Allow or Deny.



3-3 Management

Management / Change Password

This page allow you to change password of the 5GHz 4x4 MIMO HT-OFDM MESH Radio.

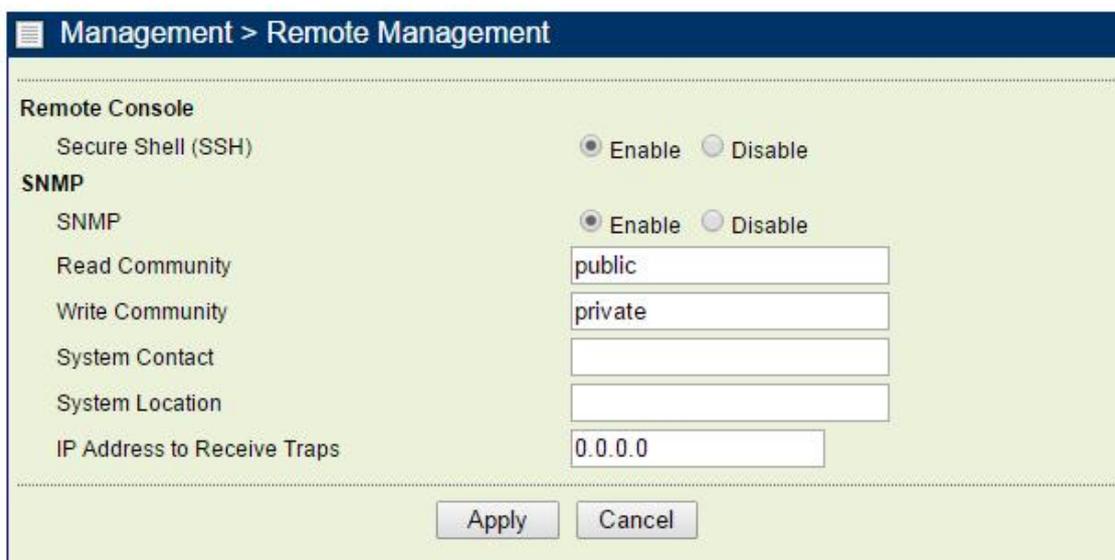


1. Key in the current password in the “Current Password” filed. Default password of this radio is “password”
2. Key in the new password to the New Password field, and then type it again into the Repeat New password field to confirm the new password.
3. Click the “Apply” button to active the settings.
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 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 5GHz 4x4 MIMO HT-OFDM MESH Radio.

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



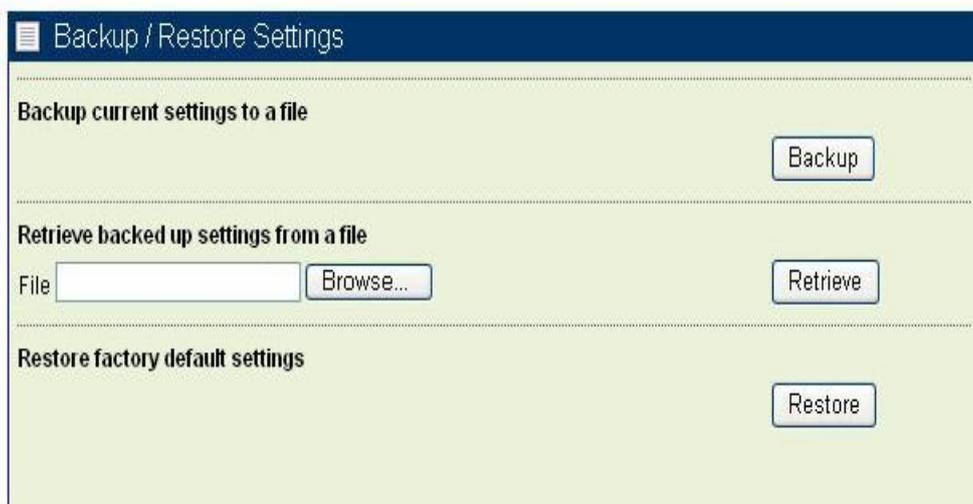
Below are the upgrade procedures:

- Using browser to access the main page of the Lite 5GHz MIMO HT-OFDM outdoor 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.

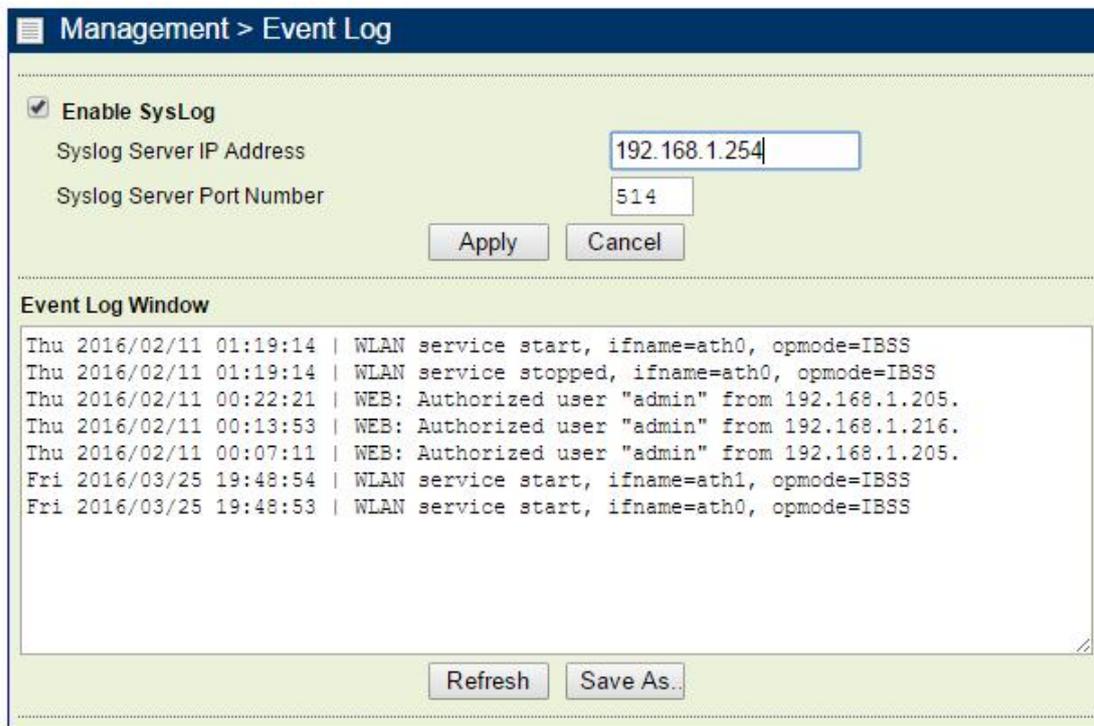
Note! Do not power off the unit when it is being upgraded.

