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FCC Compliance Statement

Caution: changes or modifications could void the user's authority to operate the equipment [FCC 15.21].

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

FCC 15.105 Information to the user [FCC 15.105]:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.

§ 15.706 Information to the user.

This equipment has been tested and found to comply with the rules for white space devices, pursuant to part 15 of the FCC rules. These rules are designed to provide reasonable protection against harmful interference. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

(1) Reorient or relocate the receiving antenna.

(2) Increase the separation between the equipment and receiver.

(3) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

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(4) Consult the manufacturer, dealer or an experienced radio/TV technician for help.

FCC RF Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
Caution: Exposure to Radio Frequency Radiation
To comply with FCC RF exposure compliance requirements, for fixed configurations, a separation distance of at least 41cm must be maintained between the antenna of this device and all persons. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Compliance Statement

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

Professional Installer

To comply with FCC interference protection requirements for TV Band Devices, this equipment should only be installed by a professional installer.

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Wifrost User Manual

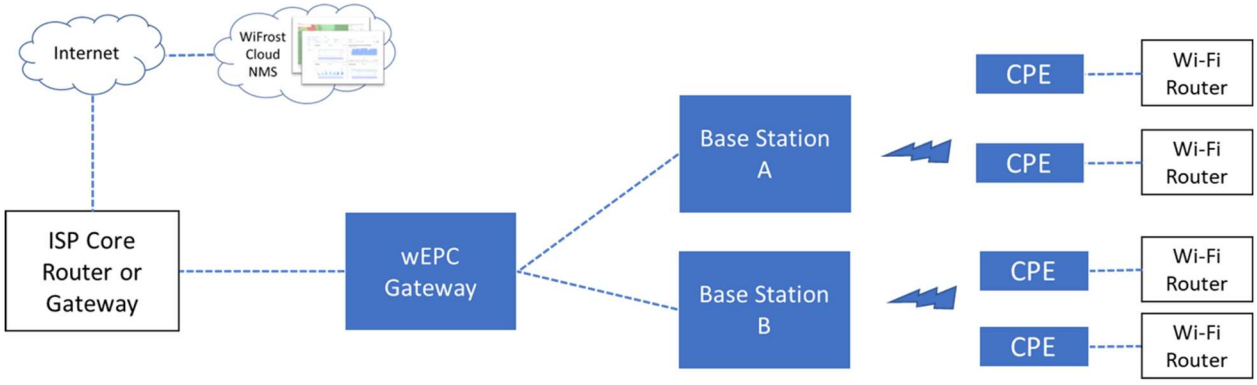
Wifrost provides an end to end fixed wireless solution using TVWS unlicensed spectrum. We also offer professional support to help ISPs and enterprises to plan, build and operate the TVWS network.

The Wifrost solution includes hardware systems and cloud based software to manage the TVWS spectrum and TVWS devices.

This Operation manual goes through the detailed steps of setting up the radios and network for delivering broadband services.

The network diagram outlines the overview of the wireless network that our systems can set up.

Network Diagram



Fixed wireless devices include:

1. wEPC (WiFrost EPC)

This is a miniPC/NUC, with 2 ethernet interfaces, Eth0 (left) and Eth1 (right).

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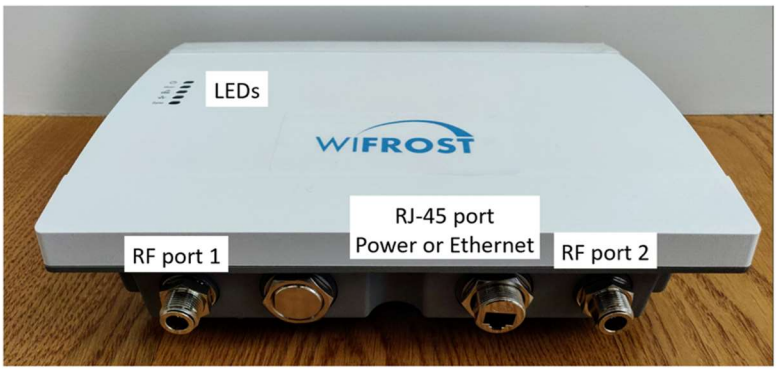
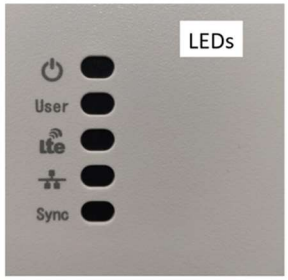
a) AC adapter
b) Indoor device that needs to be in a temperature-controlled location
c) Typically, 1 wEPC Gateway per tower. This device can support up to 10 Base Stations or upto 1000 CPEs

