Foxconn Industrial Internet

Outdoor Small Cell (CBRS)

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User's Manual - Safety Guide

The following safety precautions must be observed during all phases of operation, such as usage, service of Foxconn FII products. Safety guidelines provided below is for user's

general safety guidelines only, Foxconn Industrial Internet assumes no liability for customer's failure to comply with safety precautions.

FCC Exposure Limits

The Federal Communications Commission (FCC) has established safety guidelines relating to RF transmitter sites. The FCC developed limits for human exposure, known as Maximum Permissible Exposure (MPE) limits, in consultation with numerous other federal agencies. The standards were developed by expert scientists and engineers after extensive reviews of scientific literature related to RF biological effects. The FCC explains that its standards incorporate prudent margins of safety.

The human exposure limits are provided for two groups of potentially exposed people.

Occupational - People are "exposed as a consequence of their employment" and are "fully aware of the potential for exposure and can exercise control over their exposure".

General Population - Any people that "may not be made fully aware of the potential for exposure or cannot exercise control over their exposure". This group does not receive RF Safety & Awareness Training.

Radio frequency radiation

Cellular wireless products and devices operating over radio signals and the cellular products contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency signals. Exposure to RF radiation may occur.

Interference

Cellular Wireless products and devices may cause interference, so please be aware of the restrictions on the use of wireless devices

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Warnings and Cautions

Human Exposure to Radio

Frequencies The T99B226 should be installed and operated from a minimum safe distance of at least 31.2 in. (80 cm) and installed higher than 2 meters to prevent unauthorized access.

Radio Interference

This T99B226 B48 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, television reception or WiFi AP, which can be determined by turning the equipment on and off, the technician is encouraged to try to correct the interference by performing one or more of the following measures:

- Re-orientate or relocate the unit
- Increase separation between the units and/or End Devices
- Connect the equipment to an outlet on a circuit different from that to which the power source is connected

Modifications

Any changes and modifications to this device that are not expressly approved by Foxconn Industrial Internet may void the user's authority to operate the equipment

General

- Only qualified personnel should be allowed to install, replace, and service the equipment.
- The device cannot be sold retail, to the general public or by mail order. It must be sold to

operators.

- Installation must be controlled.
- Installation must be performed by licensed professionals. Installation requires special training. The T99B226 B48 should be installed ONLY by experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities. Failure to do so may void FII's product warranty and may expose the end user or the service provider to legal and financial liabilities.
- FII and its resellers or distributors are not liable for injury, damage or violation of regulations associated with the installation of units or antennas.

Important Safety Instructions

- Read and Save these instructions
- This Installation Guide contains instructions and warnings that should be followed during installation, and operation.
- Failure to follow these instructions could cause bodily injury and/or product failure

Safety

1. Read this guide and follow all operating and safety instructions.
2. No user serviceable parts inside.
3. Position the power cord to avoid possible damage; do not overload circuits.
4. Do not place this product on or near a direct heat source, and avoid placing objects on the terminal.
5. Use only a damp cloth for cleaning. Do not use liquid or aerosol cleaners. Disconnect the power before cleaning.
6. The units should not be located near power lines or other electrical power circuits.
7. It is the user’s responsibility to install this device in accordance with the local electrical codes.
8. Installation of the T99B226 B48 must be contracted to a professional installer.
9. The circuit breaker should be easily accessible in case you have to disconnect the device.

10. When installed in the final configuration, the product must comply with the applicable Safety Standards and regulatory requirements of the country in which it is installed. If necessary, consult with the appropriate regulatory agencies and inspection authorities to ensure compliance.

1. Introduction

A compact, high output power, resilient CBRS (Citizens Broadband Radio Service) LTE compliant Small Cell is shown in Fig1.1. This device is water and dust- resistant (IP65) and can be pole mounted, which makes it suitable to be deployed in a dense factory area, both indoors and outdoors.

Figure 1.1 T99B226 Overview

The LTE CA technology deployed in this outdoor small cell is compliant with the specifications defined by IEEE 3GPP alliance. This small cell has four LTE antenna ports and one GPS antenna port and is powered by a 56V DC PoE. Its LTE interface operates in CBRS band and supports SAS (Spectrum Access System). By using GPS timing synchronization, handover between various small cells can be achieved. This is essential for scenarios that require quick switches between base stations, such as AGV (Automatic Guide Vehicle) that is used in factory automation.

2. HW installation guide and product specifications

This section describes the HW overview of the Outdoor Small Cell-T99B226.

2.1 Connectors and Interfaces

As shown below in fig 2.1, T99B226 consists of four N-type cable connectors (LTE antenna #1,2,3,4) on the bottom side of the device for LTE antennas and an ethernet RJ45 port for power. There are four bolt holes on the back of the device so that it can be pole mounted onto a factory pole by using a mounting bracket. The SMA connector on the back of the device can be used to connect a GPS antenna and provide 3.3V DC power to it.

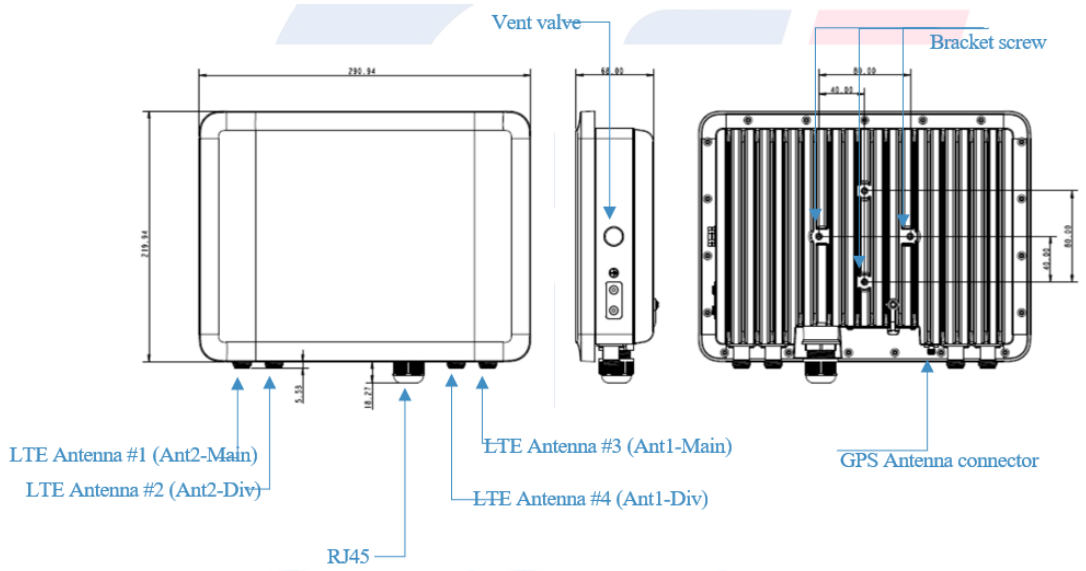


Figure 2.1 T99B226 Ports and connectors

2.2 Cable routing and installation guide

During installation, the device should have a clear view of the potential user transmitters and

should not be obstructed by nearby trees or buildings. Once you pick an ideal installation spot, place the mast bracket and wrap it around the mast, clamp the bracket and device together by tightening the screws through the bolt holes on the back of device and the bracket.

LTE antenna wires need to be pulled from the N-Type connectors on device along four bracket arms to four antennas on each corner as shown in figure2.2 and the running wires can be fixed onto bracket arms using bracket ties. It is the best practice to keep all the antenna rods perpendicular to the bracket branches and to ensure that the four antennas are evenly distributed in the four corners.

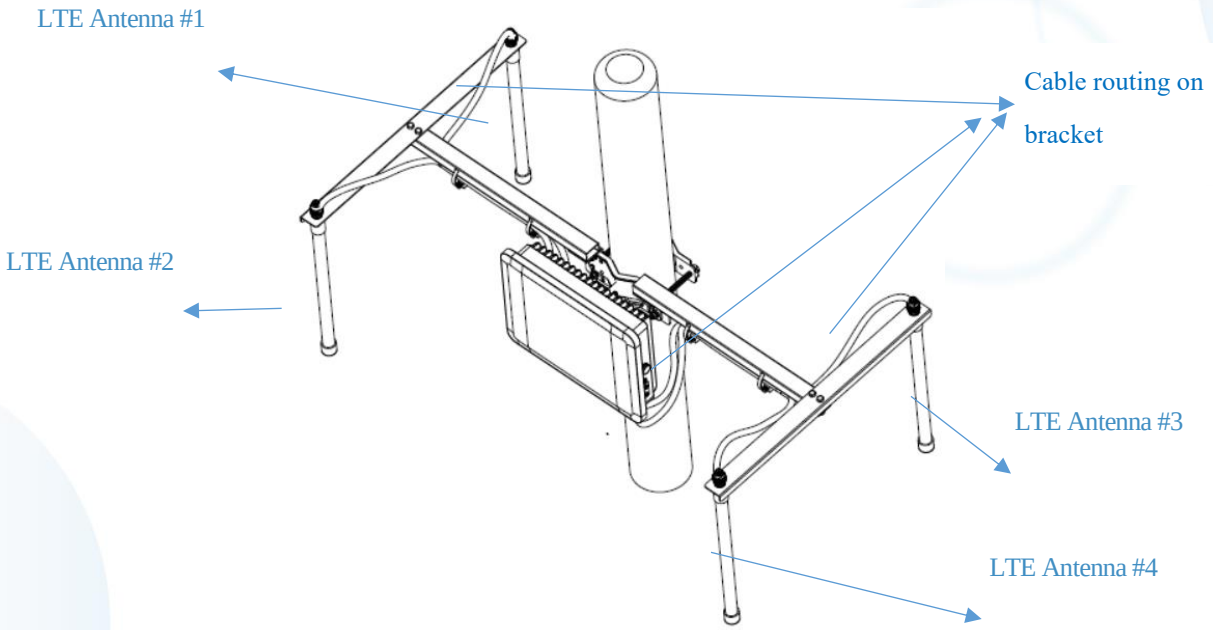


Figure 2.2 T99B226 Top view

In addition, the GPS antenna should be positioned at a location where the GPS signal reception is solid and the wire connecting the GPS antenna to the device should be attached to the pole to ensure the stability of the connection during non-ideal weather conditions. Power for T99B226 is provided by connecting the power supply to a POE (power on Ethernet) adapter and through the waterproof ethernet cable to the ethernet port situated next to the antenna ports as shown in fig2.3. For the same reasons, the wires should be attached to the pole firmly. The waterproof ethernet port is complied with IP65 regulations which makes it resilient to outdoor conditions.

