goRAN
Small Cell Guide

User Manual

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1.1. Overview

The goRAN Small Cell provides eNodeB (eNB) and Evolved Packet Core (EPC) functionality to create a low-power, long range 3GPP compliant network suitable for IoT devices. It is optimized for operating with LTE-M, NB-IoT but can support potentially other technologies. The network can support bidirectional wireless communication of data between a Small Cell (base station) and a moderate density of user equipments (UEs) for use in standalone, public, private and hybrid networks.

1.2. Hardware

The items shown in Table 1.2 are included as standard options for the goRAN Small Cell product offering - see Figure 1.2 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 setup as an LTE-M or NB-IoT small cell. The goRAN provides eNodeB (eNB) and Evolved Packet Core (EPC) functions that can be used either for creating standalone private IoT networks, range extenders of existing networks or some hybrid combination of the two.

There are two standard versions of the goRAN available to users: (1) A full band version intended for evaluation purposes and (2) a band specific version intended for production environments. Full detailed specifications for each version can be found at the end of this document in System Specifications.

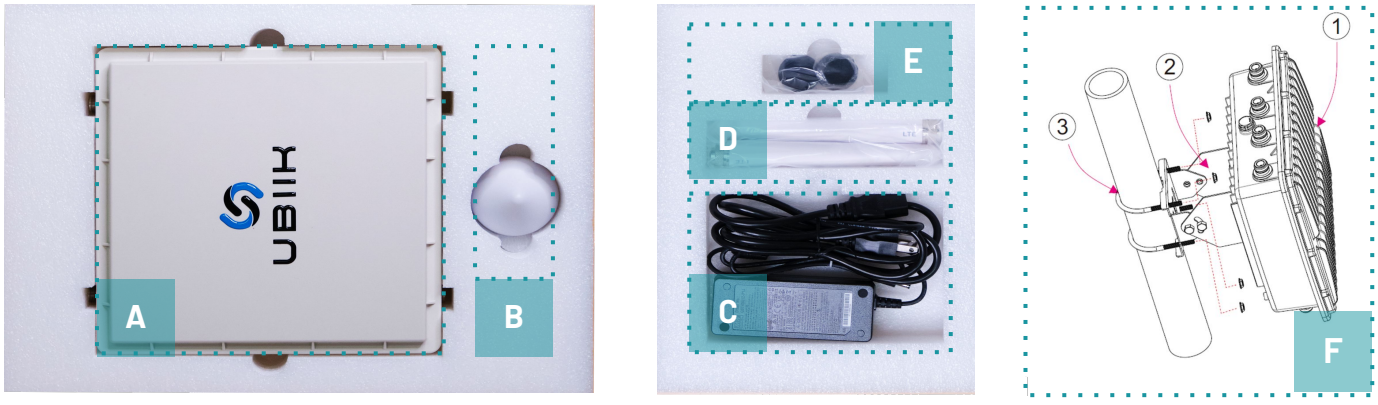


Figure 1.2: Items included in as part of a standard goRAN Small Cell product offering

Ref	Item	Qty.
A	goRAN small cell (with eNB and EPC function)	1
B	GPS antenna	1
C	AC Power adaptor or Power-Over-Ethernet (POE) Injector with Ethernet cable (as needed)	1
D	LTE antennas (one or two as needed)	1 / 2
E	Cable grips for ethernet and power cables (as needed)	2
F	Mounting kit (either pole or wall mount as needed)	1

Table 1.2: Items included in a standard goRAN Small Cell product offering. Note that these items are subject to Options and Limitations specified below.

1.3 Options and Limitations

The goRAN Small Cell comes in two main versions. Each type has a number of customizable options as seen in Table 1.3. For further technical details please see the section on System Specifications provided at the end of this manual.

WARNING: The user is responsible for setting up the goRAN small cell unit in a confined environment to validate spectrum configurations. it is the user's responsibility to ensure that regional spectrum licensing requirements are met during testing and installation.

A. Full Band Version

This version is preferred for testing and evaluation as it does not have a power amplifier, filter or duplexer. The absence of a power amplifier limits range and transmit power (typically up to 10m line-of-sight). Since duplexer is missing, two antennas are required for transmit and receive. The presence of the two antennas can cause problems with communication beyond 10m line-of-sight due to the proximity of the transmit and receive antennas when operating in full-duplex mode. Increasing distance between these antennas can reduce interference. This can be done via an external cable extension for the antennas. The absence of a power amplifier means that the maximum transmit power is limited, but can be adjusted over a wider range. See options in Table 1.3 or System Specifications for further details.

B. Band Specific Version

This version is configured, by Ubiik, according to user communicated specifications and spectrum licensing requirements before delivery. This version is intended for production and deployment and has a power amplifier, filter and duplexer added to it. The presence of band-specific duplexer(s) restricts the usage in the corresponding frequency bands. The maximum transmit power is also higher thanks to the power amplifier, and can be configured using either the goRAN Management System (cloud platform) or with the Admin Config. Tool - see subsequent sections of this user guide for details. See Table 1.3 or System Specifications for further details.

WARNING: Care has to be taken not to exceed the power handling capability of the power amplifier to avoid permanent damage.

Options		Description	Sub-options	Default
A	EPC	Configured for internal or external EPC	- Internal EPC, - External EPC	Internal EPC
B	Duplexer	Configured for time division or frequency division duplexing	- TDD - FDD	FDD
C	Backhaul	Configured for ethernet with optional 4G backhaul	- Ethernet, - Ethernet + 4G	Ethernet
D	Mounting	Packaged for pole or wall mounting or neither	- Pole Mount - Wall Mount	None
E	Location	Configured for either indoor or outdoor operation	**Outdoor** IP67 Power over Ethernet (POE), IP67 enclosure and fittings, IP67 ethernet cable **Indoor** Standard enclosure and fittings, Universal wall adapter, standard ethernet cable	Indoor
F	Protocol & Band	Configured for appropriate communication protocol & band	- LTE-M - NB-IoT	LTE-M

Table 1.3: Options available for band specific and full band goRAN Small Cell. Configured at time of ordering.

2.1. goRAN Small Cell Overview

Figure 2.1 below shows an example of how the the goRAN Small Cell unit can be connected at a high level. The goRAN Small Cell unit contains an integrated eNB and EPC to allow for easy plug and play operation. This is connected via a 120/240V Universal AC supply to a wall outlet or through a Power-Over-Ethernet (POE) injector. The Small Cell unit can also be configured to operate with an external EPC. By way of demonstration, an Evaluation Kit (EVKs) that acts as User Equipment (UE) is also shown - this UE is not included with the standard goRAN Small Cell package but is a part of a goRAN Ignition Kit that can be requested by the user during the ordering process.