2. Base Station

a) The Base Station is an Outdoor Unit, with 2 N-connector for antenna ports, 1 GPS port, and 1 ethernet port
b) PoE+ Adapter: 56V @0.536
c) GPS antenna
d) Weatherproof/waterproof Boot for Ethernet slot
e) One Base Station supports up to 64 CPEs





	State	Description
Power	Green	Powered On
	Red	On initial boot, Red for a short time
	Red	Power or System error
User	On	CPE/UE online
	Off	No CPE/UE online
	Blinking	User traffic Tx/RX
LTE	On	LTE service up
	Off	LTE service down (check EPC)
	Blinking	User traffic Tx/Rx
Ethernet Port	On	Ethernet cable is connected, up
	Off	No link, eth down, or cable disconnected
	Blinking	Tx/Rx ethernet traffic
GPS Sync	On	GPS sync is good
	Off	No link (GPS sync disabled)
	Blinking	Out of sync

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3. Base Station Antenna (dual port, 2x2 MIMO)

a) Install Pictures
b) All necessary mounting brackets are pre-installed and fit up to 2.5 inches diameter pipe.

4. CPE - Customer Premise Equipment

a) PoE adapter included
b) SIM card slot and Ethernet slot in the back, physical reset button is in the SIM card slot
c) All necessary mounting brackets are pre-installed and fit up to 2.5 inch diameter pipe.

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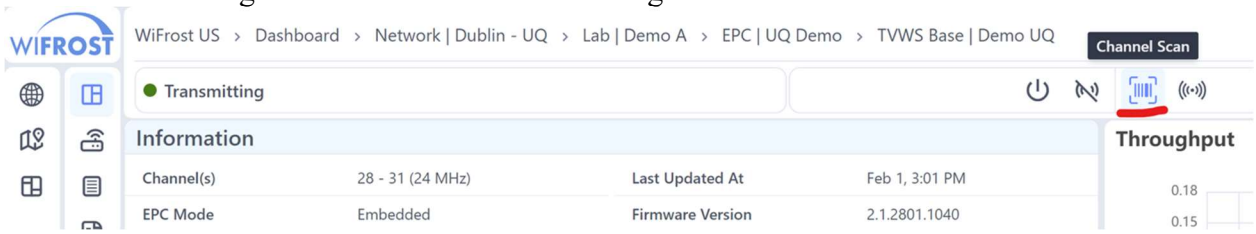
d)

Spectrum Scan Best Practice

1. TVWS is an unlicensed spectrum band, so scanning the spectrum to understand the quality of the channels is the most important step before connecting the CPEs.
2. Scan the spectrum for 24 hours.
3. After watching the above videos and becoming a WiFrost Cloud NMS expert, :), on the Base Station dashboard page, go to the “Channel Scan” page.
4. Hit “Start Scanning” and confirm in the next dialogue box
5. 

