

freeRAN™ IoT Base Station

Installation guide

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1.1. Overview

The freeRAN™ IoT Base Station 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.

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial or industrial installation. This device 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 device does cause harmful interference to radio or television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one of the following measures.

Method	Action
1	Reorient or relocate the receiving antenna
2	Increase the separation between the device and receiver
3	Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
4	Consult the dealer or an experienced RF technician for help

Table 1.1: Approaches to correcting interference

CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this device. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

1.2. Radiation Exposure Statement

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20 cm during normal operation.

1.3. Professional Installation Statement

The freeRAN™ IoT Base Station provides unique features. It is not available to the average consumer. Note that the freeRAN™ IoT Base Station will be distributed through controlled distribution channels and installed by trained professionals and will not be sold directly to the public through retail stores or by mail order.

1. Installation personnel: This product is designed for specific applications and needs to be installed by a qualified personnel who has RF and related regulations knowledge. The general user should not attempt to install or change the settings.
2. Installation location: The product should be installed at a location where the radiating antenna can be kept 8 inches from nearby persons in normal operation condition to meet regulatory RF exposure requirements.
3. Installation procedure: Please refer to installation guide for the details.
4. Warning: Please carefully select the installation position and make sure that the final output power does not exceed the limits set in relevant rules. Violation of rules could lead to serious federal penalties.
4. Antennas: Only antennas specified in the installation guide are allowed to be used. The non-approved antennas may produce unwanted RF transmit power, which may violate FCC rules and is prohibited.

1.4. Safety Statement

All instructions, warning and caution statements that accompany this device must be strictly followed at all times to ensure its safe use. Observe all warning and caution symbols that are fixed to this device. This device is designed with the utmost care for the safety of those who install and use it. However, when using this device, basic safety precautions should always be followed to reduce the risk of fire and injury to persons, and the dangers of electric shock and static electricity. Do not cover the device or block the airflow to the device with any other objects. This device was qualified under test conditions that included the use of the supplied cables between system components.

To be in compliance with regulations, the user must use the cables supplied with the unit and install them properly. This includes the power adapter that is provided. Place the unit to allow for easy access when disconnecting the power adapter from the main wall outlet. Operate this device only with the type of power source indicated on the marking label. If you are not sure of the type of power supplied to your facility, consult your dealer or local electricity provider.

Do not use this product near water, for example a swimming pool or a bathroom. Keep the device away from excessive heat and humidity and keep the device free from vibration and dust. Wipe the unit with a clean, dry cloth. Never use cleaning fluid or similar chemicals. Do not spray cleaners directly on the unit or use forced air to remove dust.

Avoid installing or using this product during an electrical storm. There may be remote risk of electric shock from lightning. During a lightning storm for added protection please unplug it from the wall outlet and disconnect all cables. This will prevent damage due to lightning and power surges. For safety reasons, only authorized service technicians should open the device. If the device is opened the warranty will become void. The device may affect medical equipment and so please take account of any technology restrictions with this equipment. This device, like other radio devices, emits radio frequency electromagnetic energy, but operates within the guidelines found in radio frequency safety standards and recommendations. It is recommended that the minimum operating distance from the installed Base Station to persons is 8 inches.

1.5. General Hazard Statement

Safety notes are marked with symbols. Ignoring the safety notes may lead to personal injury, damage to the instrument and malfunctions. Signal Words identify the hazard severity level as the following:

Word	Meaning
DANGER	Indicates an extremely hazardous situation which, if not avoided, will result in death or serious injury, permanent damage to equipment or large fines and penalties
WARNING	Indicates a hazardous situation which, if not avoided, could result in serious injury or damage to equipment and moderate fines or penalties
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor injury or minor damage to equipment or minor to moderate penalty fees
NOTICE	Indicates a hazardous situation not related to personal injury or damage to equipment

2.1. Standard product offering

The items shown in [Table 2.1](#) are included as standard options for the freeRAN™ IoT Base Station - see [Figure 2.1](#) for an example of the accessories included as part of this standard offering. The unit provided is configured to the user's specification during the ordering process and accessories may vary from those shown in the diagram below.

The unit can be configured using a cloud tool called the freeRAN™ IoT Base Station Management System. The freeRAN™ IoT Base Station provides air-interface and core network functions that allows management of large number of devices.

The unit can be used for creating LTE-M standalone private IoT networks. Full detailed specifications of the freeRAN™ IoT Base Station are provided in the User Manual.

Ref	Item	Qty.
A	freeRAN™ IoT Base Station	1
B	GPS antenna	1
C	RF Antenna (one of two kinds as shown in Figure 2.1)	1
D	Power-Over-Ethernet (PoE) injector with Ethernet cable (as needed)	1
E	Cable grip for Ethernet (as needed)	1
F	Mounting kit	1
G	Backhaul LTE antenna	1

Table 2.1: Items included in a standard freeRAN™ IoT Base Station product offering. Note that these items are subject to [Options](#) specified below.