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.



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 Lite5GHz 2x2 MIMO HT-OFDM 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 Lite 5GHz MIMO HT-OFDM outdoor radio if any changes are made and you want to refresh the radio, you need to reboot the 5GHz 4x4 MIMO HT-OFDM MESH 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 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.



$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

Long Distance Backhaul
Login 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.



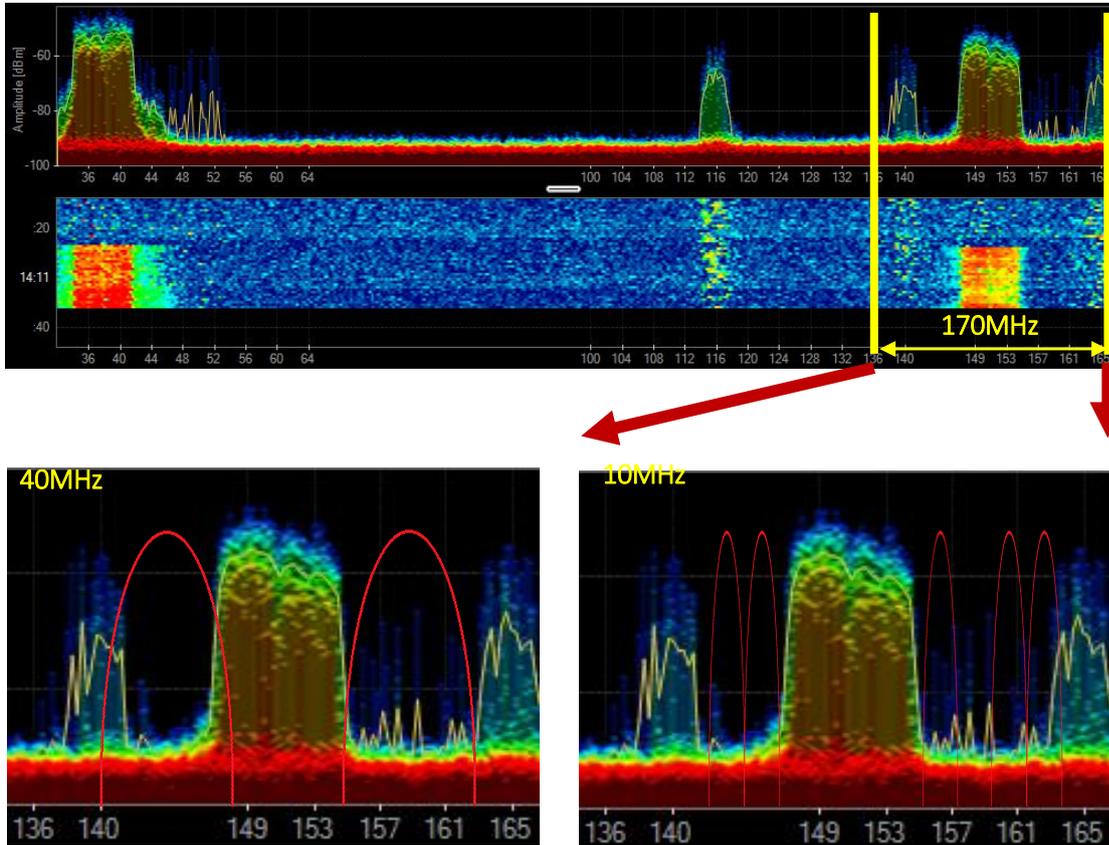
2 is the Reset button of the radio

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \lim_{n \rightarrow \infty} \left(\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} \right)$$

3-4 Les avantages du concept de canalisation

1. More effective non-overlapping channels for flexible channel Plan
2. More total assumption capacity due to more effective narrow band channels in limited clear band without interferences.

Example: In a 170MHz available range with other interference source



40 MHz channel BW: **1 x effective channel** without interference only, total throughput < 300Mbps.

10 MHz channel BW: **6 x effective channels** without interferences, each channel offers 50Mbps TCP throughput. Total throughput about 300Mbps

2.5 MHz channel BW: **24 x effective channels** without interferences, each channel offers 12Mbps TCP throughput. Total throughput about 300Mbps.

Channel BW (MHz)	2.5	3	3.5	4	5	6	7	8	10	15	20	30	40	52	
Real TCP throughput (Mbps)	12	14	17	20	25	30	35	40	51	77	104	158	215	268	
Application area	Valuable spectrum				Crowded urban						Rural				

Channel BW & TCP throughput list table