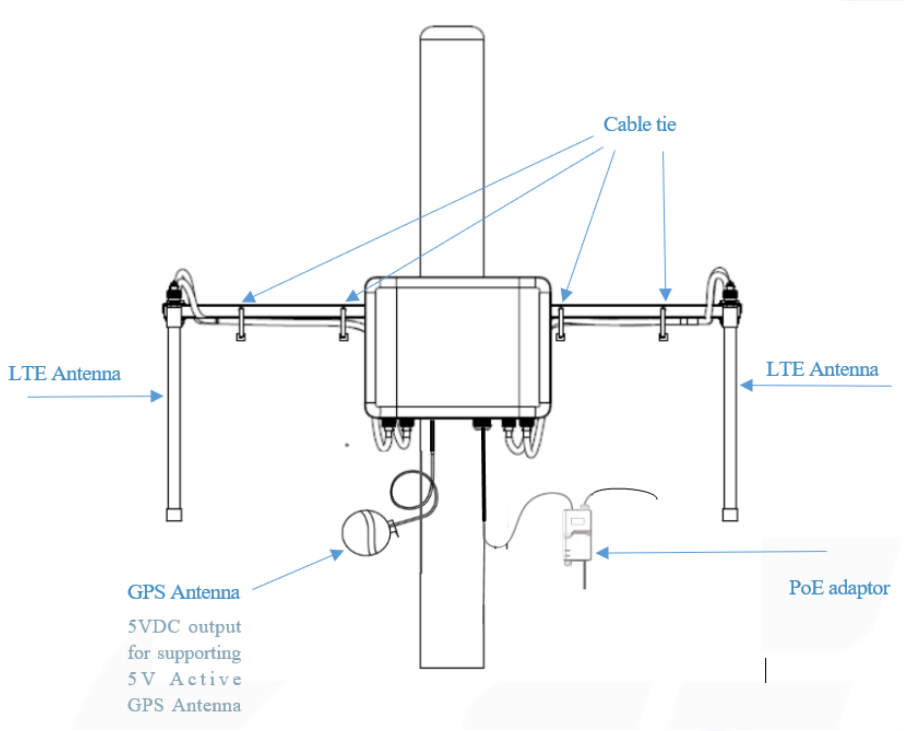


Figure 2.3 T99B226 assembly front view

The installation instructions are specified in the steps below:

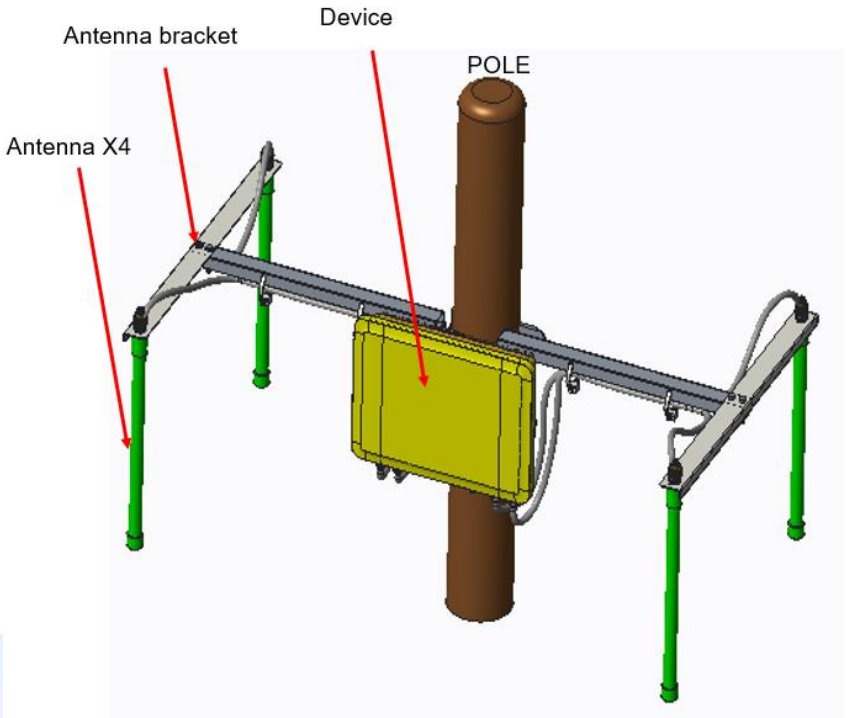
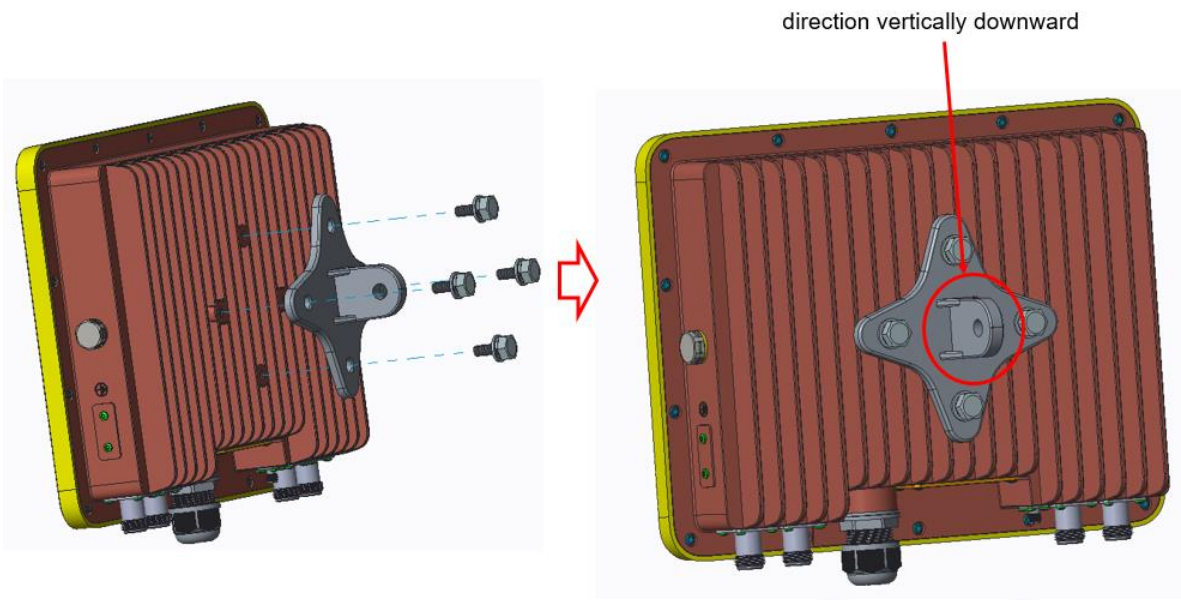


Figure 2.4 Installation setup

- **Step1: Bracket base and housing assembly:**

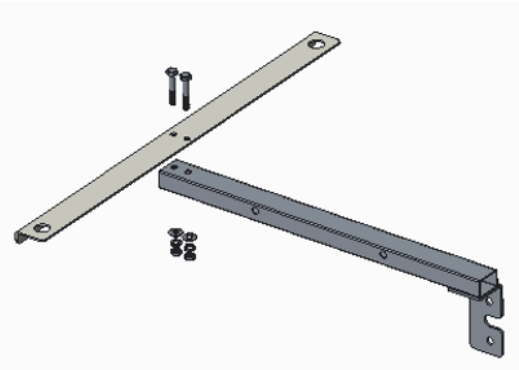
1.The bracket base is first assembled in the housing, using 4pcs M6 X 15screw with a torque of 50-70kgf cm.
2.Note: the bracket base setting direction vertically downward.