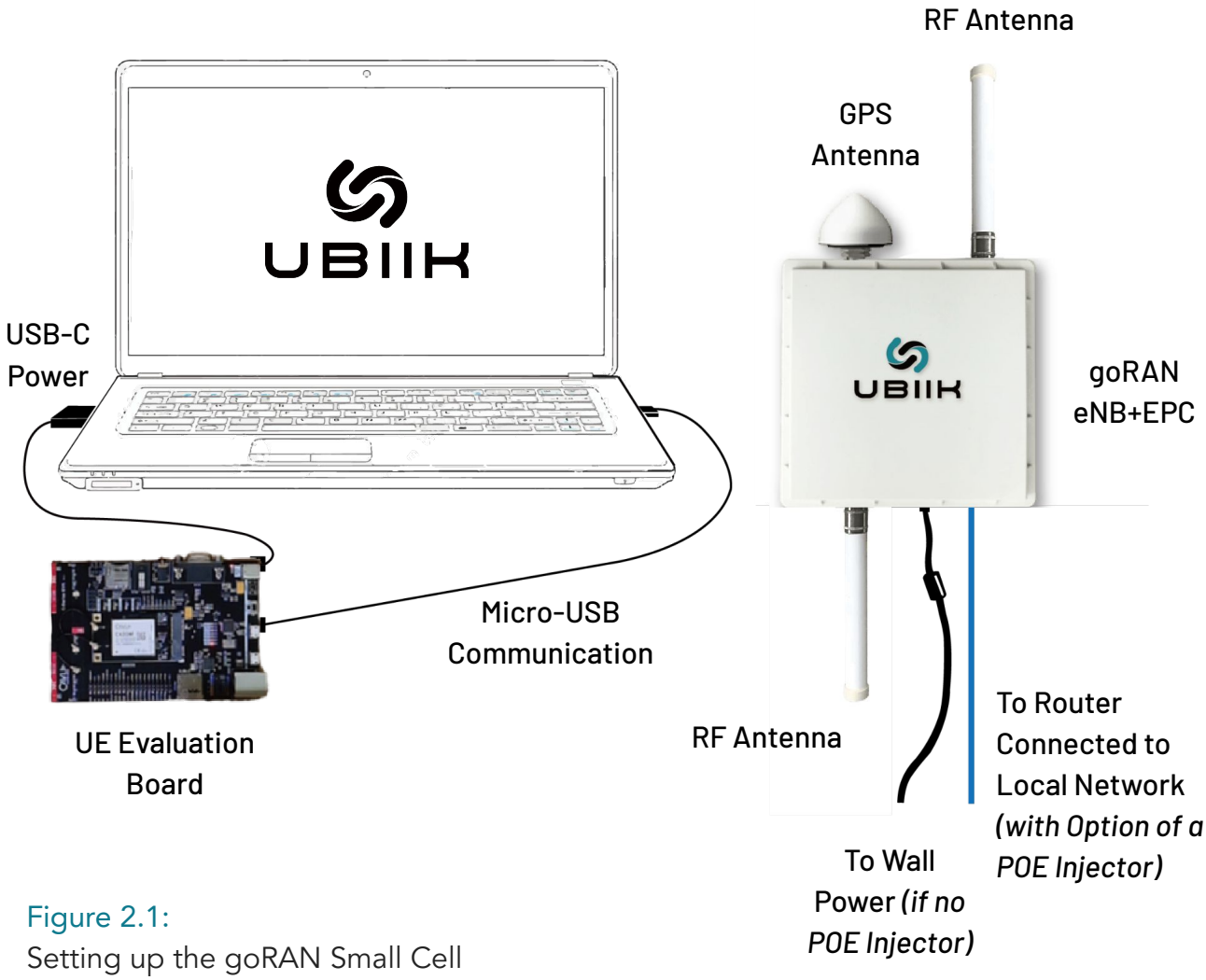


Figure 2.1:
Setting up the goRAN Small Cell

2.2. goRAN and 3GPP Architecture

The goRAN Small Cell is a 3GPP standard LTE/4G eNB combined with an internal EPC - a number of options are available for the Small Cell unit as discussed earlier. Any 3GPP standard UE can be configured to operate with the goRAN as long as they are correctly configured. Figure 2.2a below shows how goRAN Small Cell (eNB and EPC) fits in the standard LTE infrastructure.

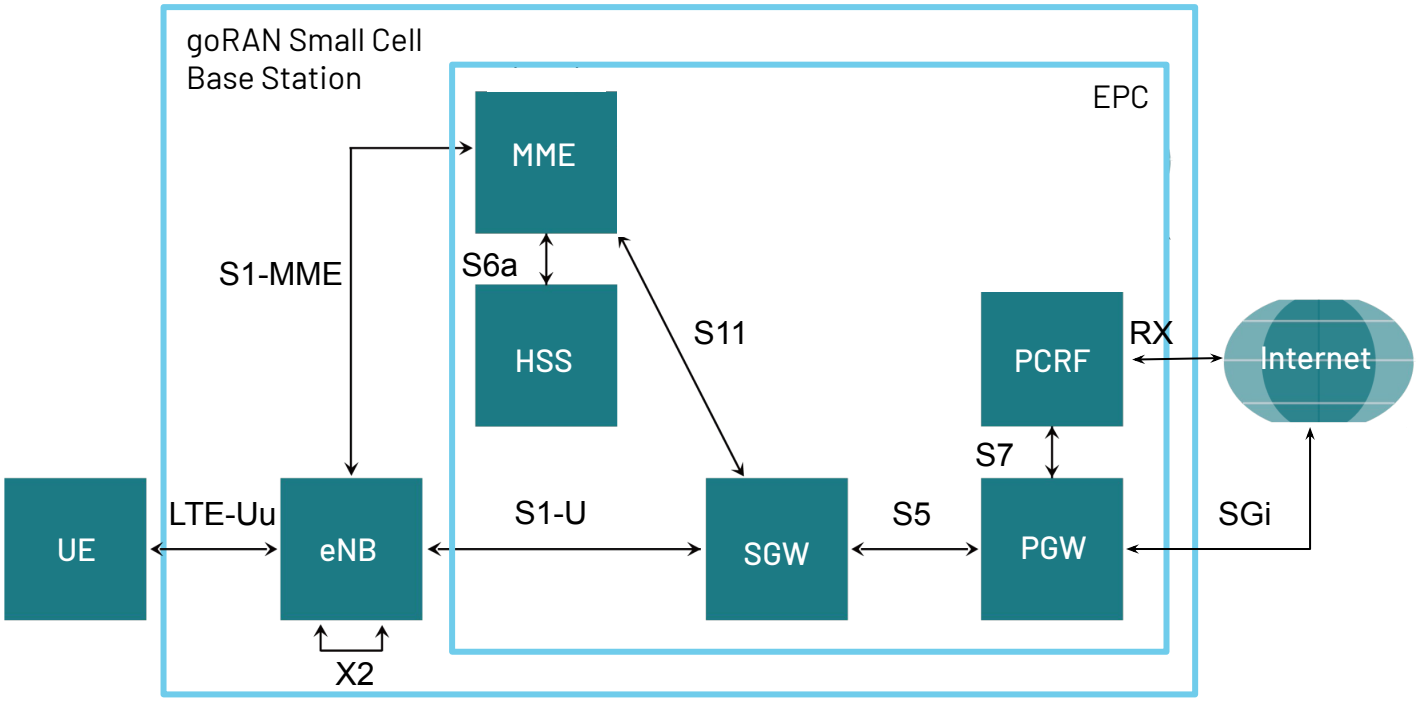


Figure 2.2a: How the goRAN Small Cell fits the 3GPP standard.

The goRAN Small Cell, provided to the user, when setup, forms a simplified network to the one shown in the earlier diagram (see Figure 2.2a). In standalone operation (see Figure 2.2b), the internal EPC of the goRAN is used - this simplifies setup, for the user, over that of an external EPC. Though it should be noted that the goRAN can be configured easily for use with an external third-party EPC as well.

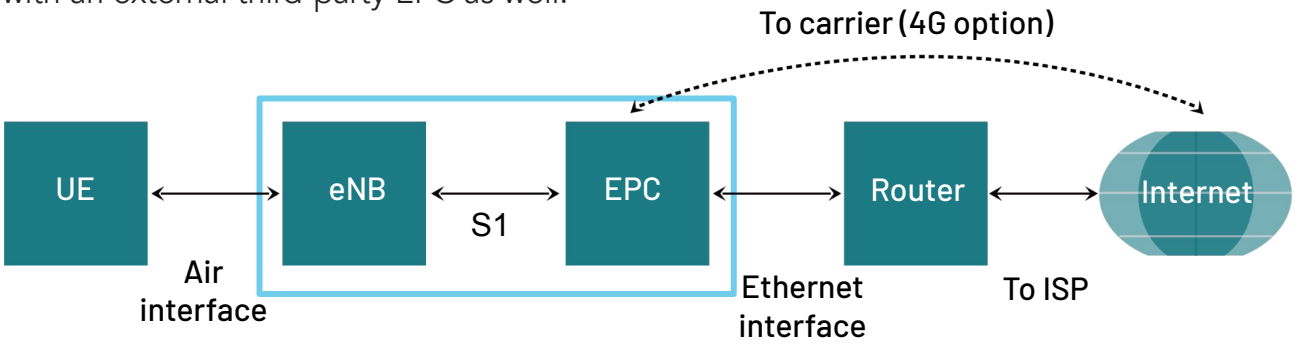
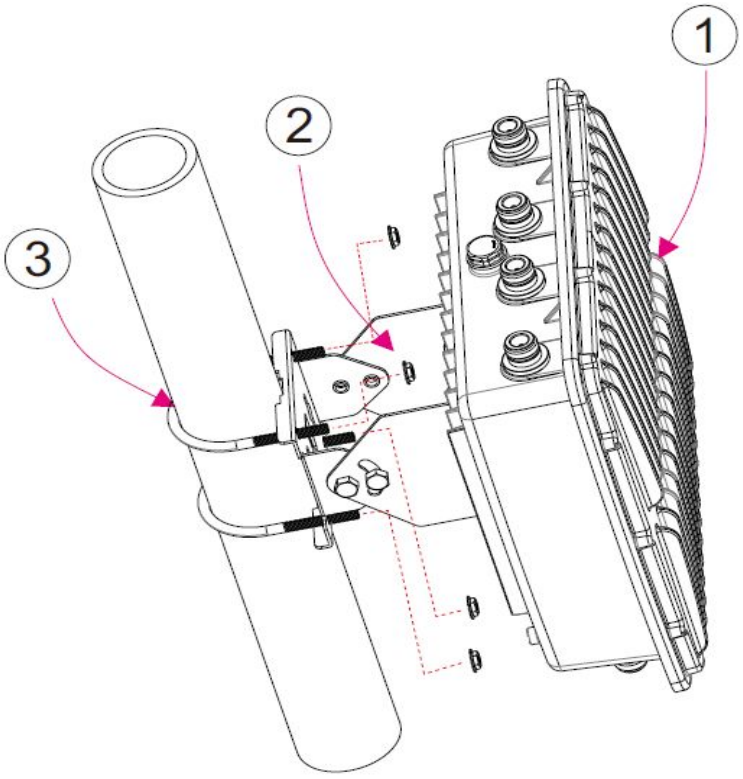