CAUTION: Do not use any antennas with freeRAN™ IoT Base Station. Only antennas specified in the [Antenna Specifications](#) are allowed to be used.

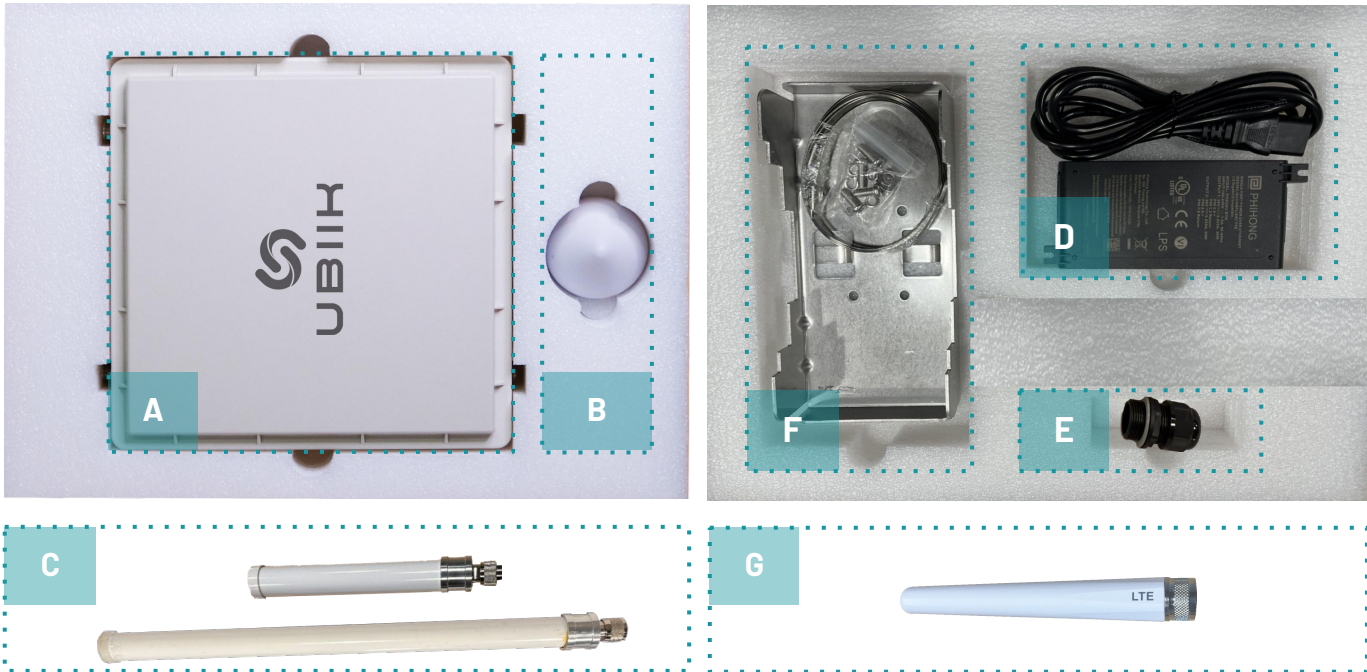


Figure 2.1: Items included in as part of a standard freeRAN™ IoT Base Station product offering

2.2. Options

The freeRAN™ IoT Base Station comes with a few customizable options as seen in [Table 2.2](#). For further technical details please see the User Manual.