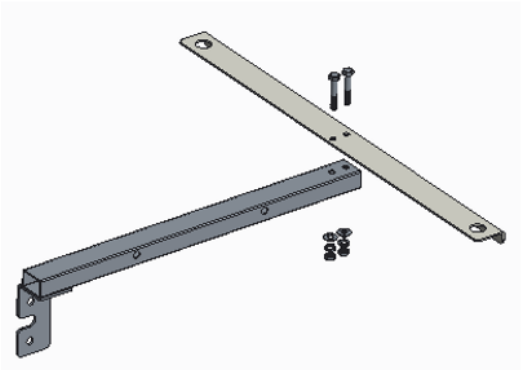
- **Step2: Antenna holder assembly:**

1. Assembled Left and Right Holder, using 4pcs M6 X 35screw with a torque of 50-70kgf cm.

LEFT-HOLDER-ASM

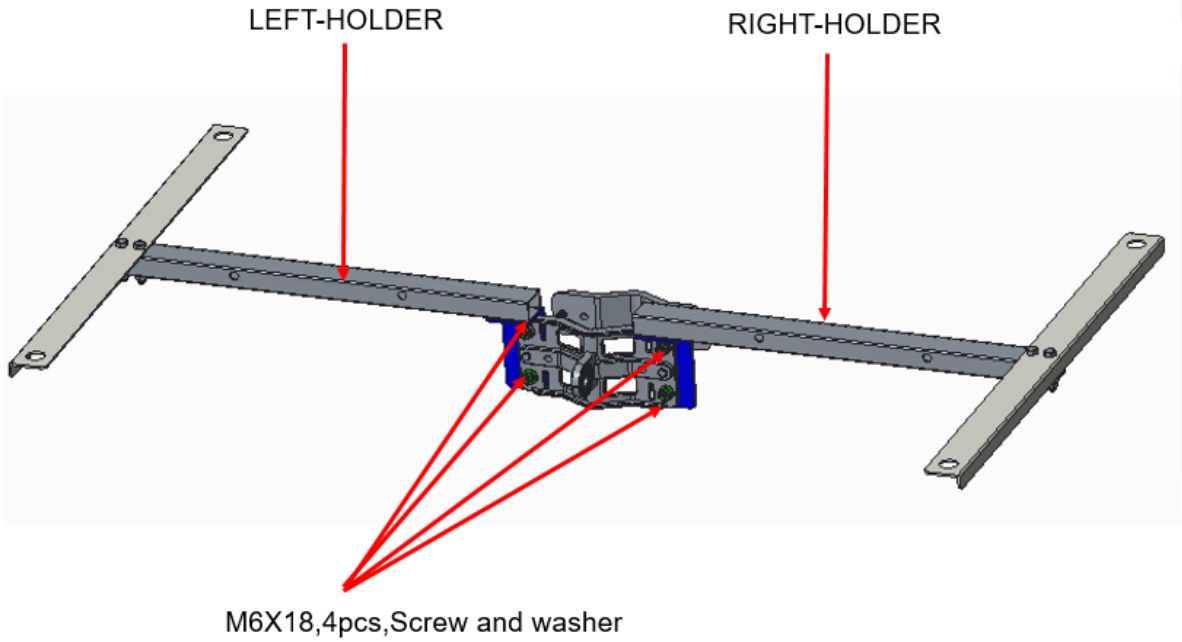


RIGHT-HOLDER-ASM



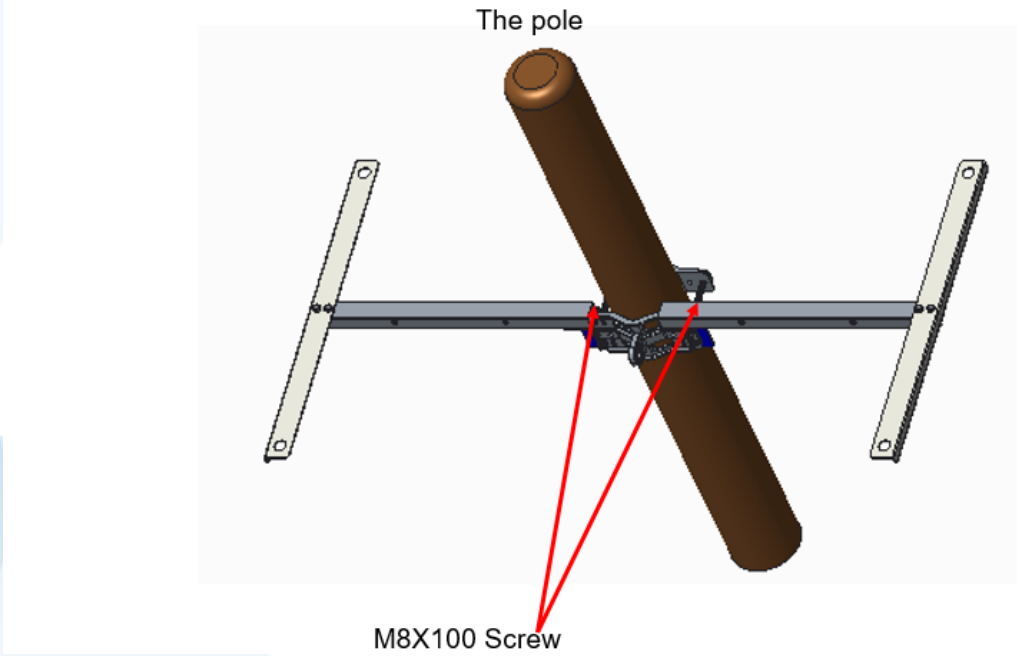
- **Step3: Assembly of the antenna holder with the bracket:**

1. Assembled Left and Right Holder on bracket base, using 4pcs M6 X 18screw with a torque of 50-70kgf cm.



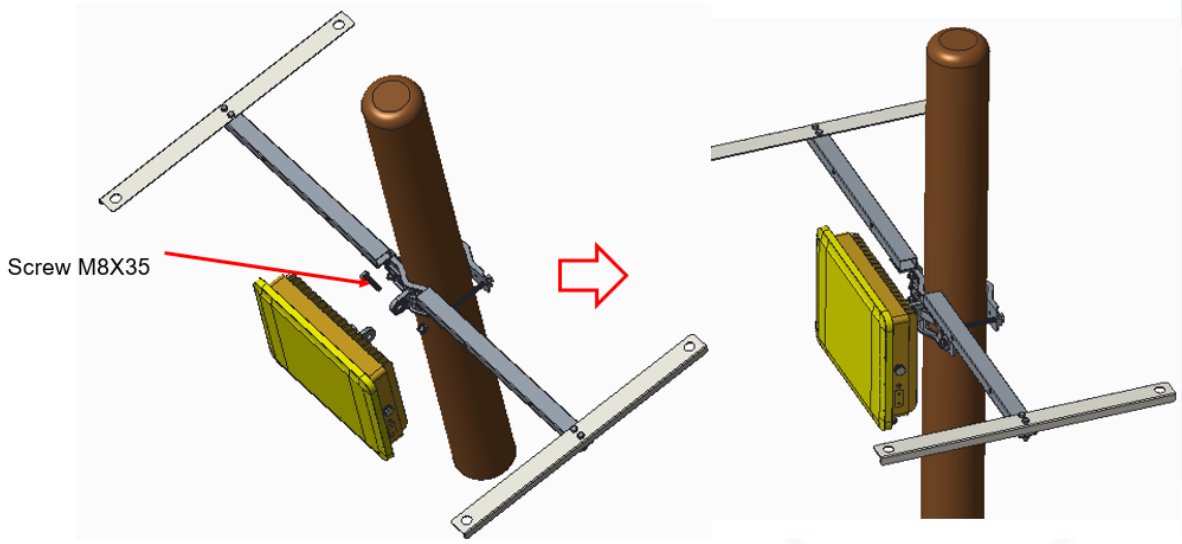
Step4: Mounting the bracket on a pole:

1. Assembled bracket base on the pole, using 4pcs M8 X 100screw with a torque of 150-170kgf cm. The pole diameter range is from 40- 100mm.



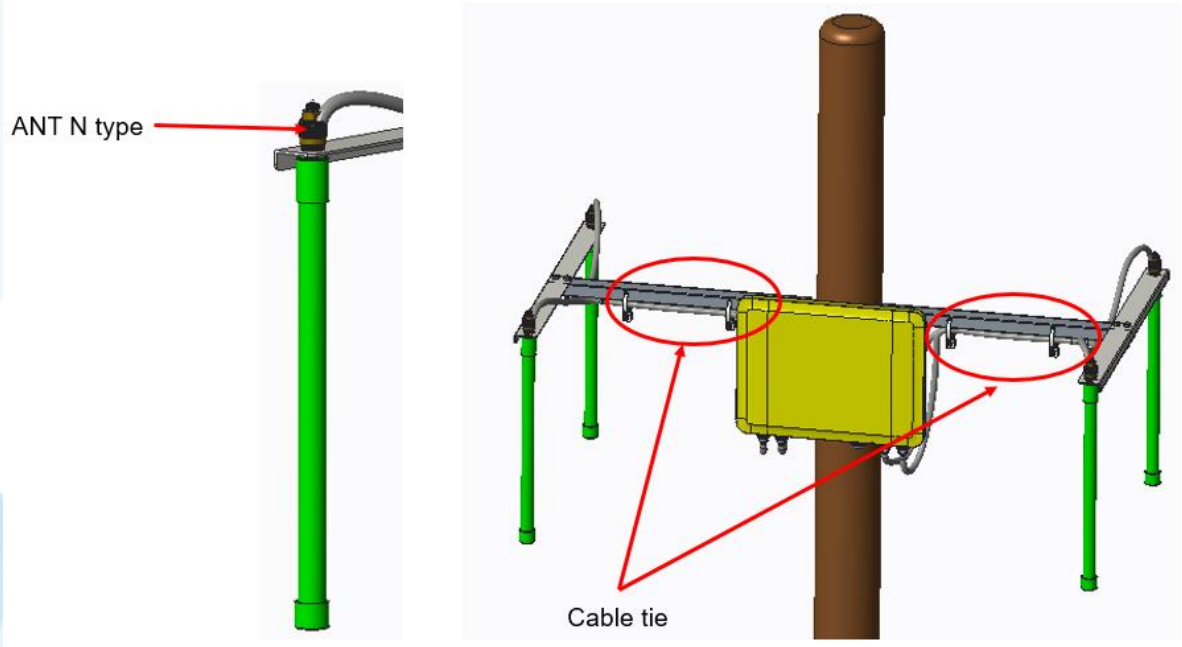
Step5: Mounting the device to the bracket:

1.Assemble the device on bracket M8X35 using 1pcs M8 X 35 screw and washer with a torque of 150-170kgf cm.