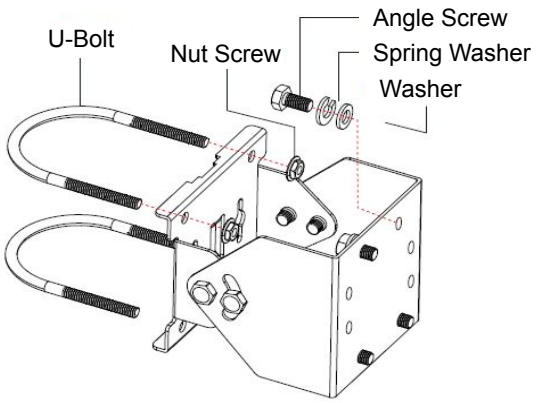
Figure 2.2b: The goRAN operating as a standalone private LTE network.

3.1. Pole Mounting

A. Overview

The pole mounting kit provides an adjustable mounting system that can be attached to an outdoor or indoor pole or post. This kit is designed for versatile use for a variety of conditions that may be encountered when attempting to mount the goRAN Small Cell unit for optimal coverage.





1	goRAN Small Cell Unit
2	Mounting Bracket
3	Pole and U-Bolt

B. Hardware

The pole mounting kit should include the following hardware items.

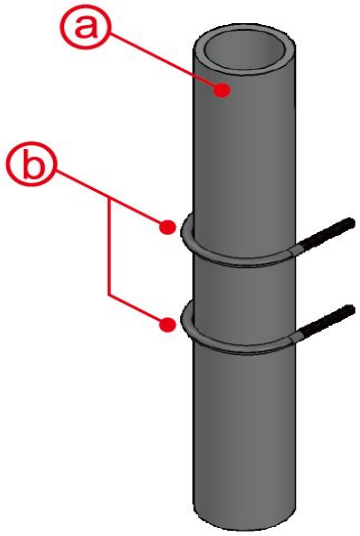
Qty	Description
1	goRAN Small Cell Unit
1	Mounting Bracket (2 pieces)
4	Angle Screws
4	Spring Washers

Qty	Description
4	Washers
2	U-Bolt
4	Nut Screw

C. Assembly Steps

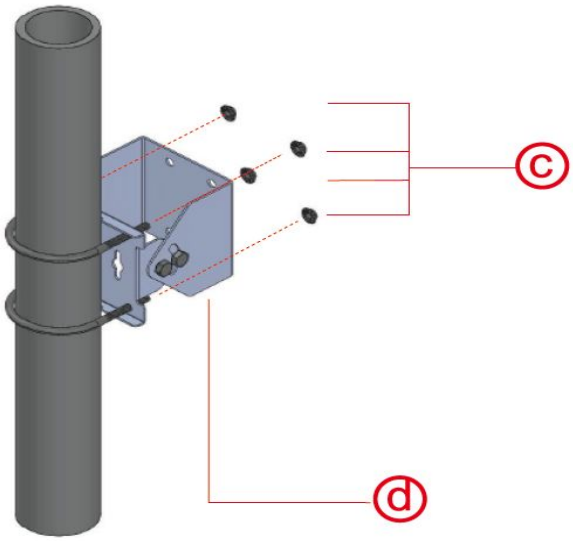
Step 1

Attached the two U-Bolts (b) to an appropriately selected pole (a) at your location



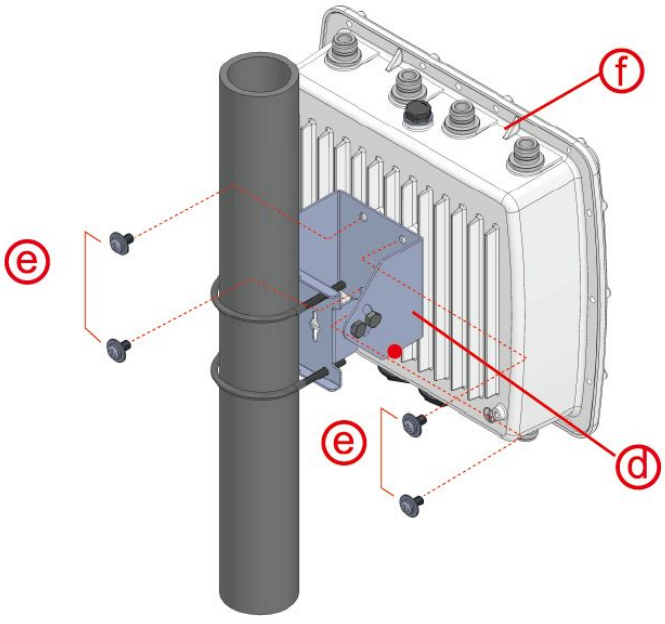
Step 2

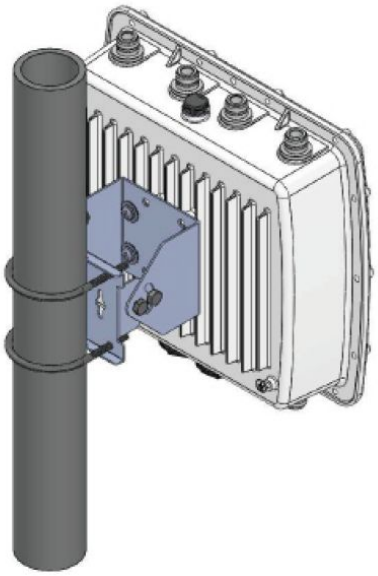
Fasten the two piece mounting bracket (d) to the U-bolts (b) using the nut screw fasteners (c).



Step 3

Attach the goRAN base station (f) to the mounting bracket (d) using the angle screw, spring washer and washer combination (e).