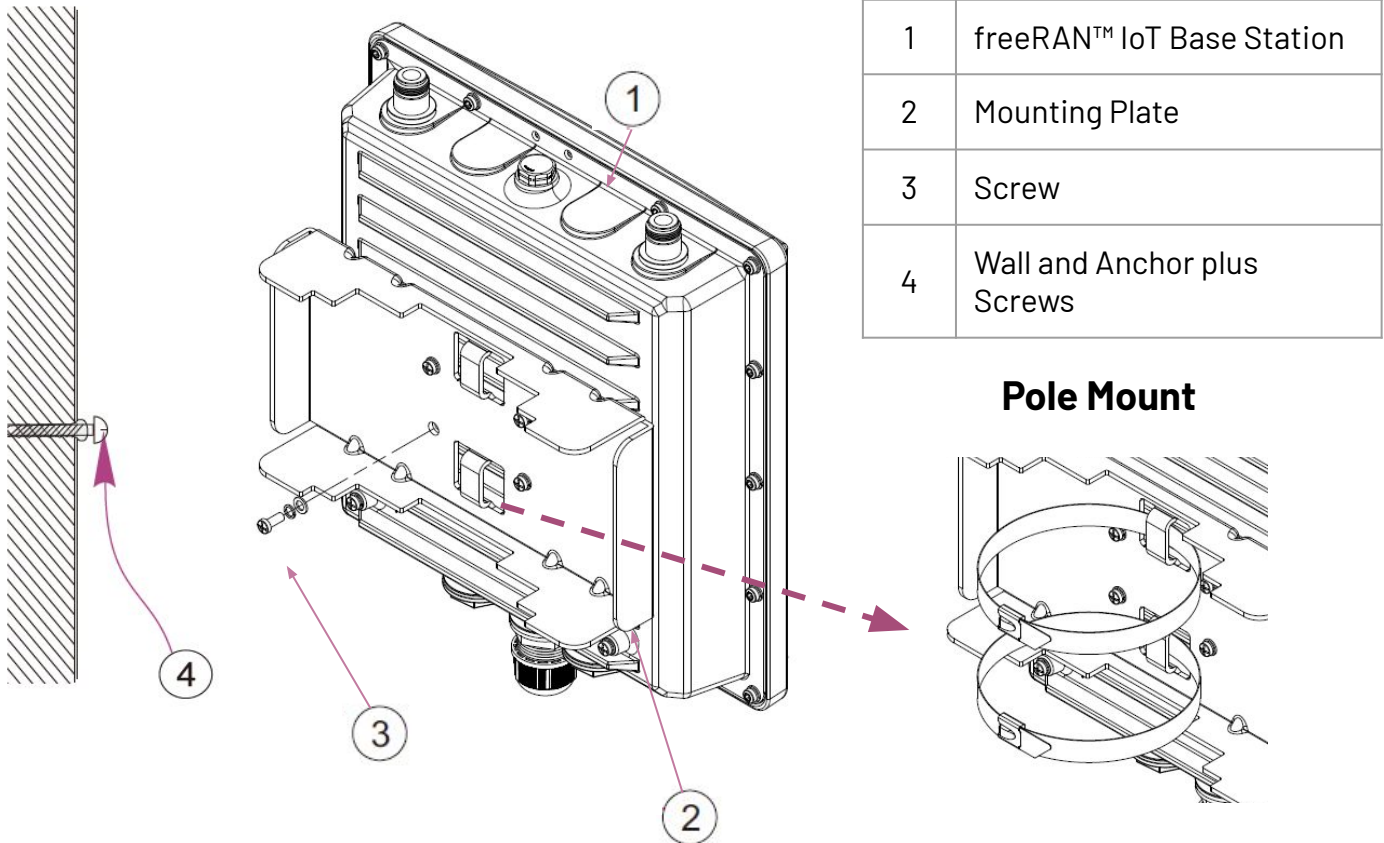
The freeRAN™ IoT Base Station is configured by Ubiik before delivery, however the configurable parameters can be set using the freeRAN™ IoT Base Station Management System (cloud platform).

Options		Description	Sub-options
A	Backhaul	Configured for Ethernet or LTE backhaul	- Ethernet - LTE
B	Location	Configured for various installation location types	- Enclosure Types - Cable Types - Power Supply Types

Table 2.2: Options available for the freeRAN™ IoT Base Station, configured at time of ordering

3.1. Overview

The pole mounting kit provides a mounting system for the typical installation environment. With this kit the freeRAN™ IoT Base Station can be mounted directly on to a pole of diameter between 3.9 inches to 11.8 inches.



3.2. Hardware

The pole mounting kit should include the following hardware items. Note that the Anchor & Screw can be substituted with the Hose Clamps or Hose Clamps can be provided as an expansion to support pole mounting.

Qty	Description
1	freeRAN™ IoT Base Station
1	Mounting Plate
4	Angle Screws
4	Spring Washers

Qty	Description
4	Washers
4	Screws
4	Anchor & Screws
2	Hose Clamps

3.3. Assembly Steps

Step 1

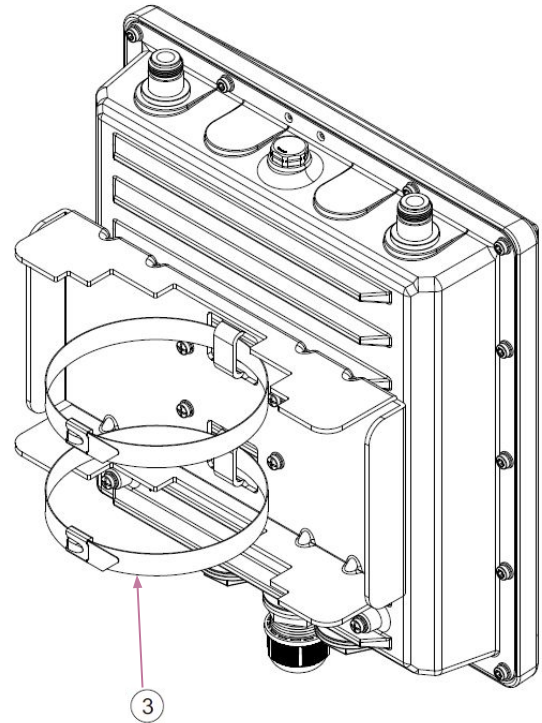
Use the four Angle Screws, Spring Washers and Washers to attach the mounting plate onto the freeRAN™ IoT Base Station as with the wall mounting approach.