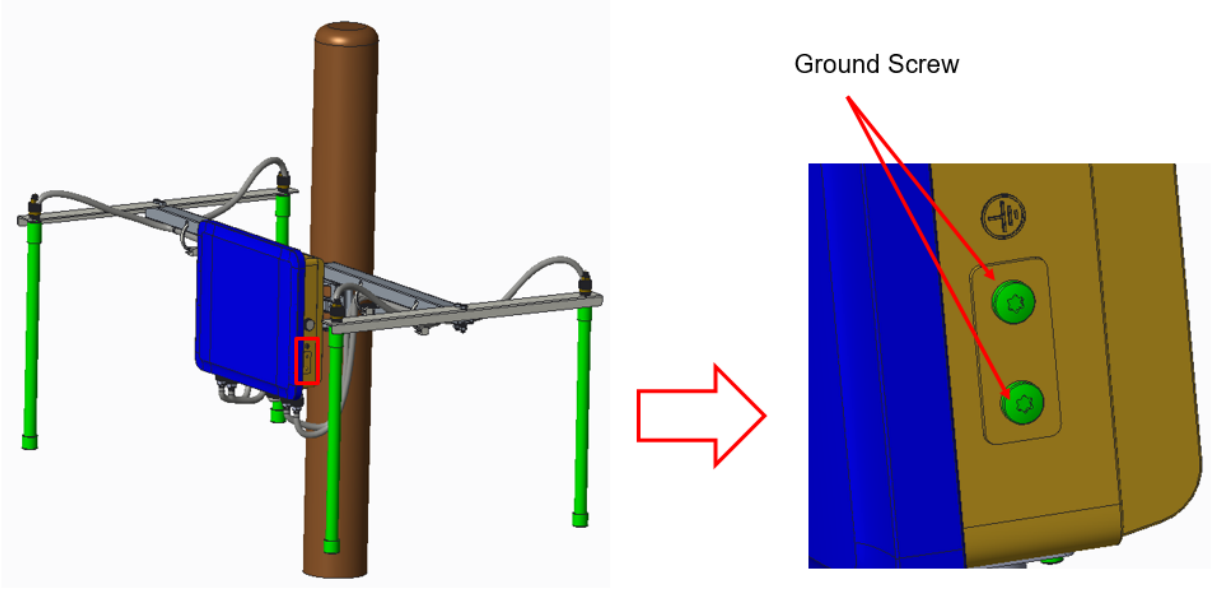
Step6: Assemble the Antenna onto the antenna holder:

1. Assemble antenna and cable by N type connector.
2. Using the cable tie to fixed the cable on holder



Step7: Assemble the Ground Screw on Device:

1. Lock the ground wire on the ground screw, M4X6 screw, torque 5 kgf.cm;



2.3 Product Specifications

Table 1. Product Specifications

Specification	Description
LTE	
Frequency/Band	3400~3800MHz /Band 42,43,48
TX Power	+24 dBm/port
RX Sensitivity	-95 dBm
CA Support	YES (2CA)
Duplex technique	LTE TDD
Compute & Storage	
Main chip	FSM9955+FTR8900*2
Flash/ Memory	8GB eMMC/ 16Gb DDR3
Antenna Interface	
LTE Antenna Connector	Four extendable N type RF antenna ports (6dBi omni-directly antenna)
GPS Antenna Connector	One extendable SMA type RF antenna port (supply 5V for active GPS antenna)
WAN Interface	
Ethernet	100/1000 Base-T Ethernet RJ45
GPS	
GPS	With 5 VDC output for active GPS antenna and built-in 1575.42 MHz, GPS & GLONASS module
Power	
Power Input	PoE (42.5-57 VDC)
Power Consumption	Maximum 30 watts
Antenna	
LTE	< 6 dBi Omni- directly antenna
GPS	5 VDC active GPS antenna
Physical Specifications	
Mounting	Pole mount

Housing Material	Aluminum, plastic
IP Rating	IP65
Operation Humidity	20% ~ 90%
Operation Temperature	-40 ~ 50 ℃
Net Weight	2.5 kg
Dimension	287 × 216 × 68 mm
Reliability	
MTBF	20 years at room temperature
Operating System (need SW confirm)	
Firmware	Base on Linux with kernel 3.14 ask software

3. Private Network Solution

This outdoor unit (ODU) T99B226 receives data from user equipment (UE), then relays it to a backend server (EPC) and routes the same to an application server for information processing.

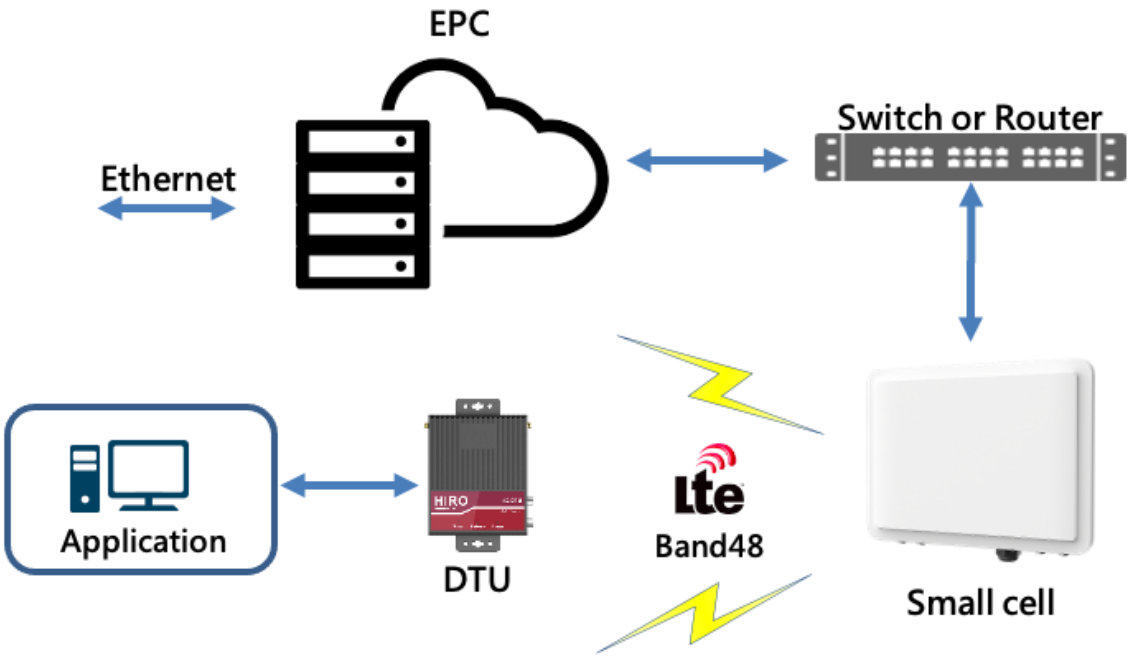


Figure 3.1 CBRS Network Topology

3.1 Configuration Overview

Users can configure Small Cell parameters through the local Ethernet port of the Small Cell. A personal computer, with a browser installed, can be used to configure the gateway. The recommended browsers are Google chrome or Firefox for Small Cell configuration management to obtain the best display experience. Connect the Ethernet port of the computer with a network cable to the ethernet port of the small cell. The length of the network cable should not preferably exceed 100m, since longer cable might cause abnormalities in the communication.

The factory default login address of the Small Cell management page is https://192.168.152.1. Set the computer's subnet as 192.168.152.0/24 to access the webpage.

If the configuration page cannot be accessed, contact your computer's network administrator to check the IP address of your computer. If you still cannot open the management page correctly, please contact a technician of Foxconn Industrial Internet incorporated company.

Figure 3.2 Configuration Overview

3.2 Basic Setting

The Small Cell contains one 10/100mbps Ethernet interface. The factory default setting is DHCP. The Ethernet port should be configured according to the actual requirements when used for the first time. Click "Basic Setting" → "WAN Configuration" to enter the gateway network configuration and WAN Configuration.

➢ WAN Configuration

The WAN mode includes two modes – DHCP and static IP. The specific functions of each mode are explained below:

1） DHCP: The Small Cell will automatically receive the IP address from the superior route, contact your IT administrator to get this address. Note: the IP address will be automatically changed each time the gateway is restarted in this mode.

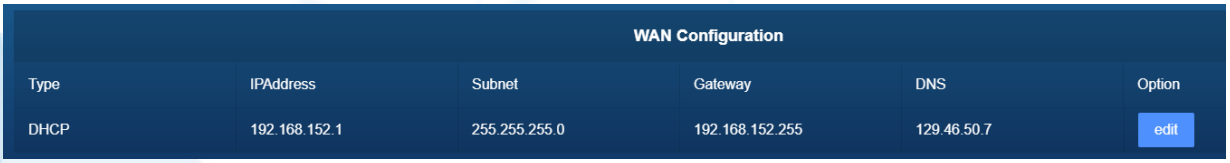


Figure 3.3 WAN configuration is set to DHCP

2） Static IP: The gateway WAN port address should be set by the user. Contact your IT administrator for the corresponding information.

a. IP address: enter the IP address information provided by the superior route.

b. Subnet mask: enter the subnet mask provided by the parent route.

c. Gateway: enter the gateway IP address for the superior route.

After confirming that the information input is correct, click on the corresponding application button to change the network configuration.

WAN Configuration					
Type	IPAddress	Subnet	Gateway	DNS	Option
Static	10.20.46.101	255.255.255.0	10.20.46.255	10.20.46.1	edit

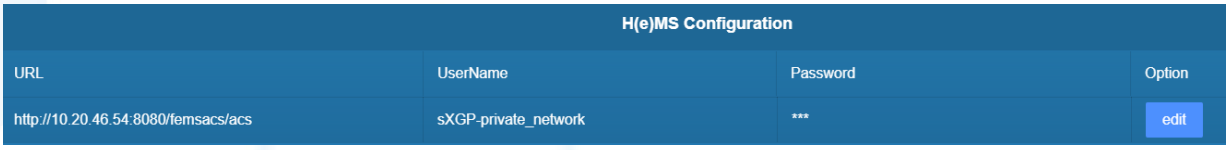
Figure 3.4 WAN configuration is set to Static

- **HeMS Configuration**

The Small Cell has a HeMS configuration function, this function enables the Small Cell to communicate with Auto Configuration Server (ACS). If the configuration of this setting is incorrect, the Small cell will lack the ability to communicate with the configuration/fault management portion of the EPC and must rely on manual configuration of the device.

1) Ensure that you have reserved a static IP inside of the network with IT and installed all the necessary software for EPC.