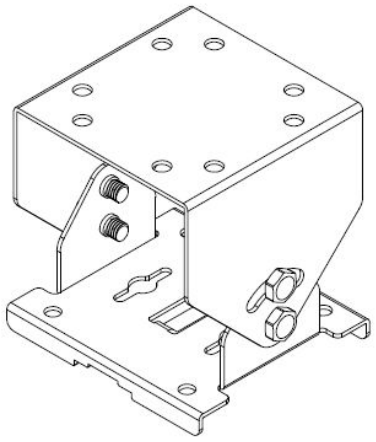


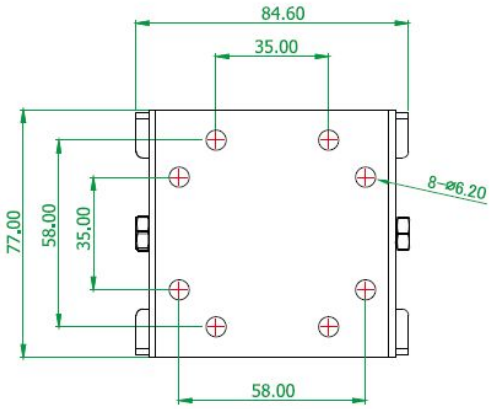


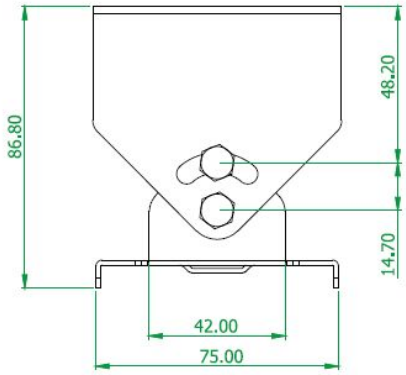
D. Mechanical Drawings

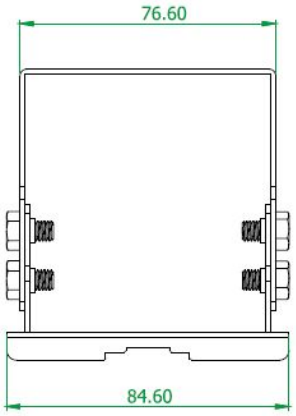
Note that all dimensions are in mm unless otherwise stated.

Mounting Bracket

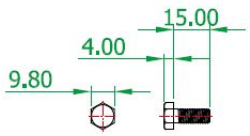




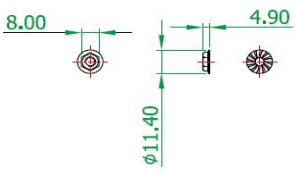




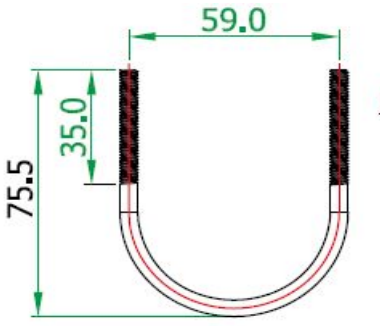
Angle Screw



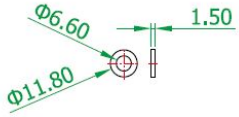
Nut Screw



U-Bolt



Washer

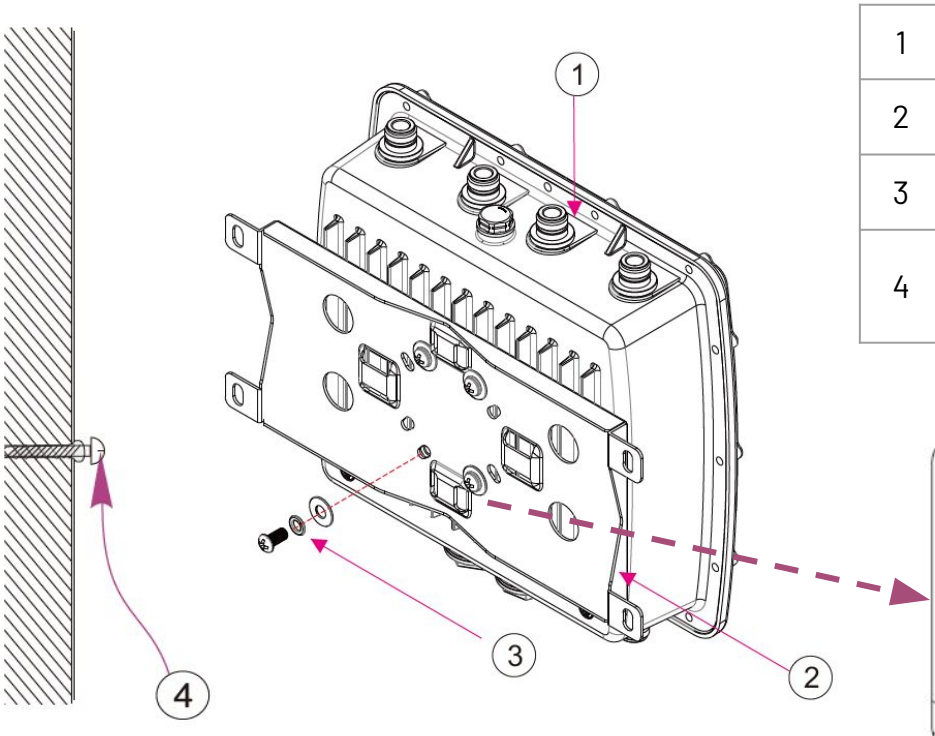


Spring Washer

3.2. Wall Mounting

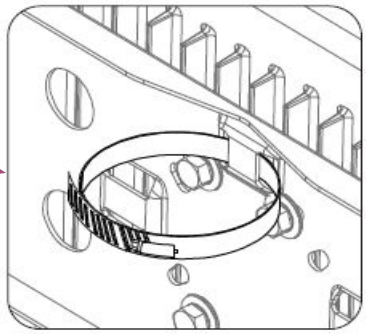
A. Overview

The wall mounting kit provides a mounting system where no pole can be found. With this kit the goRAN Small Cell unit can be mounted directly to a wall. This kit provides additional ability for the installer to mount the goRAN Small Cell to a pole with the use of a pole mount option that includes hose clamps for this purpose.



1	goRAN Small Cell Unit
2	Mounting Plate
3	Screw
4	Wall and Anchor plus Screws

Pole Mount Option



B. Hardware

The wall 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	goRAN Base Station
1	Mounting Plate
4	Angle Screws
4	Spring Washers

Qty	Description
4	Washers
4	Screws
4	Anchor & Screws (wall mount)
2	Hose Clamps (pole mount option)

C. Assembly Steps (for Wall)

Step 1

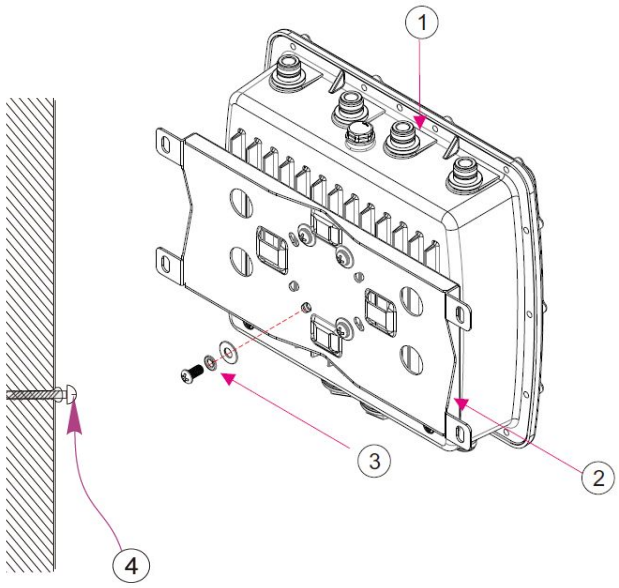
Drill a four holes in the wall for the plastic anchors and insert these anchors (4). The holes should match the location of the four outside tabs of the mounting plate

Step 2

Use the four Angle Screws, Spring Washers and Washers (3) to attach the mounting plate (2) onto the goRAN Small Cell (1).

Step 3

Use the four screws for the wall anchors (4) to mount the mounting plate onto the wall.