Step 2

Pass the two Hose Clamps (3) through the matching hole in the mounting plate as shown.

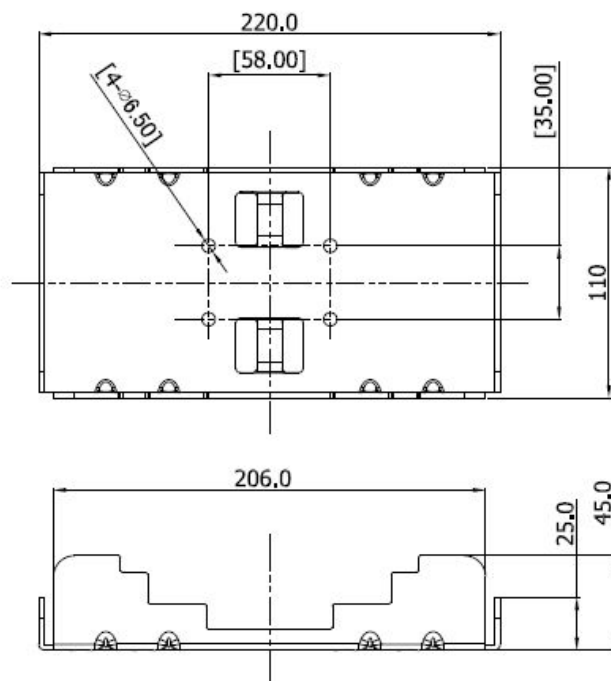
Step 3

Loop the open Hose clamps around the pole chosen for the installation and tighten the screw until the unit is secure.

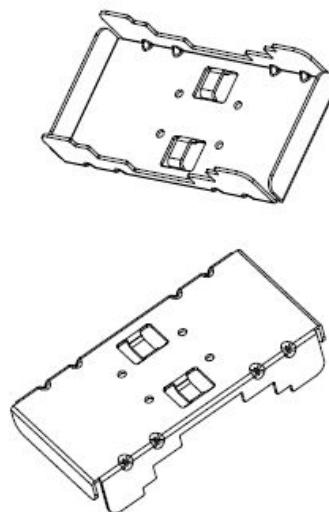


3.4. Mechanical Drawings

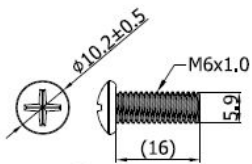
Mounting Plate



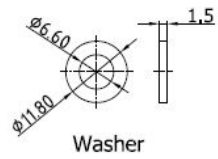
Note that all dimensions are in mm unless otherwise stated.



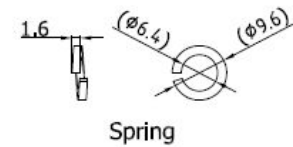
Screw, Spring Washer and Washer



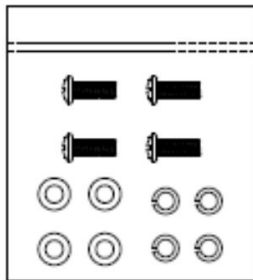
Screw



Washer

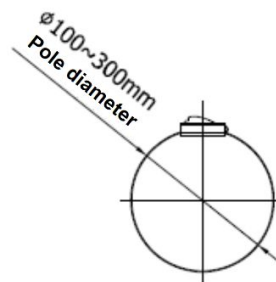
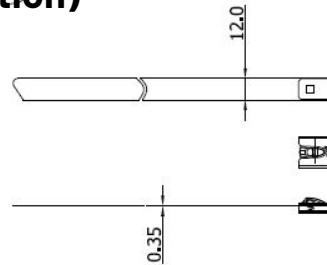


Spring

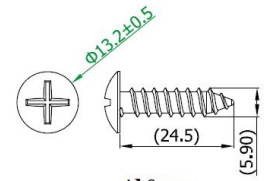


(W)50x(L)70mm
Plastic zip lock bag

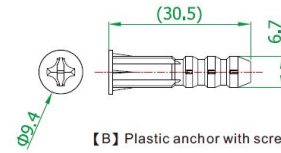
Hose Clamp (Pole Mount Option)



Anchor & Screw



A] Screws



【B】 Plastic anchor with screw

The following steps should be completed in the order listed to get the freeRAN™ IoT Base Station up and running.