2) Point the Small Cell to the established IP of the EPC. Example IP: 192.168.1.222:8080/femsacs/acs



H(e)MS Configuration			
URL	UserName	Password	Option
http://10.20.46.54:8080/femsacs/acs	sXGP-private_network	***	edit

Figure 3.5 HeMS Configuration

3.3 Advanced Setting

Configure Cell Information, REM Settings and ShareRan settings - Navigate to “One Page Setting → Advanced Settings”. However, if the basic Settings page has been configured properly, this section should be auto configured by the Auto Configuration Sever (ACS).

3.4 Cell Configuration

1) Cell Identity – unique identifier to identify the Small Cell. This Value cannot be assigned to another small cell in the same network.
2) TxPowerMax – Maximum power level of the small cell. Sets the LTE max coverage radius.
3) TxPowerMin – Minimum power level of the small cell. Sets the minimum LTE coverage radius.
4) DL_EARFCN_List – Specifies the downlink Radio Frequency Channel Number for two RF card. In this use case, you are using Band 48. This means that the frequency range is from 3550MHz~3700MHz. It is important to note that setting multiple small cells within the range of each other to the same frequency will cause interference.
5) UL_EARFCN_List – Specifies the uplink Radio Frequency Channel Number for the two RF cards.
6) ULDLMode – Indicates the TDD subframe configuration. The supported values are mode 1 and mode 2. Mode 1 will obtain higher uplink bandwidth and lower downlink bandwidth.

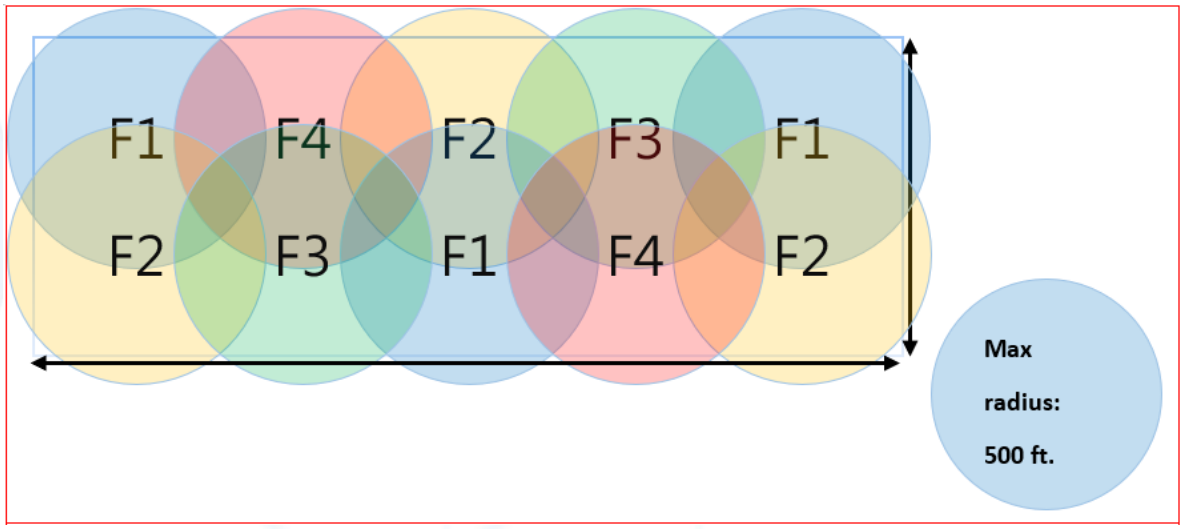


Figure 3.6 Small Cell radiation Overlap

3.4.1 Rem Configuration

This is the algorithm used for handover function. Select the band to listen to macro cell for

time synchronization of multiple small cells.

1) REM Enable – Boolean value to toggle function on and off
2) REM Band List – A band that is being broadcast from a microcell in your area to which small cell can listen to for the time sync function. For example, band 48
3) REM EARFCN – Absolute Radio Frequency Channel Number. Select a list of frequency channel numbers that are supported both in your area and by the band that was selected above. Leaving this section blank will greatly increase the time to find an available Macro cell. (approximately 2 hours).

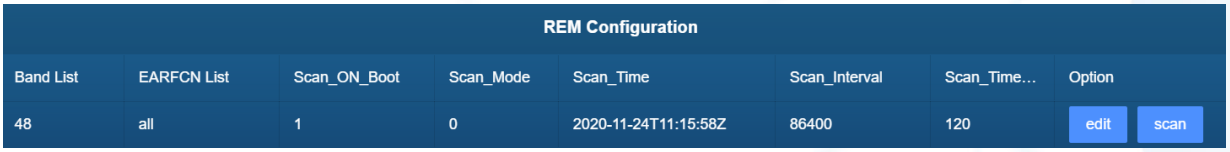


Figure 3.7 REM Configuration

3.4.2 Gateway Configuration

The Small Cell needs to be in constant contact with the EPC via an inform method. This inform method carries with it the connection information, configuration options and general Small Cell data. When the small cell needs to make a configuration change or status check, the small cell should update the EPC. When the Small Cell needs to check in with the EPC, the Small Cell checks the ShareRan configuration option to find the address.

1) IPAddress: The Gateway IP address is set to the static IP of the EPC. Ex: 10.20.46.54
2) PLMNList: Public land Mobile Network list is used by the User Equipment (UE) to select the small cell that it will connect with.

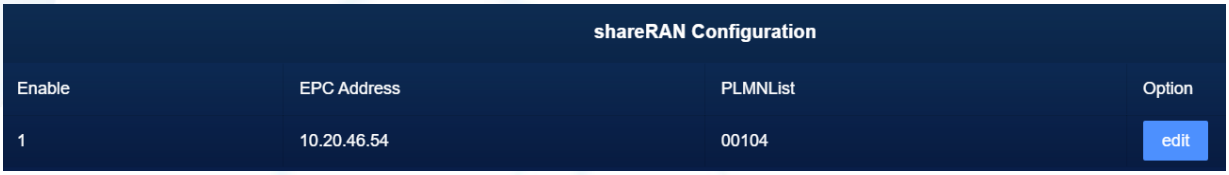


Figure 3.8 shareRAN Configuration

3.4.3 NTP Configuration

Specify the Network Time Protocol (NTP) server for the Small Cell, so that the system time of the Small Cell can be synchronized.

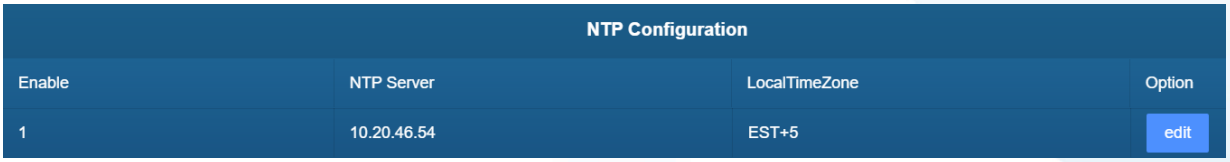


Figure 3.9 NTP Configuration

3.4.4 PTP Configuration

The Precision Time Protocol (PTP) is a protocol used to synchronize clocks throughout a computer network. Specify the PTP mode for your small cell.

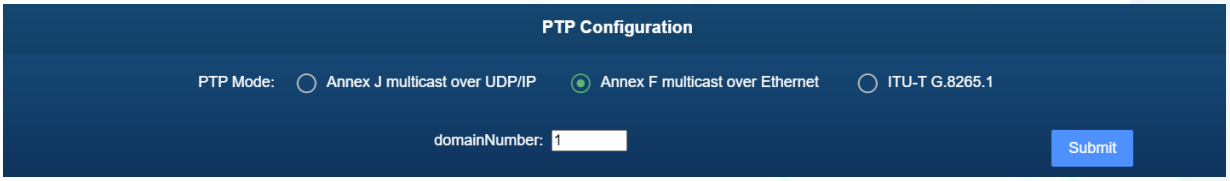


Figure 3.10 PTP Configuration

3.4.5 HeNB Running Mode _ Sync Source

1) GPS sync

Step 1:

HeNB Connects to GPS Antenna, the GPS antenna should be placed near the window or outdoor.

Step 2: ensure GPS positing successfully.

2) PTP sync

Step 1: use MicroSemi IGM-1100i as the PTP master, connect it to the GPS Antenna.

Step 2: ensure that IGM-1100i is synchronized with GPS signal.

Step 3: Turn on HeNB, connect HeNB and PC with network cable.

3) NL sync

Step 1: HeNB need to be connect to the LTE antenna.

Step 2: the synchronized HeNB needs to be sync with GPS or PTP Master, and it need to connect to the EPC, its CellID needs to be set to 55 and the ARFCN needs to be set to 55990.

Step 3: if the other HeNB want to sync with the HeNB in EPC through NL sync mode, the HeNB in EPC must already sync time with GPS or PTP Master, then the other HeNB can sync

with this HeNB through NL sync mode.

4) free running sync mode

If you do not have any sync source (GPS/PTP/NL) in your environment, you can use the free running sync mode to test HeNB

3.4.6 HeNB Running Mode _ SAS

Enable the SAS in your small cell.

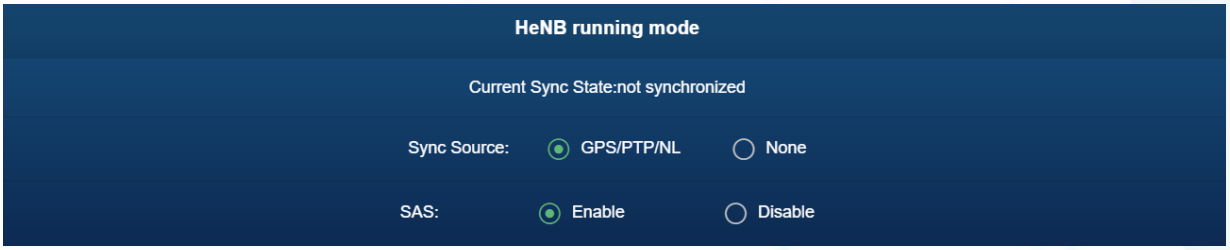


Figure 3.11 HeNB Running Mode

3.5 Firmware Upgrade

Using File Transfer Protocol (FTP) to perform the firmware upgrade on the small cell. Navigate to Firmware Upgrade, then specify the Protocol used to do the firmware upgrade, the FTP server IP address, the Username and Password for the FTP server, and the File name of the firmware.