D. Assembly Steps (for Pole)

Step 1

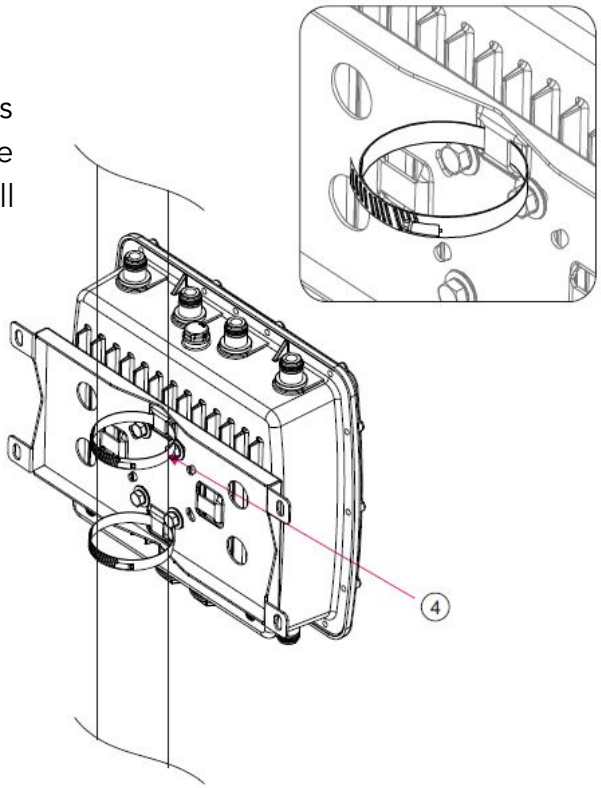
Use the four Angle Screws, Spring Washers and Washers to attach the mounting plate onto the goRAN Small Cell as with the wall mounting approach.

Step 2

Pass the two Hose Clamps (4) through the matching hole in the mounting plate as shown.

Step 3

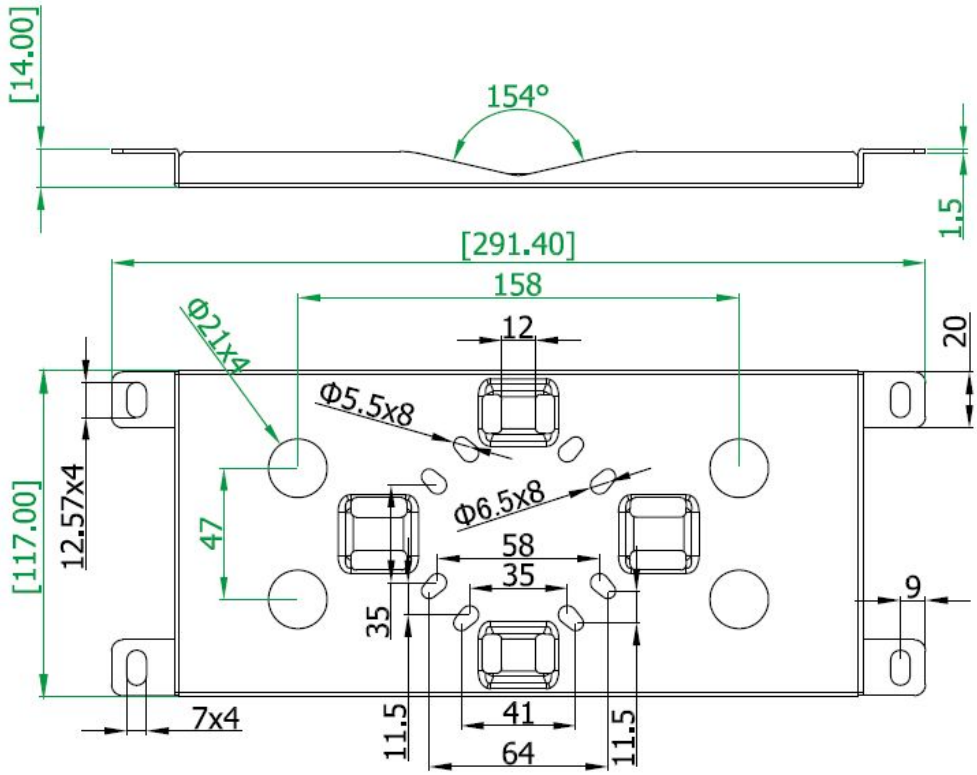
Loop the open Hose clamps around the pole chosen for the installation and tighten the screw until the Small Cell unit is secure.



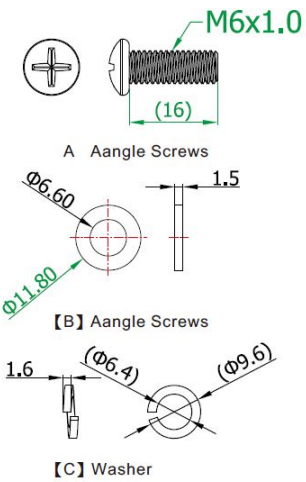
E. Mechanical Drawings

Note that all dimensions are in mm unless otherwise stated.

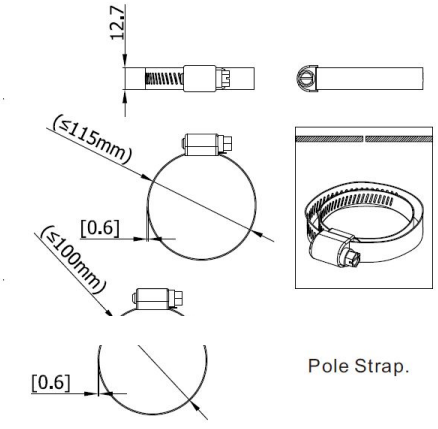
Mounting Plate



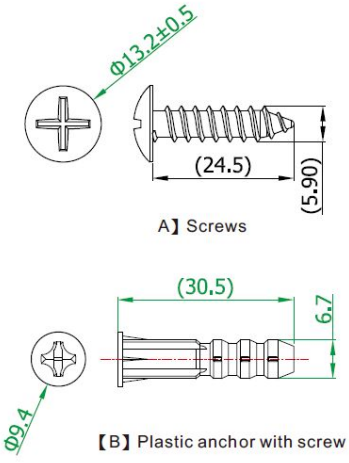
Screw, Spring Washer and Washer



Hose Clamp (Pole Mount Option)



Anchor & Screw



The following steps should be completed in the order listed to get the goRAN Small Cell unit, including EPC and eNB, up and running.

WARNING: The user is responsible for setting up the goRAN small cell unit in a confined environment to validate spectrum configurations. it is the user's responsibility to ensure that regional spectrum licensing requirements are adhered to during testing and installation.

4.1. Powering-Up Hardware

A. Mounting Antennas

Depending on whether the user has received a full band version or a band specific version of the goRAN, one or two RF antennas may be needed. The full band version requires a bottom receive (RX) RF antenna as well as a top transmit (TX) RF antenna. A band specific goRAN unit configured for TDD or FDD operation only requires one antenna on the top side. The process of attaching two RF antennas is shown in Figure 4.1a.