4.1. Hardware Power Up

A. Mounting Antennas

The standard freeRAN™ IoT Base Station requires RF antenna, backhaul LTE antenna and GPS antenna. The process of attaching these antennas is shown in [Figure 4.1a](#).

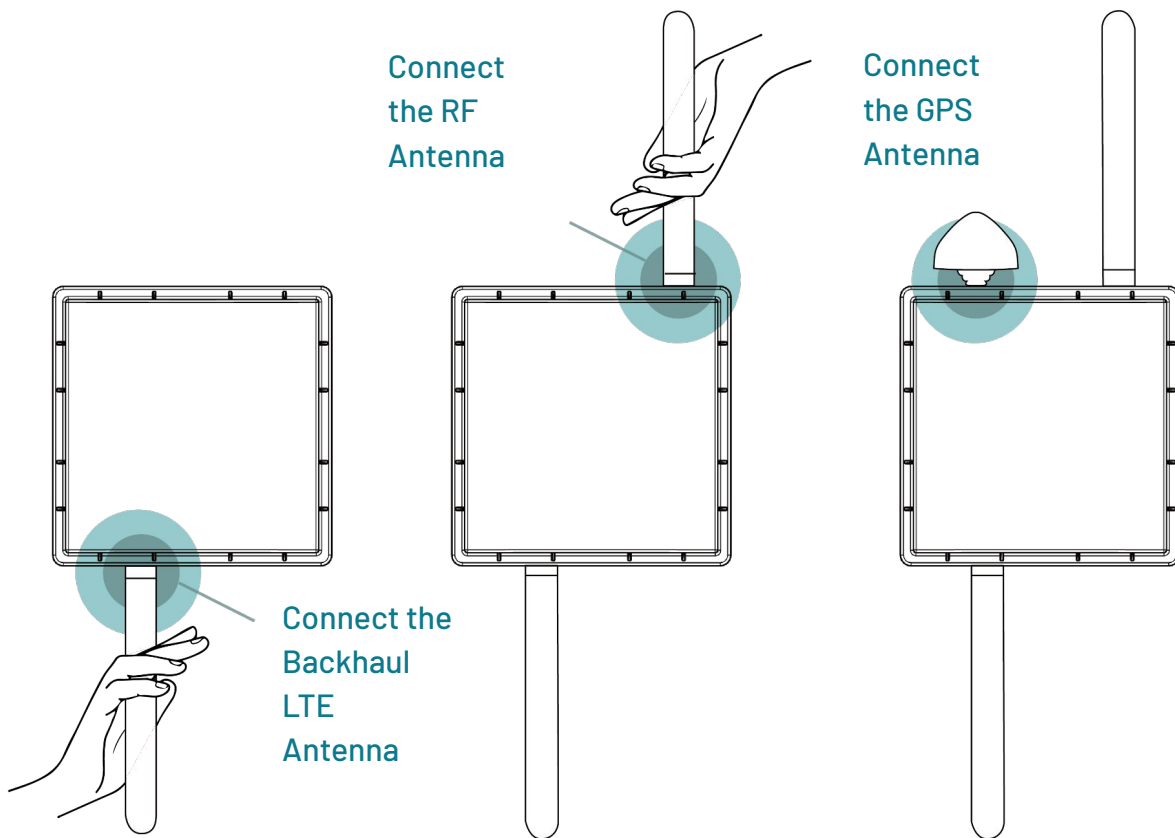
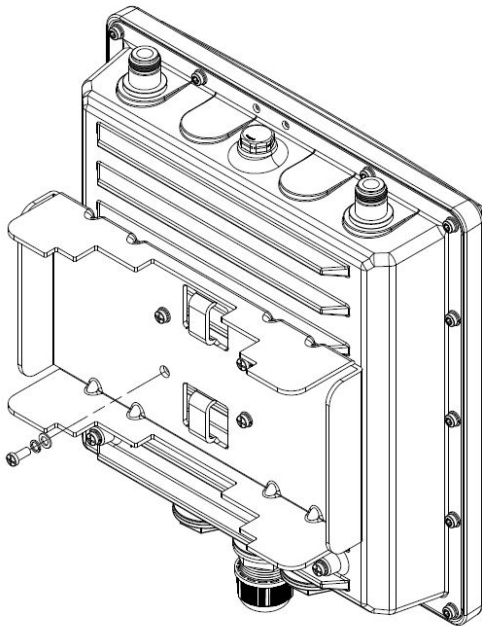


Figure 4.1a: Attaching the antennas to the freeRAN™ IoT Base Station

CAUTION: Make sure all antennas are attached properly before apply cables to the freeRAN™ IoT Base Station

B. Mounting the freeRAN™ IoT Base Station

While not necessary for testing purposes, the freeRAN™ IoT Base Station can be mounted to a wall or pole to provide a more permanent setup as described in the figures below. Depending on request from the user, the freeRAN™ IoT Base Station comes with a pole mounting kit. Please refer to the previous [Installation](#) section for a step by step set of instructions for mounting the freeRAN™ IoT Base Station to either a wall or a pole.