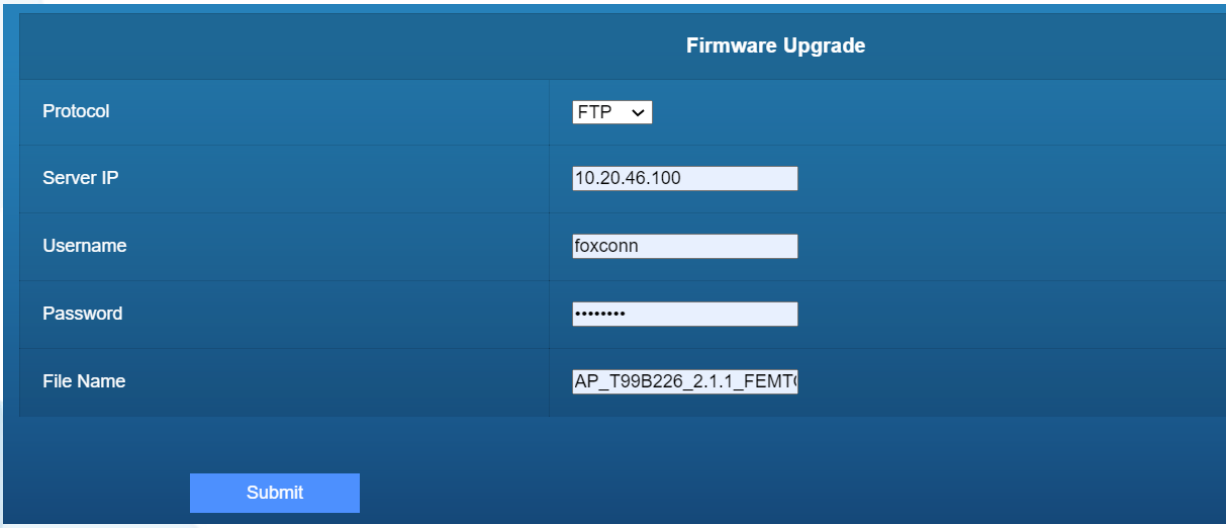


Figure 3.12 Firmware Upgrade Configuration

Upon firmware upgrade process is completed, there will be a RESULT: SUCCESS notification will be displayed on the web page.

Figure 3.13 Firmware Upgrade Result

3.6 Syslog

3.6.1 Syslog List

The Small cell records all events that take place while it is powered on. These events can be triggered by the user or by a running process. They help you to keep track of all the activities and to troubleshoot problems. Listed below are two of the most commonly seen error messages and their definitions:

1) **[DNS] IP is not up:** Small Cell is unable to obtain IP address from DHCP server.
2) **[ENB] veMmeReadyGet: primary ePC not ready**: EPC needs to be restarted or shareRan configuration is incorrect (see section 3.3.3)

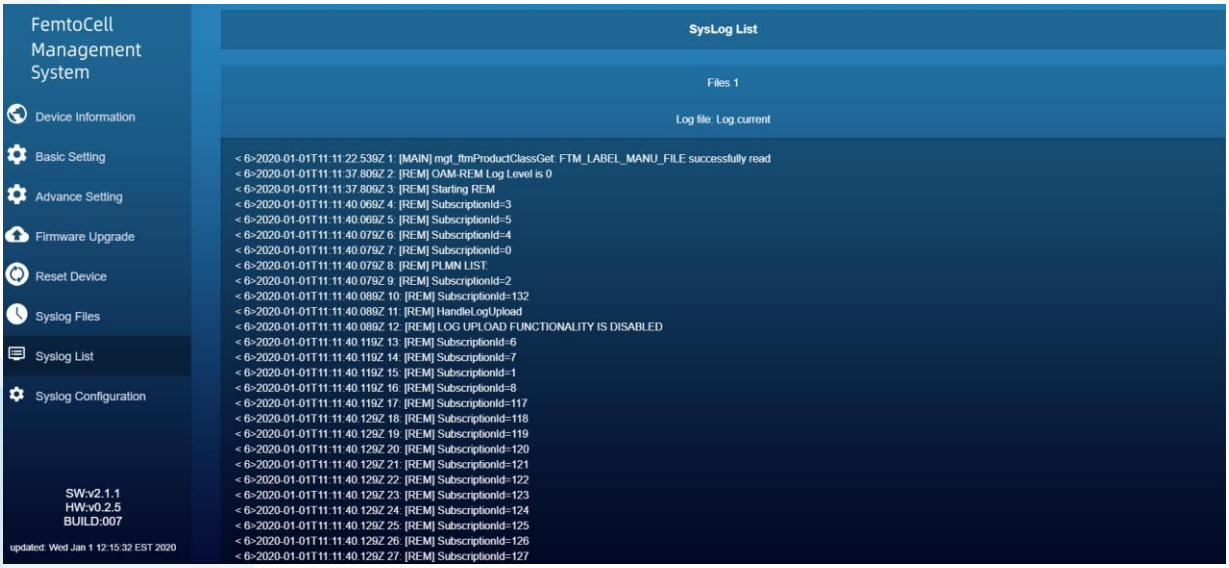


Figure 3.14 Syslog List

3.6.2 Syslog Files

The log in the small cell could be manually downloaded from here.

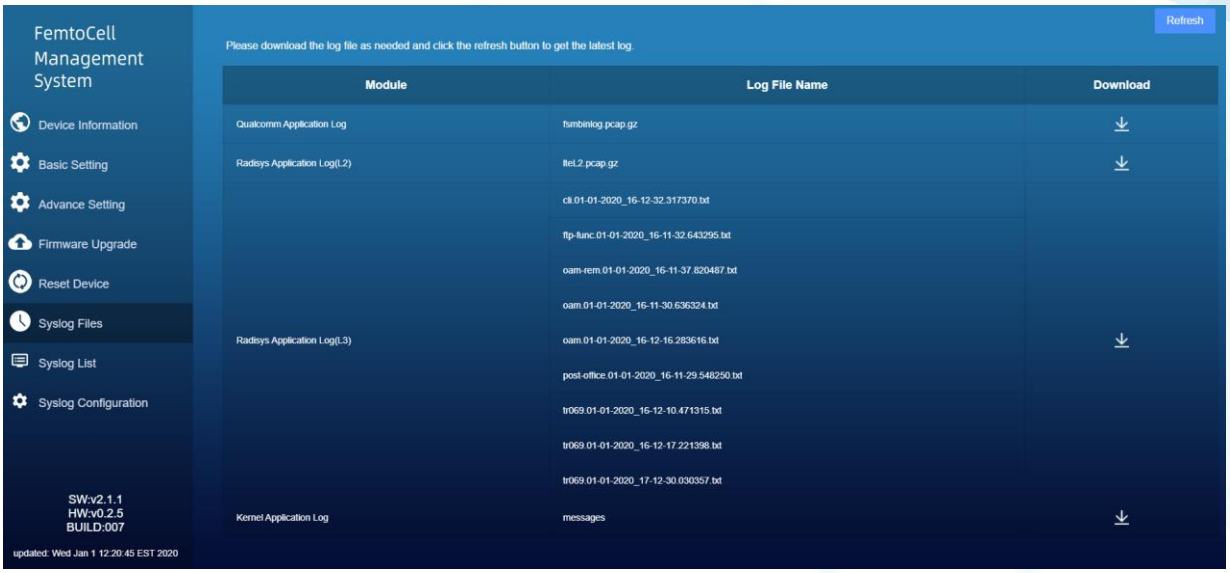


Figure 3.15 Syslog Files

3.6.3 Syslog Configuration

The log can be automatically uploaded to your PC using an FTP server.

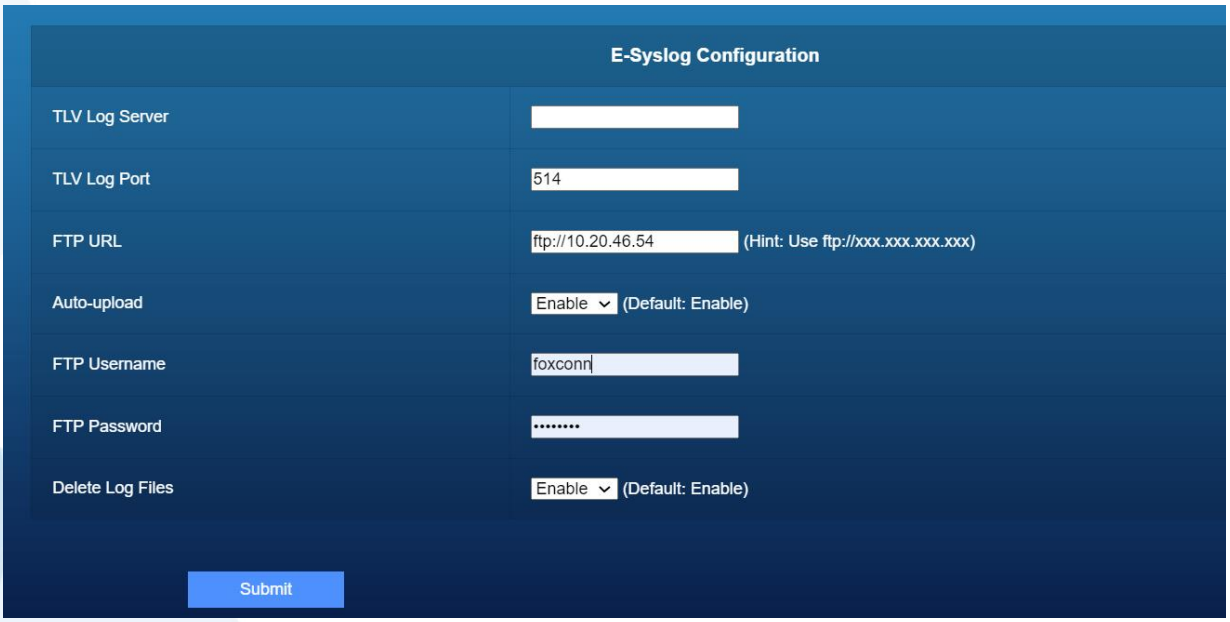


Figure 3.16 Log auto-upload

3.7 Reset Device

You can manually reset the small cell to its default settings, or to manually reboot it.