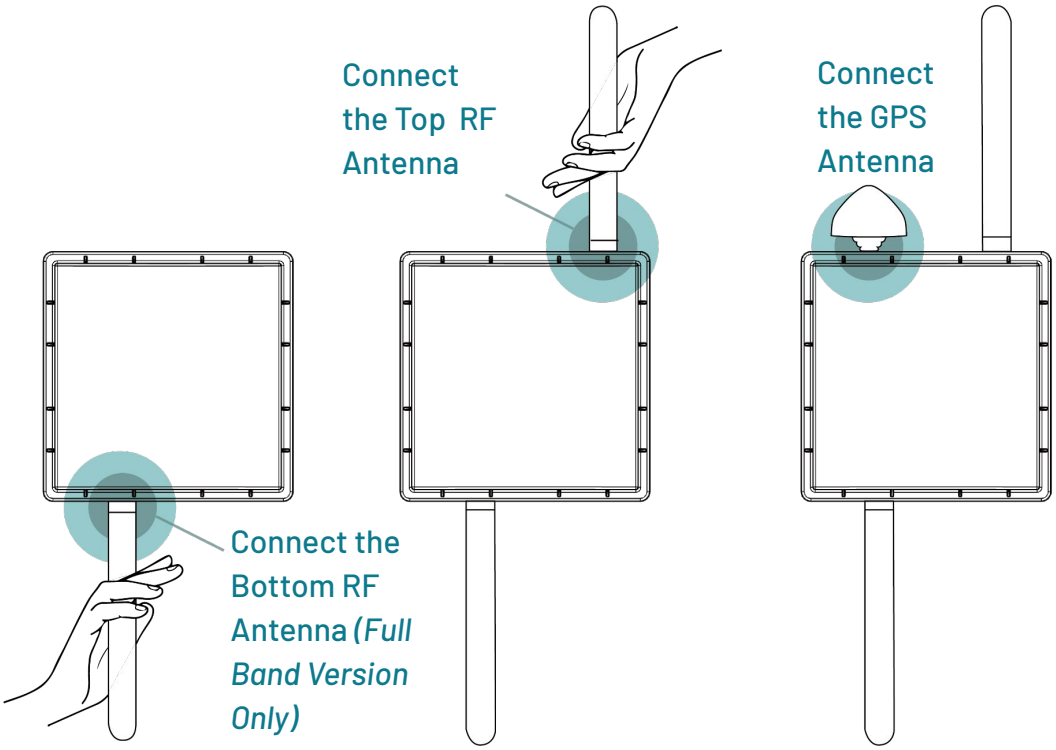
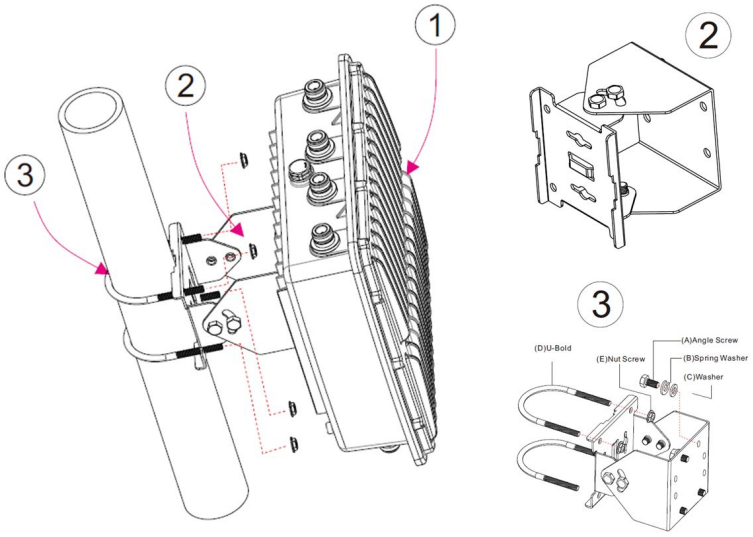


Figure 4.1a: Attaching the RF and GPS antennas to the goRAN small cell.

B. Mounting goRAN Small Cell

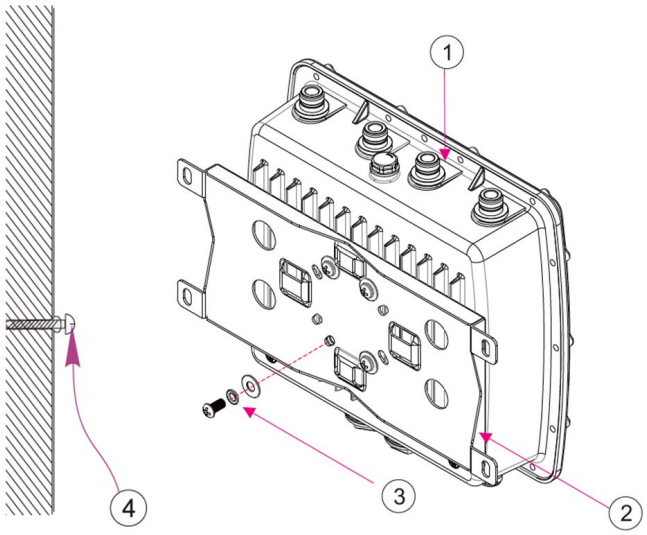
While not necessary for testing purposes, the goRAN Small Cell unit can be mounted to a wall or pole to provide a more permanent setup as described in the figures below. Depending on request from the user, the goRAN Starter Kit comes with one of two mounting kits: (1) A pole mount or (2) a wall mount mounting kit. Please refer to the previous Installation section for a step by step set of instructions for mounting the goRAN to either wall or pole.

1. Pole Mounting



Qty	Description
1	goRAN Small Cell Unit
1	Mounting Bracket (2 pieces)
4	Angle Screws
4	Spring Washers
4	Washers
2	U-Bolt
4	Nut Screw

2. Wall Mounting



Qty	Description
1	goRAN Small Cell Unit
1	Mounting Plate
4	Angle Screws
4	Spring Washers
4	Washers
4	Screws
4	Anchor & Screws
2	Hose Clamps

C. Physical Network Connection

The goRAN Small Cell comes with an ethernet cable and a corresponding cable grip. Attach the cable grip to the ethernet wire and plug in the goRAN on one end and plug in the local network router on the other end as shown in Figure 4.1c. If provided with an outdoor version of the goRAN Small Cell unit, 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.

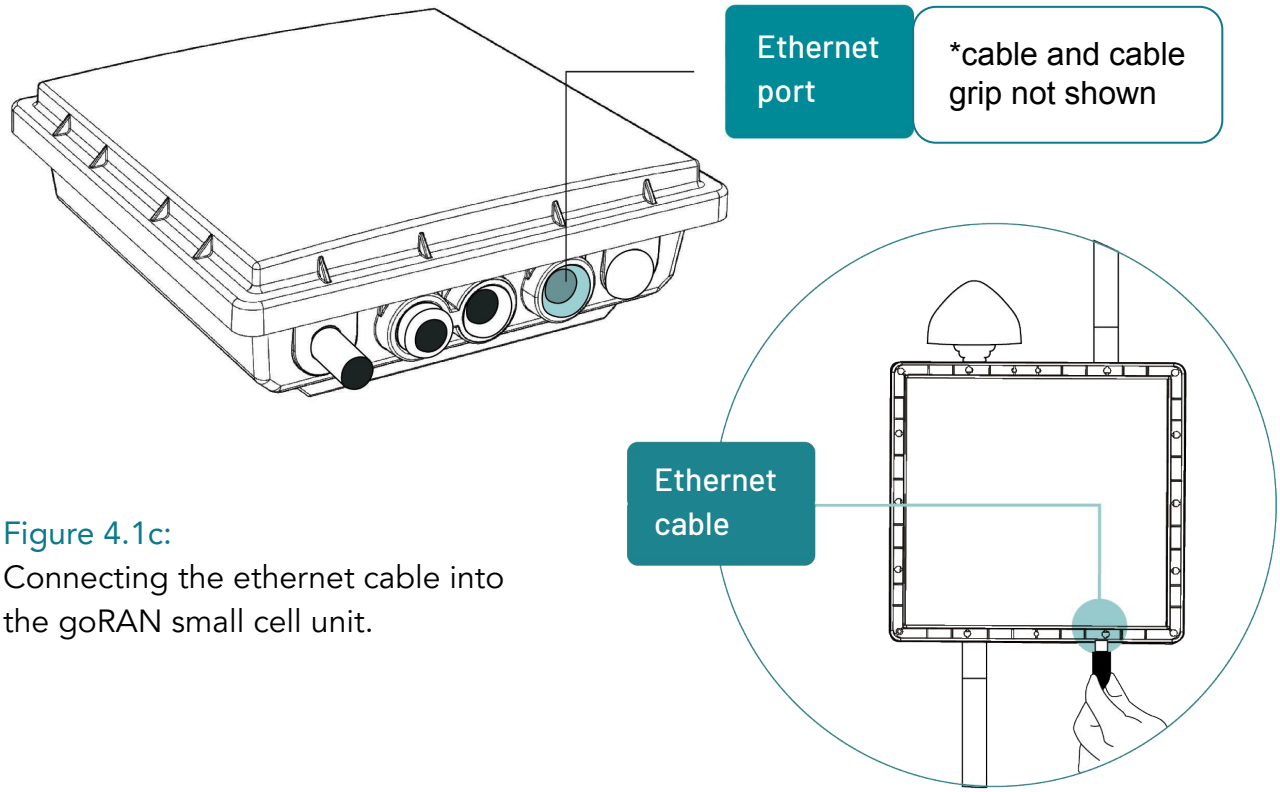


Figure 4.1c:
Connecting the ethernet cable into the goRAN small cell unit.

CAUTION: The default goRAN small cell offering comes with an indoor ethernet cable - this cable is not suited for outdoor use. Choose the outdoor option as indicated in the **Options and Limitations** section for outdoor use.