Qty	Description
1	freeRAN™ IoT Base Station
1	Mounting Plate
4	Angle Screws
4	Spring Washers
4	Washers
4	Screws
4	Anchor & Screws
2	Hose Clamps

C. Physical Network Connection

The freeRAN™ IoT Base Station comes with an Ethernet cable and a corresponding cable grip. Attach the cable grip to the Ethernet wire and plug in the freeRAN™ IoT Base Station on one end and plug in the local network router on the other end as shown in [Figure 4.1c](#). For outdoor installation of the freeRAN™ IoT Base Station, screw in the cable grip to provide a water-tight seal for outdoor use. Note that, in the picture below, the power connector has not been shown as connected. And no cable grips are present. In a real outdoor installation, cable grips must be installed to ensure IP67 ingress protection.

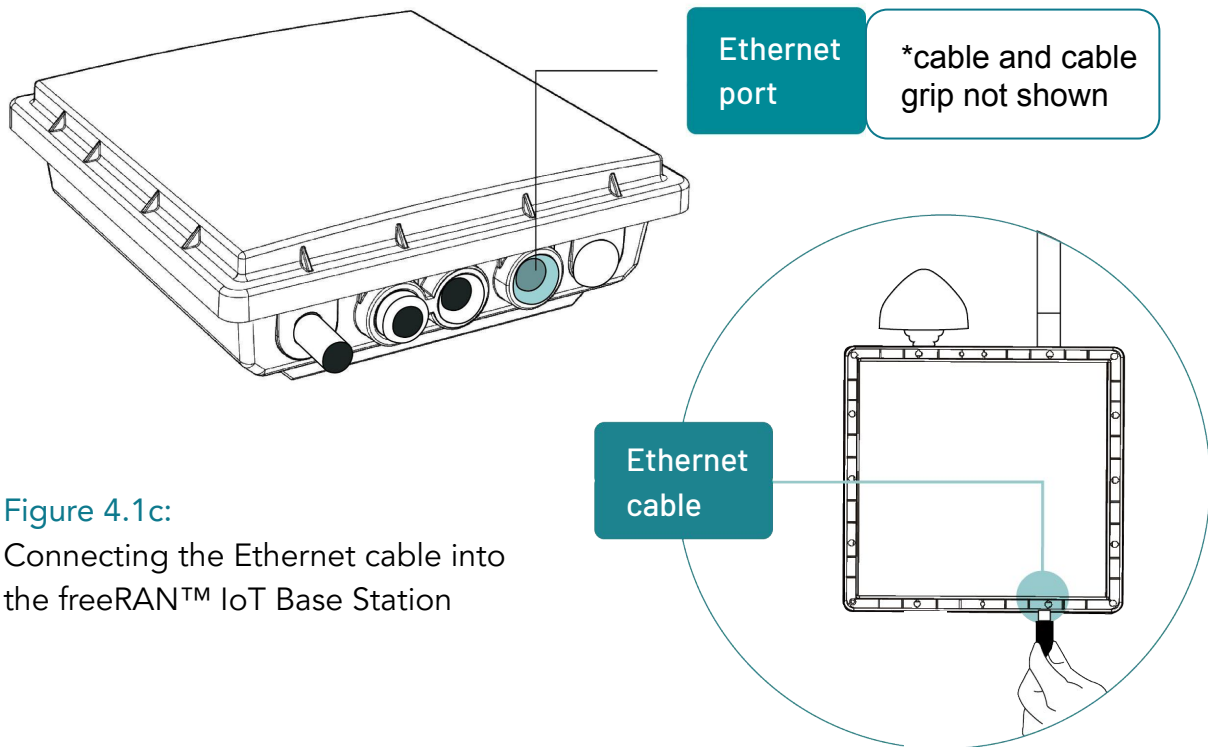


Figure 4.1c:
Connecting the Ethernet cable into
the freeRAN™ IoT Base Station

CAUTION: The default freeRAN™ IoT Base Station offering comes with an indoor Ethernet cable - this cable is not suited for outdoor use. Choose the outdoor option as indicated in the [Options](#) section for outdoor use.

D. Inserting SIM card

For LTE backhaul, a user needs to insert a SIM card. [Figure 4.1d](#) shows the SIM card slot and the correct insertion direction of the SIM card.