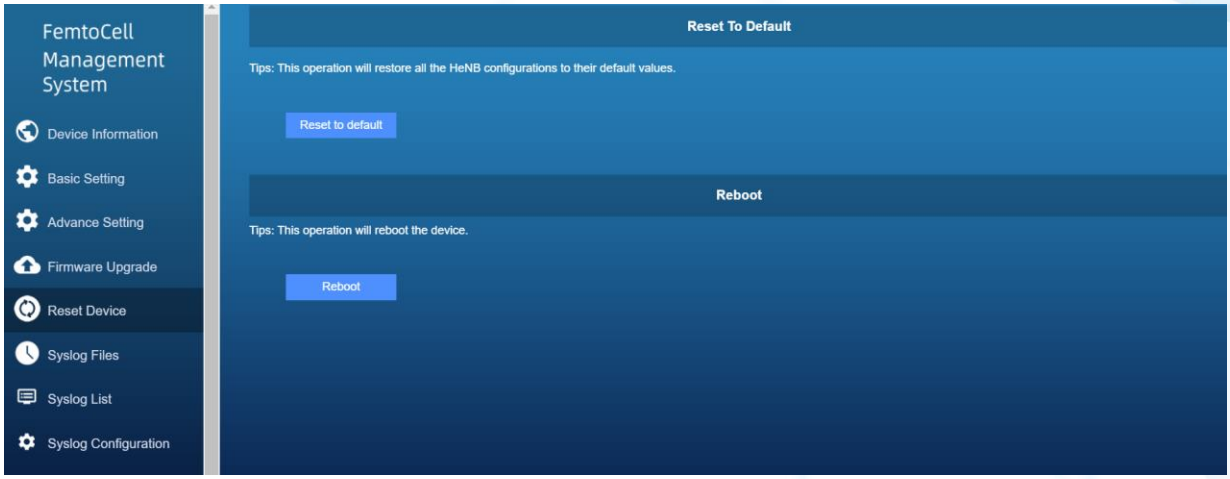


Figure 3.17 Reset Device

3.8 Diagnostic

UE: List of currently connected pieces of user equipment (UE) and the UE's current settings.

4 LED display

The Small cell has six LEDs to monitor various system functions.

Figure 4.1 LED display

Table 2. LED display

LED	LED color	Status	Description
LED1	Green	Blinks	Synchronization working
		Stay green	Synchronization success
		Turn off	No synchronization source
LED4	Red	Turn on	No synchronization source
		Turn off	Finded synchronization source,resync status
LED2	Green	Turn on	ethernet link up
		Turn off	ethernet link down or DHCP connection failed
LED5	Red	Turn off	ethernet link up
		Turn on	ethernet link down or DHCP connection failed
LED3	Green	Turn on	Power on
		Turn off	Power off

5 Warranty and compliance

The T99B226 Small Cell comes with a 5-year limited hardware warranty.

- **ITU**

  3GPP: 3GPP E-UTLA Release 9

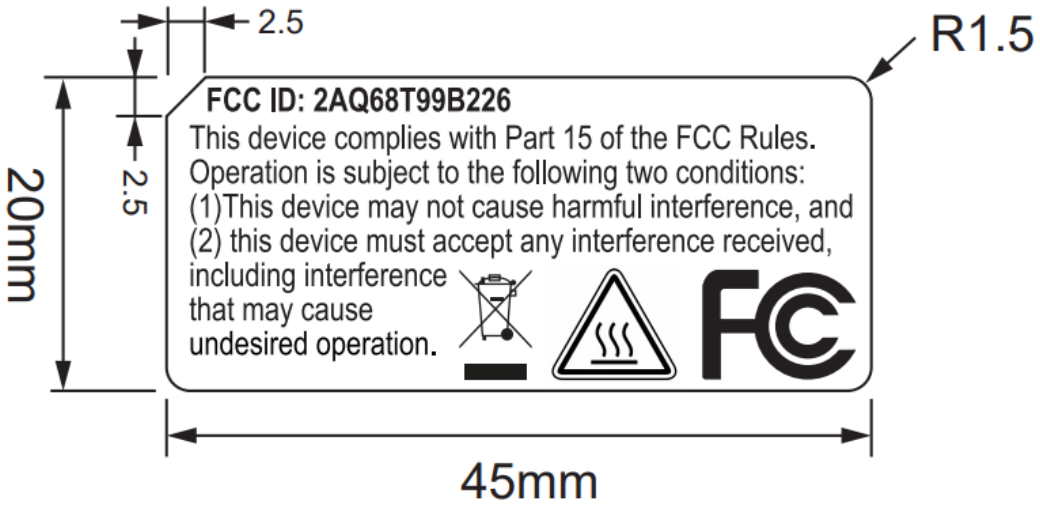
- **IEEE**

  IEEE 802.3u 100Base Ethernet

  IEEE 802.3ab Gigabit Ethernet

- **Others**

Outdoor Rating	IP65
Safety	UL (Optional)
FCC	Part 96



6 Frequently Asked Questions

This chapter provides answers to the commonly asked questions about the CBSD Outdoor Small Cell. (Also refer to Troubleshooting.)

The chapter covers the following topics:

• Why can’t my device connect to the CBSD Outdoor Small Cell? Ethernet PHY detection failed

• What is the setting to Connect to HeMS?

• How to Set Update File Server?

• How to check the fault record?

• How to check the performance statistic?

• How to setup the Security Management?

Why can't my device connect to the CBSD Outdoor Small Cell?

If you are experiencing problems connecting to the CBSD Outdoor Small Cell, try the following steps:

1. Try manual power cycle HeNB
2. After repeating step1 for 3 times, if the situation still exists, call the service center and replace the HeNB

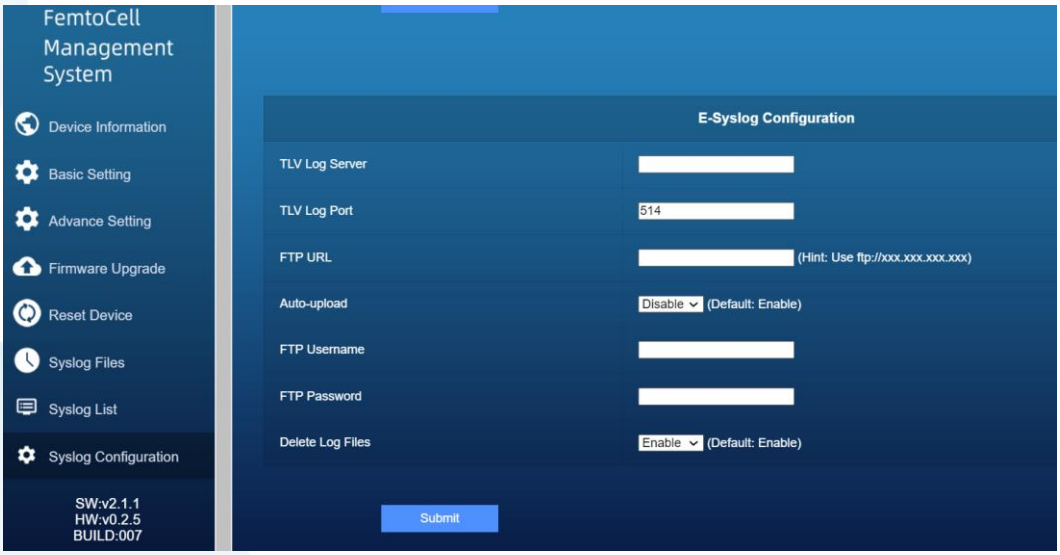
What is the setting to Connect to HeMS?

Go to "Basic Settign" page, set the URL, username and password of the serving HeMS. After the HeMS is configured, click on "Submit".

How to Set Update File Server?

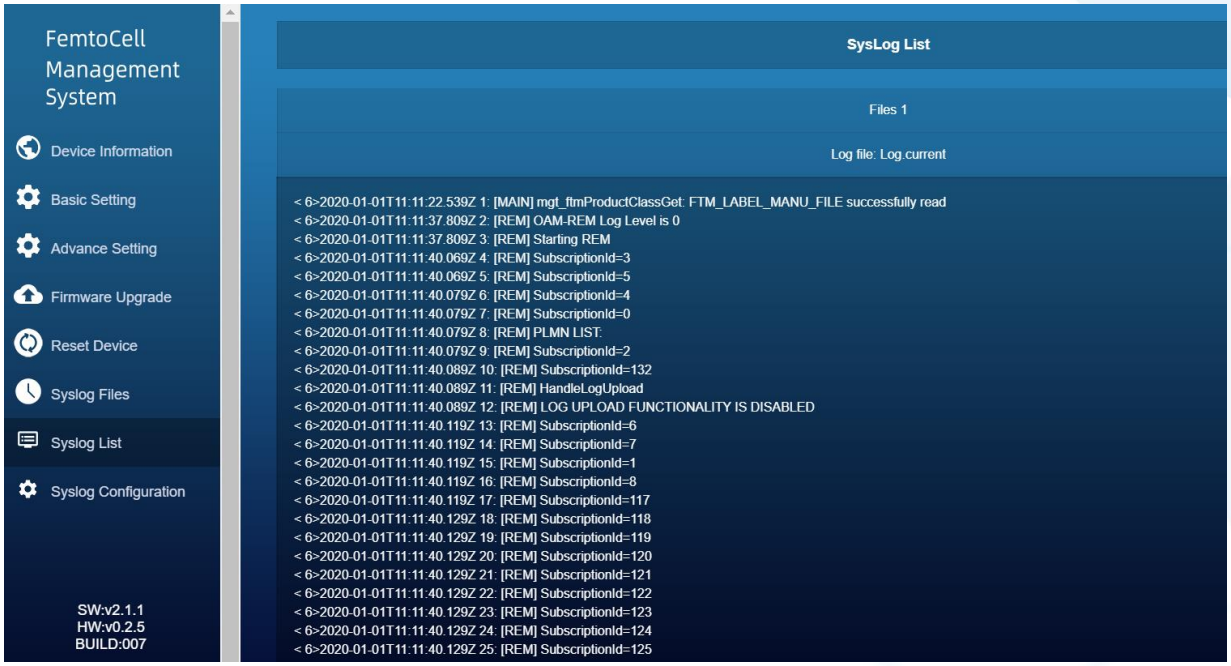
Go to data model path "Syslog Configuration" and fill in the upload server information to this object:

- FTP URL
- FTP Username
- FTP Password



How to check the fault record?