D. Connecting Power

The goRAN Small Cell unit comes with a 110-240V AC to 12V DC universal power supply or a Power-Over-Ethernet (POE) injector customized to the user specification during the ordering process. If supplied with a DC power supply, an appropriately sized cable grip may be included in the delivered kit. If such is the case, attach the cable grip to the power cable and plug it in as shown in Figure 4.1d.

Once the power cable is connected to a power outlet or POE injector attached, the goRAN will attempt to connect to a network automatically. The unit can be reset by disconnecting and reconnecting the power adapter or injector. This may be needed in the event that there is a connection error as indicated by the green and white LEDs.

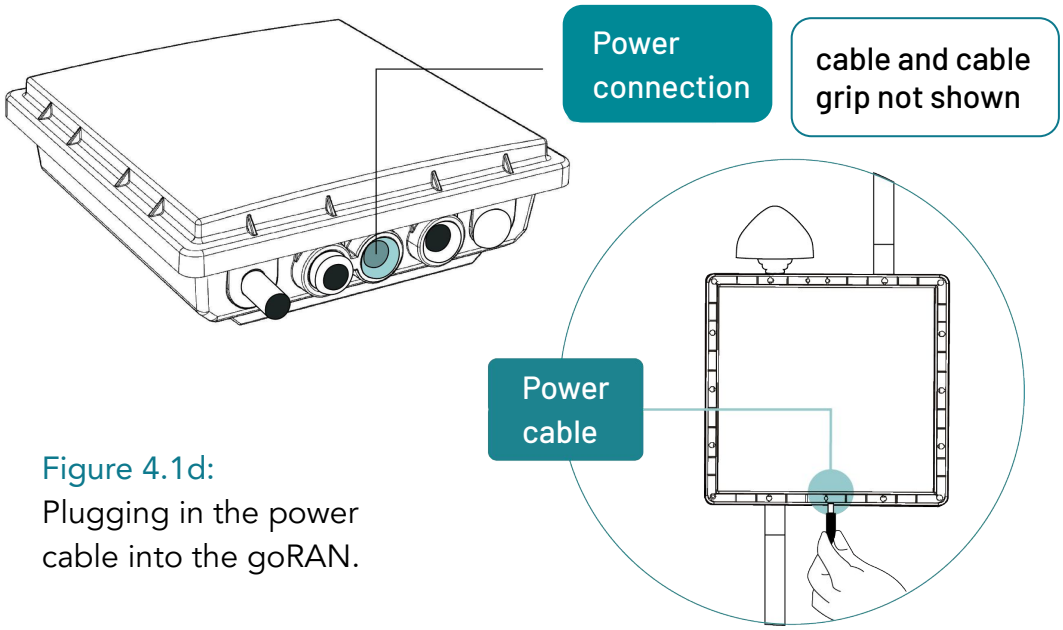


Figure 4.1d:
Plugging in the power cable into the goRAN.

CAUTION: The default setup comes with an indoor power supply - this power supply is not suited for outdoor use. Choose the outdoor option as indicated in the **Options and Limitations** section for outdoor use.

4.2. Setup Network Connection

A. Checking the goRAN Network IP Address

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

To verify the IP address assigned to the goRAN via your router and DHCP, the user can log into their router and check the IP assignment for the MAC address associated with their goRAN Small Cell unit. A MAC address label for the goRAN is provided on a label on the back of 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. This LEDs are located on the goRAN Small Cell unit as shown in Figure 4.2b below. 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.

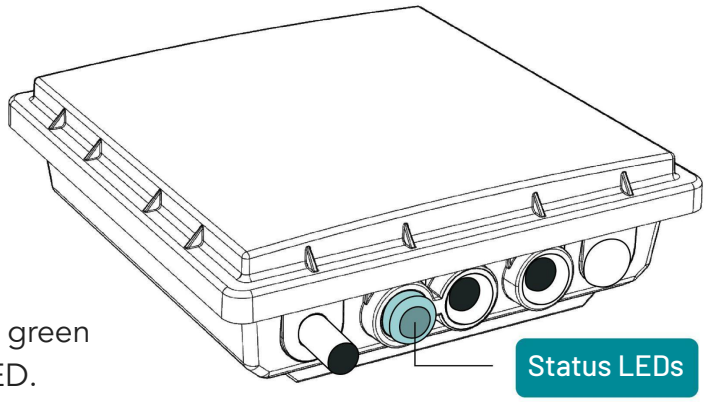


Figure 4.2b:
The location of the green and white status LED.

Table 4.2b below 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 four states. If the goRAN is up and running and connected to the EPC, 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, system or with the connection to the EPC.

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 EPC

Table 4.2b: Checking the status of the goRAN small cell unit to verify power and connection.

C. Confirming Local Connection via Ping From Computer

In the case where the LED is not easily accessible, the user can check that the goRAN Small Cell unit is connected to the local network using the PING command via a terminal window on their network connected computer (e.g. 'Command' terminal in Windows or 'Bash' terminal in Linux). Enter the command: ping XXX.XXX.XXX.XXX where XXX.XXX.XXX.XXX is the IP address of your goRAN Small Cell in the local network and press enter. If successful, packets should be sent and received within some finite time in milliseconds. See Figure 4.2c-1 below for an example for a successful ping and Figure 4.2c-2 below for an unsuccessful ping.

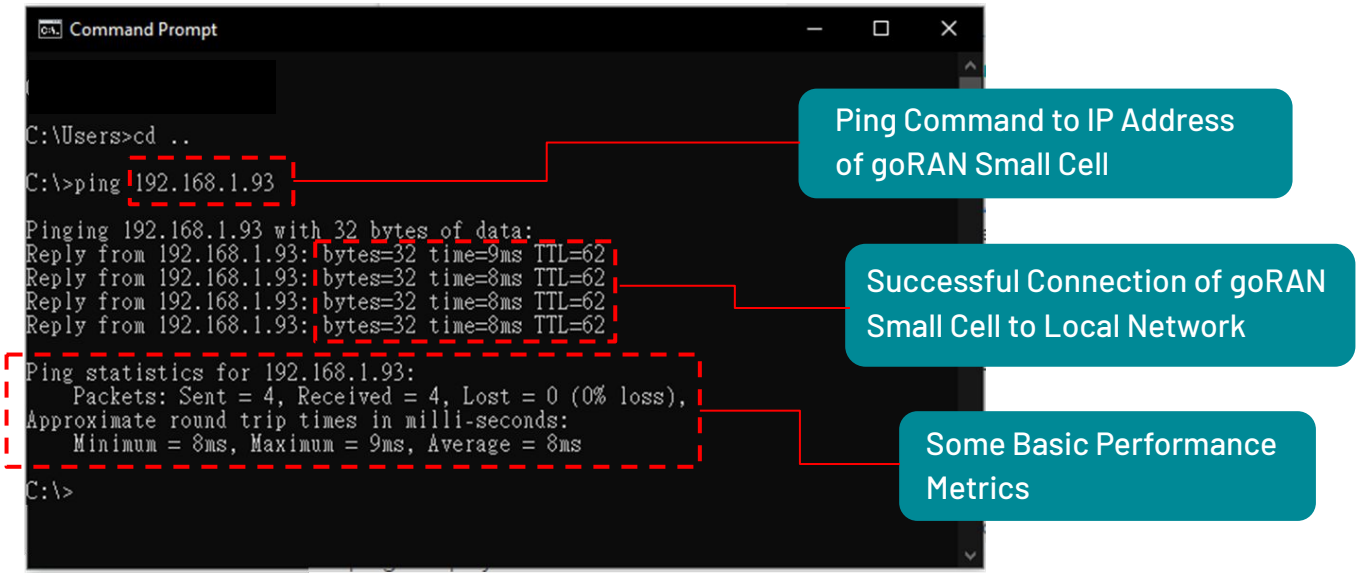


Figure 4.2c-1: Successfully pinging the goRAN Small Cell.