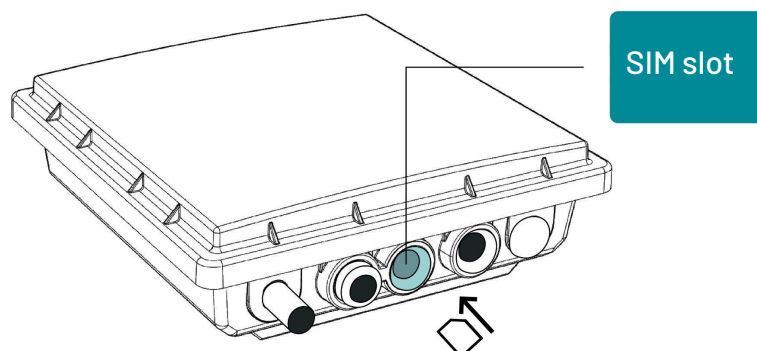


Figure 4.1d:
Inserting the SIM card into the freeRAN™ IoT Base Station

E. Connecting Power

The freeRAN™ IoT Base Station comes with a Power-Over-Ethernet (PoE) injector customized to the user specification during the ordering process. This provides power without the need of a power adaptor. Once connected to power, the freeRAN™ IoT Base Station will attempt to connect to a network automatically. The unit can be reset by disconnecting and reconnecting the injector. This may be needed in the event that there is a connection error as indicated by the green and white LEDs.

WARNING: Do not exceed the power handling capability of the power amplifier for the unit to avoid permanent damage.

4.2. Network Connection Setup

A. Checking the freeRAN™ IoT Base Station Network IP Address

Before shipping, the user can request Ubiik engineers to configure the freeRAN™ IoT Base Station with a static IP address. By default, however, the freeRAN™ IoT Base Station is configured for DHCP. For the DHCP configured version, the user's local network router should be set up to assign an IP address to the freeRAN™ IoT Base Station via DHCP. Please refer to your specific router's documentation for help with this setup.

To verify the IP address assigned to the freeRAN™ IoT Base Station via your router and DHCP, the user can log into their router and check the IP assignment for the MAC address associated with their freeRAN™ IoT Base Station. A MAC address label for the freeRAN™ IoT Base Station is provided on a label on the unit to support this. The format for the MAC address should be a colon separated 12 digit hexadecimal value (e.g. 2C:54:91:88:C9:E3). If for some reason, this MAC address is not available, please contact [Ubiik Support](#).

B. Confirming Connection to Local Network via LED status

A basic check to verify connection is to look at the green and white status LEDs. These LEDs are located on the freeRAN™ IoT Base Station as shown in [Figure 4.2b](#). Note that Ethernet cable and power cable are shown as disconnected in this picture. They should however be connected to see the real status of the LED.

[Table 4.2b](#) provides various states for the Status LED. There are two LEDs present, a white and a green. These LEDs, together, will be in one of the four states. If the freeRAN™ IoT Base Station is up and running and connected to the core network, the LEDs should be in the solid state. The LEDs should cycle through all other states to achieve this solid state. If for some reason, the last state is not reached, a problem exists either with the power supply, the OS, the system or with the connection to the core