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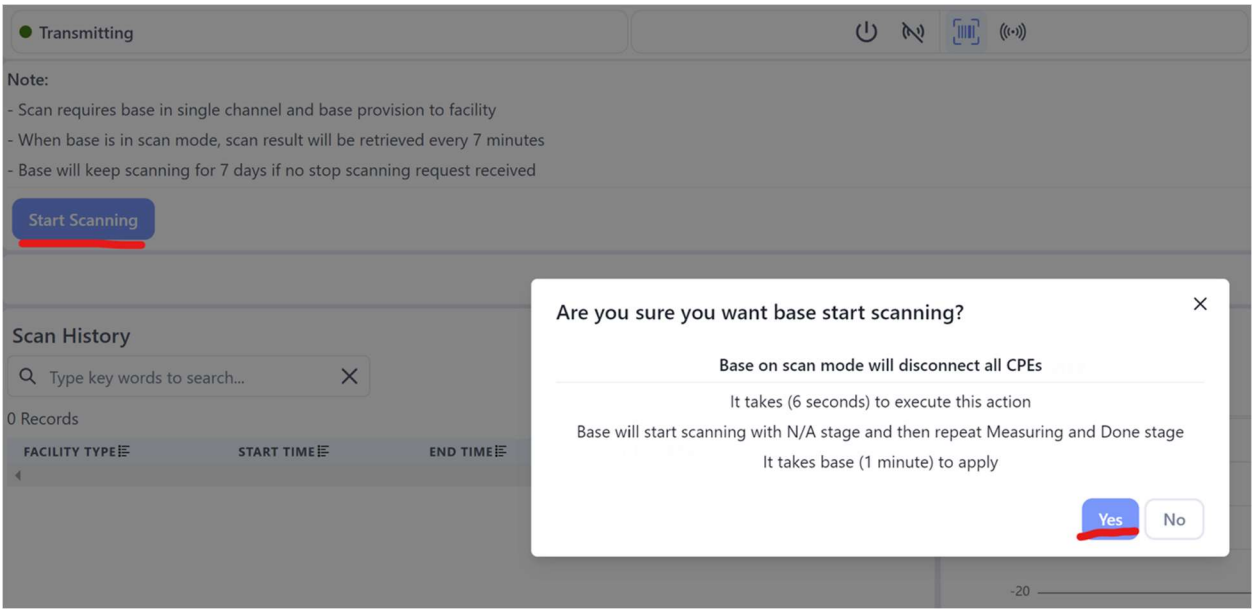

5. After the scan runs for 12 to 24 hours, come to the same/above location and hit "Stop Scan" to get the Base Station back in Transmit mode.
6. Select the cleanest available channels.

Three steps for a successful TVWS connection setup:

1. Connect wEPC eth0 port to the ISP Internet Router
2. Base Station
    1. Connect Base Station and Base Station antenna
    2. Power up Base Station and connect to the wEPC eth1. Directly wire connection is recommended. A switch can be used to connect the Base to the wEPC as well, if direct connection is not possible.
3. CPE

    1. Power up CPE and point towards the Base Station (point away if close than 100 ft to prevent too strong of a signal for indoor/lab testing)
    2. Plug in Wi-Fi Router
    3. LED Indicator

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4.

LED Indicator	Functions	Description
Power	Power indicator	Green Light – Device is powered on and booting,
SYS	System indicator	Orange Color – Device is powered on and booting, Green Color —Network is available.
LTE	Wireless signal indicator	OFF – No wireless connection is established RF1: -115dBm <= RSRP < -110dBm RF2: -110dBm <= RSRP < -105dBm RF3: -105dBm <= RSRP < -97dBm RF4: -97dBm <= RSRP
SIM	WAN indicator	Blinking Green – SIM card is error. Solid Green – SIM card is ready.
ETH	LAN port status indicator	OFF – No LAN cable connected Solid Green – The LAN port is up Blinking Green – LAN data transmission in progress

WiFrost Cloud

1. After Base Station is provisioned, it will show up on the Dashboard without any user intervention.
2. Click on Details to go to the Base Station page
    1. list of device action: reboot, start/stop transmit, turn on/off scan, enable/disable GPS, switch EPC mode
3. Click “Scan Mode” to collect spectrum scan data
    1. after scan mode turned on, “Device Status” in the to pane will change from “Transmitting” to “Scanning”. Scan interval is 7 min
    2. Let the radio run in scan mode for 1 hr to up to 24 hours initially to collect good spectrum scan data. If scan is stopped, or devices reboots, the scan mode need to be started again. Please wait 15 mins to start new scan period.
4. After spectrum scan is done, a channel graph like below will show the channel noise