Go to the path ”Syslog List” to check the fault records.



7 Troubleshooting

This chapter provides suggestions for troubleshooting problems that might arise when you are using your mobile router. The chapter covers the following topics:

• RF detection failed

• Ethernet interface link is down

• Software fault

• System resource is overloaded

• DHCP server connection failed

• DNS resolution failed

RF detection failed

1. Try manual power cycle HeNB.

2. After repeating step1 for 3 times, if the situation still persists, call the service center and replace the HeNB.

Ethernet interface link is down

1. Check if the Ethernet cable on HeNB side or the uplink router side is loosely connected.

2. Use a new ethernet cable.

3. Check the Home Router Settings.

4. Check the SBM Networking Settings.

5. Replace the HeNB.

Software fault

1. Long press and hold the push button for 10 seconds and release the push button. Wait for the HeNB to boot up.

System resource is overloaded

Long press and hold the push button for 10 seconds and release the push button. Wait for the HeNB to boot up.

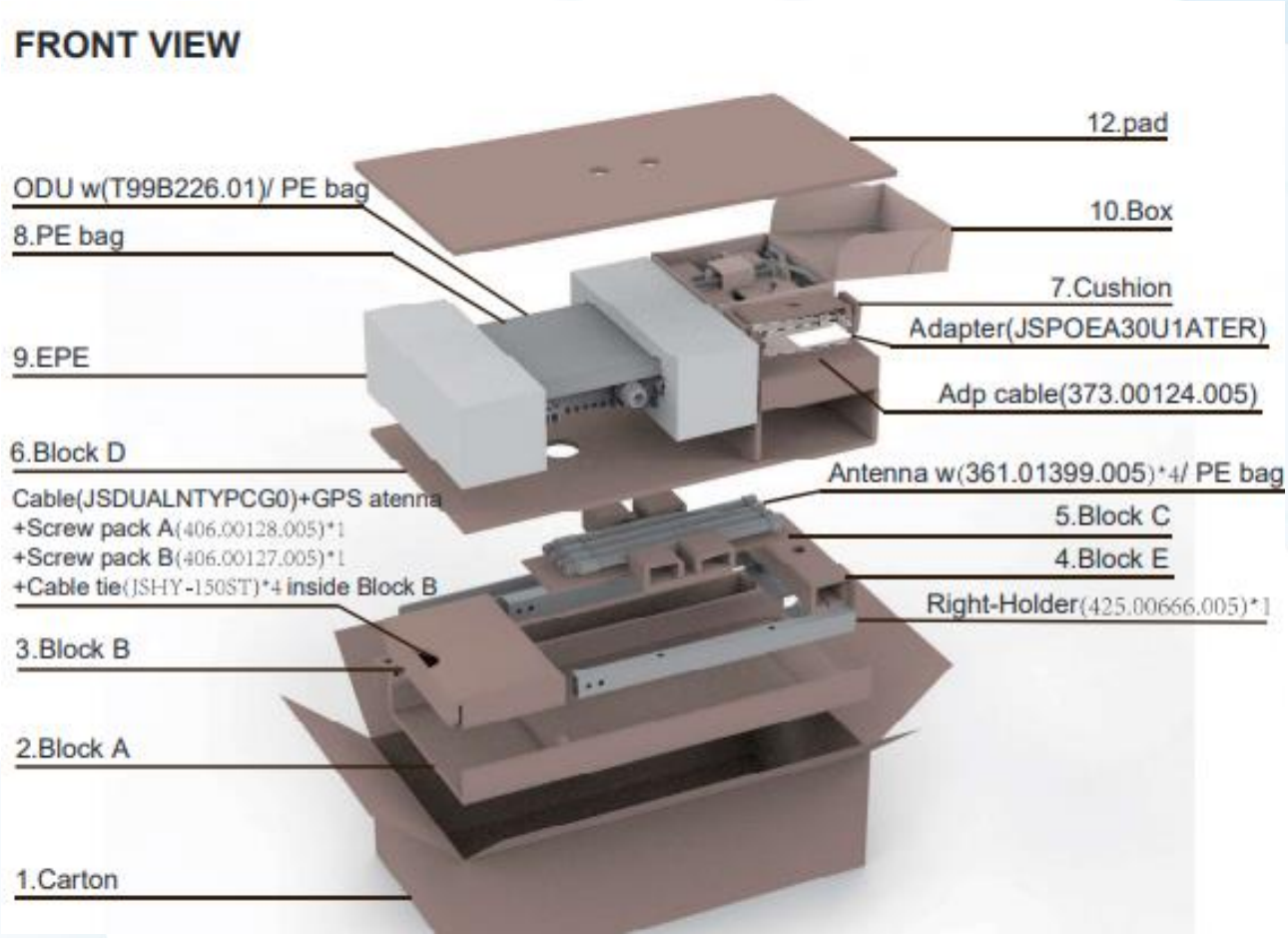
DHCP server connection failed

1. Check if the ethernet cable either on HeNB side or uplink router side is loosely connected.
2. Reboot HeNB.
3. Reboot the uplink router.
4. Long press and hold the push button for 10 seconds and release the push button. Wait for the HeNB to boot up.

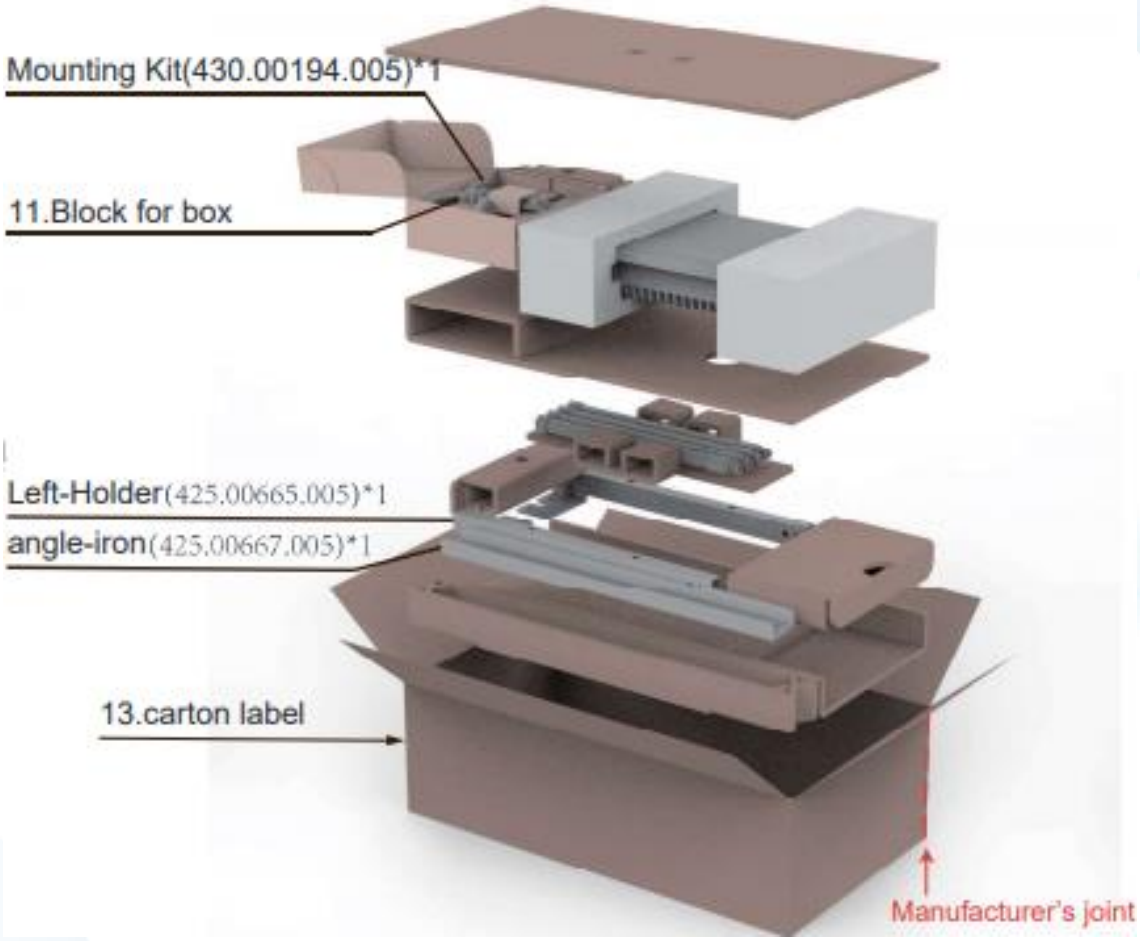
DNS resolution failed

1. Check the internet connection on the uplink router.
2. Reboot the HeNB.
3. Long press and hold the push button for 10 seconds and release the push button. Wait for the HeNB to boot up.

8 Packing information



BACK VIEW



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