Figure 4.2b:
The location of the
green and white
status LEDs

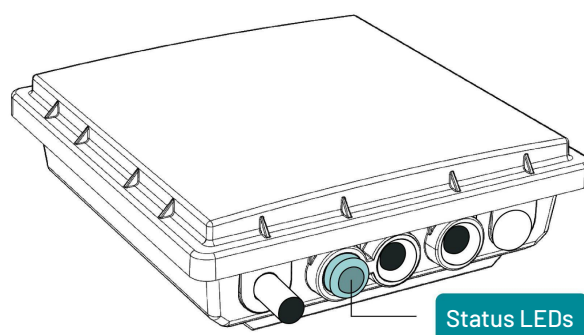
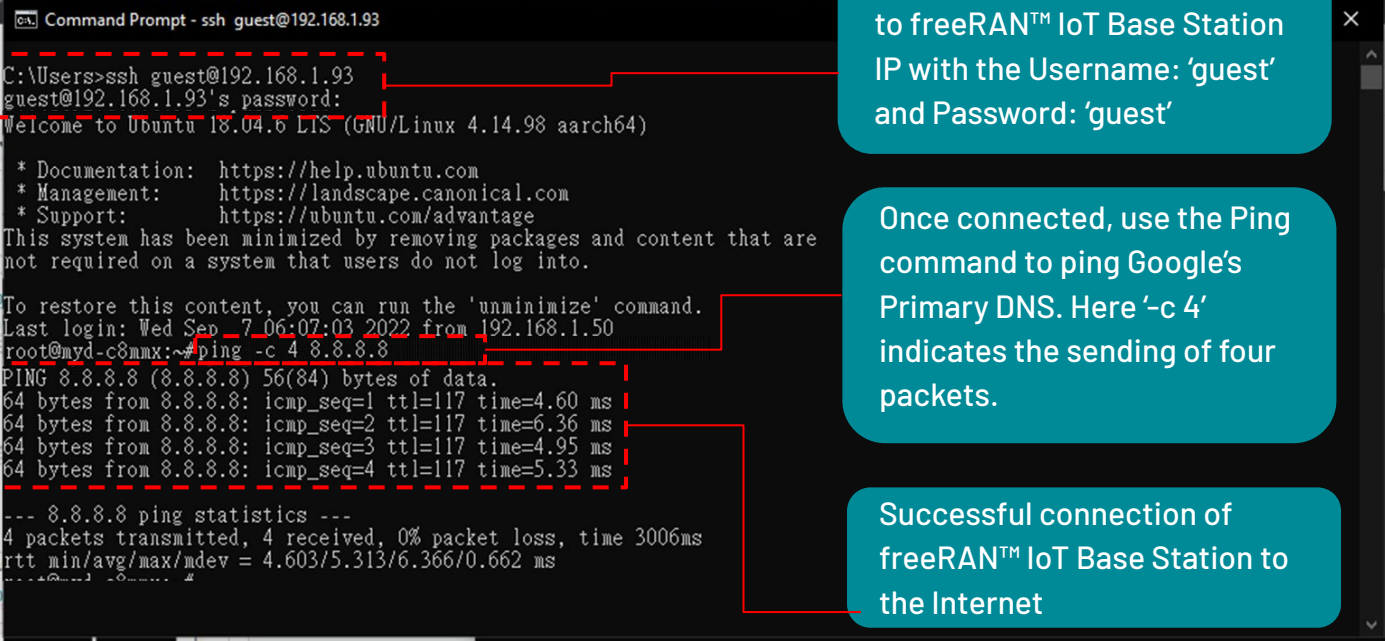


Table 4.2b: Checking the
status of the freeRAN™
IoT Base Station to verify
power and connection

Green LED	White LED	System Status
Off	Off	Power Off, Disconnected
Off	On	Power On, OS Running
Flashing	On	Power On, System Running
On (Solid)	On	Power On, System Running and Connected to the core network

C. Confirming Internet Connection via Ping from the freeRAN™ IoT Base Station

After confirming that the freeRAN™ IoT Base Station is connected to your local network, it is time to check that it can access the internet. At this stage it is necessary to connect to the unit from your computer using SSH as shown in [Figure 4.2c](#) below. Use the **username: guest** and **password: guest**. Once connected perform the same ping operation to Google's primary domain at 8.8.8.8.



The screenshot shows a Windows Command Prompt window titled "Command Prompt - ssh guest@192.168.1.93". The user enters the command `C:\Users>ssh guest@192.168.1.93` and provides the password `guest`. The terminal displays the Ubuntu 18.04.6 LTS login banner. The user then enters `ping -c 4 8.8.8.8`, and the terminal shows four successful ping responses with round-trip times around 4-6 ms. Finally, the user enters `ping -t 8.8.8.8`, and the terminal shows continuous ping results with 0% packet loss.

```
C:\Users>ssh guest@192.168.1.93
guest@192.168.1.93's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 4.14.98 aarch64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage
This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.
Last login: Wed Sep  7 06:07:03 2022 from 192.168.1.50
root@myd-c8mmx:~#ping -c 4 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data:
64 bytes from 8.8.8.8: icmp_seq=1 ttl=117 time=4.60 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=117 time=6.36 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=117 time=4.95 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=117 time=5.33 ms
--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3006ms
rtt min/avg/max/mdev = 4.603/5.313/6.366/0.662 ms
root@myd-c8mmx:~#ping -t 8.8.8.8
PING: send: 0 bytes of data...
```

Use SSH command to connect to freeRAN™ IoT Base Station IP with the Username: 'guest' and Password: 'guest'

Once connected, use the Ping command to ping Google's Primary DNS. Here '-c 4' indicates the sending of four packets.

Successful connection of freeRAN™ IoT Base Station to the Internet

Figure 4.2c: Pinging the internet from the freeRAN™ IoT Base Station.

At the command line, use `ssh guest@XXX.XXX.XXX.XXX` followed by `ping -c 4 8.8.8.8` (Replace XXX.XXX.XXX.XXX with your Base Station's IP address.)

The antennas shown below are included as standard options for the freeRAN™ IoT Base Station. Note that only these antennas are allowed to be used with freeRAN™ IoT Base Station.

GPS Antenna	5 dBi peak gain
RF Antenna	2.65 dBi peak gain
Backhaul LTE antenna	Antenna peak gain: 1.8 dBi (band 2), 0.6 dBi (band 4), 1.4 dBi (band 13)

REVISION HISTORY

Revision	Date	Description
1.0	March 2023	Initial release



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