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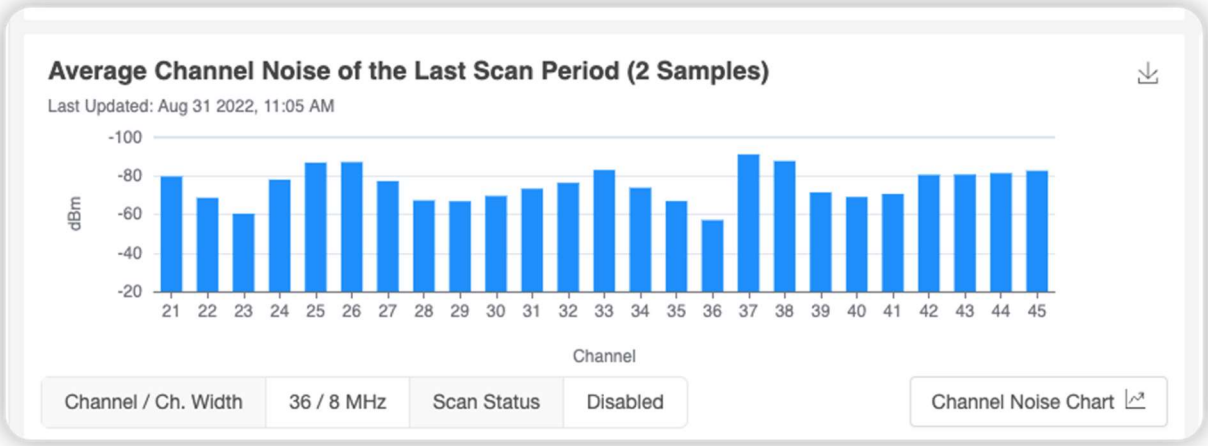

5. Go to the Channel Selection page, and select one of more channels that are clean, e.g. Ch 25, 26 , 37 and 38 appear to be the cleanest in the above screenshot. (your exact channels quality and availability will differ).
    1. After hitting transmit, the Base will reboot and start transmitting on the set channel(s)
    2. Base reboot time is between 4-6 minutes
    3. The CPE will connect to the Base Station in 3 to 4 minutes after Base starts to transmit
6. Check CPE light
    1. only one flashing green light means CPE is looking for a base to connect
    2. four solid green light means CPE connected to the Base
7. Connect a PC to the Wi-Fi router or directly to the CPE to check Internet Connectivity

Firmware Upgrade

Base (remote upgrade)

1. Go to the very bottom on the tab and the very last tab. Select firmware from the dropdown, and click “Update Firmware”.
2.

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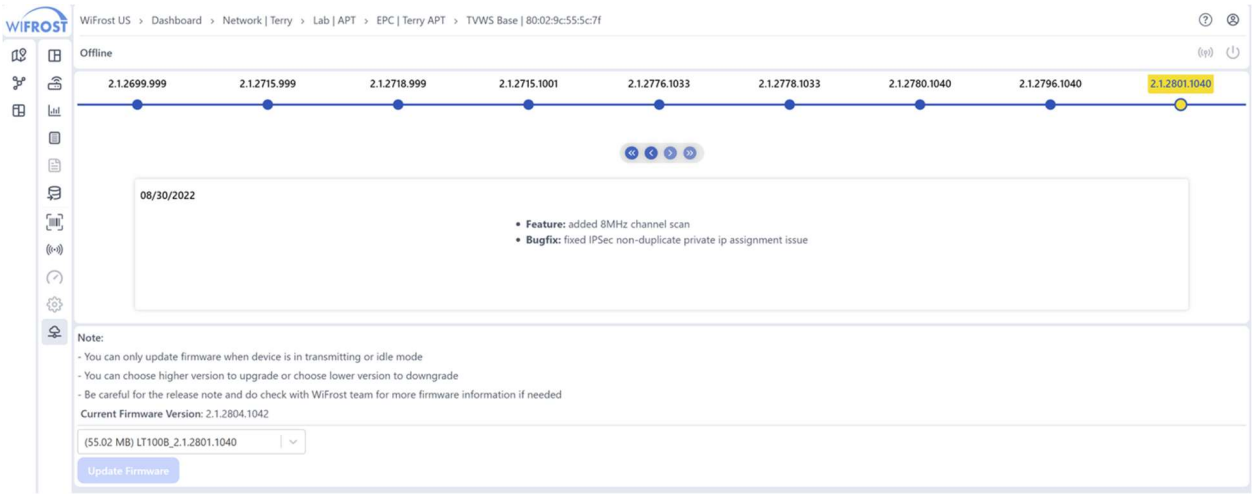
3. 

CPE (local upgrade)

1. Ask WiFrost to provide the latest firmware and upgrade via CPE local GUI
2. Log in CPE local GUI and go to Maintenance - Firmware Upgrade page, choose Reset to Factory Defaults option and file to upgrade

3.