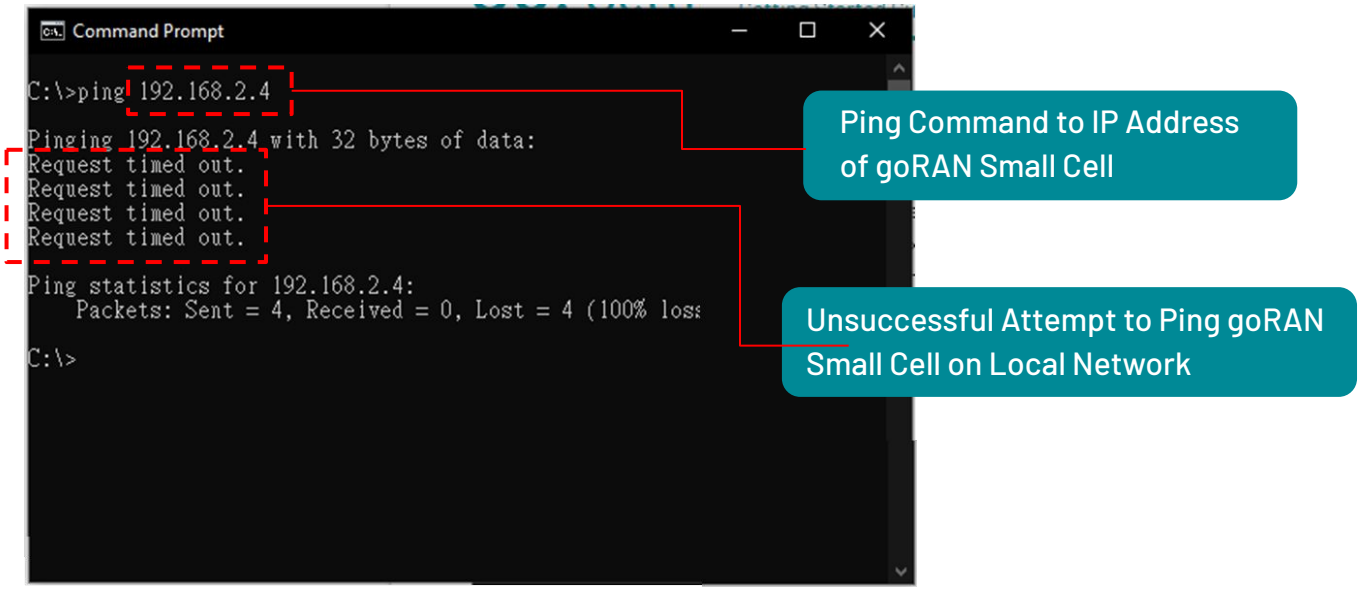


Figure 4.2c-2: Unsuccessfully pinging the goRAN Small Cell.

D. Confirming Internet Connection via Ping From goRAN Small Cell

After confirming that the goRAN Small Cell is connected to your local network it is time to check that the goRAN can access the internet. At this stage it is necessary to connect to the goRAN from your computer using SSH as shown in Figure 4.2d 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.

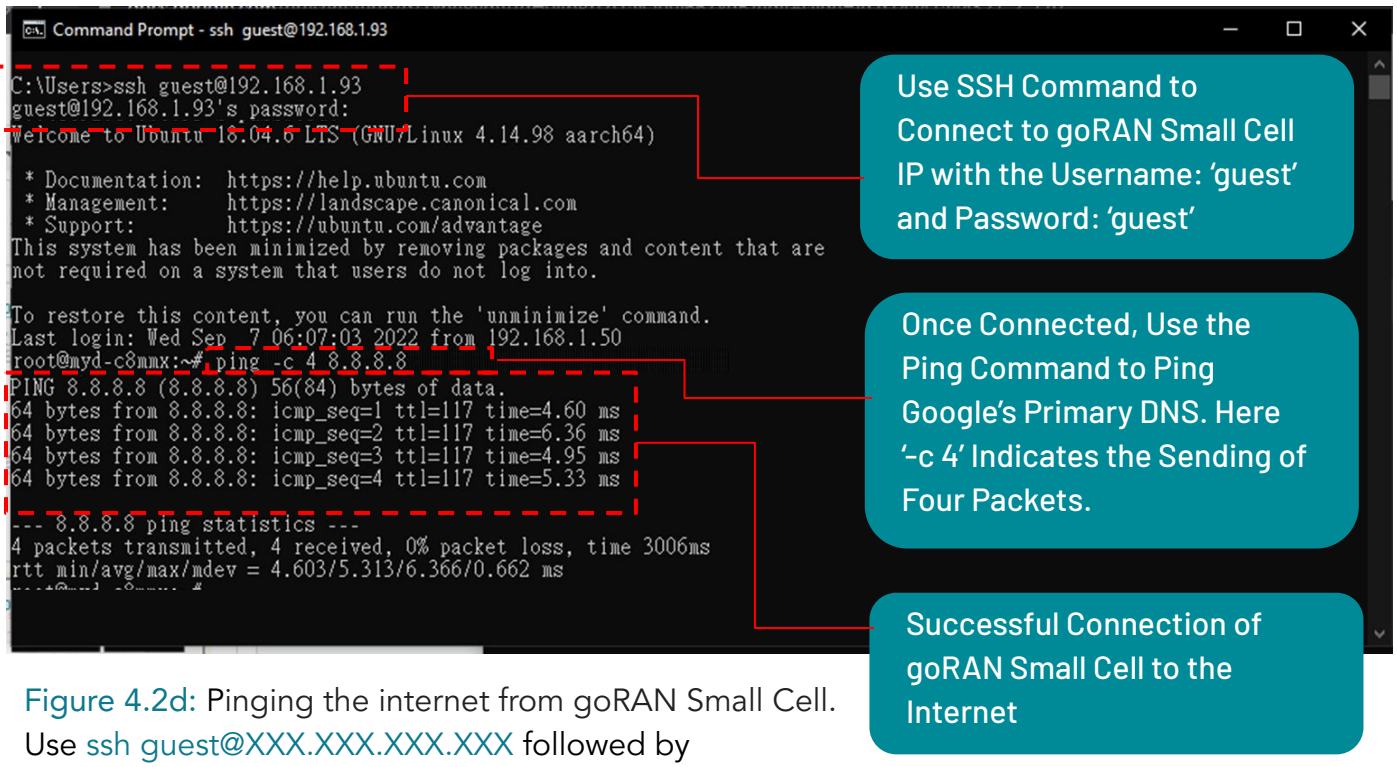


Figure 4.2d: Pinging the internet from goRAN Small Cell.
Use ssh guest@XXX.XXX.XXX.XXX followed by
ping -c 8.8.8.8 (Replace XXX.XXX.XXX.XXX with your goRAN IP address.)

4.3. Configuration & Validation

Once the goRAN Small Cell unit is network connected, it can be configured via two distinct approaches:

A. Via a Web GUI-based Tool called the goRAN Management System (Figure 4.3-1)
B. Via a Standalone Configuration Tool called the goRAN Admin Config. Tool (Figure 4.3-2)

Each of these tools provides a different level-of-detail for configuration with the Admin Config. Tool providing very fine grain control of various RF (and other) parameters and the goRAN Management System providing somewhat less detailed and simpler configuration. Power users, needing more sophisticated control of parameters, can make use of the Admin Config. Tool - this tool is available from www.ubiik.com/downloads.

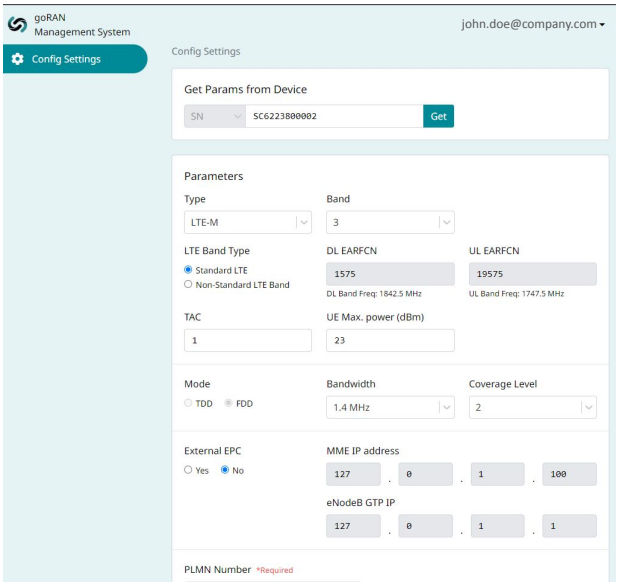


Figure 4.3-1: The goRAN Management System (a cloud platform)

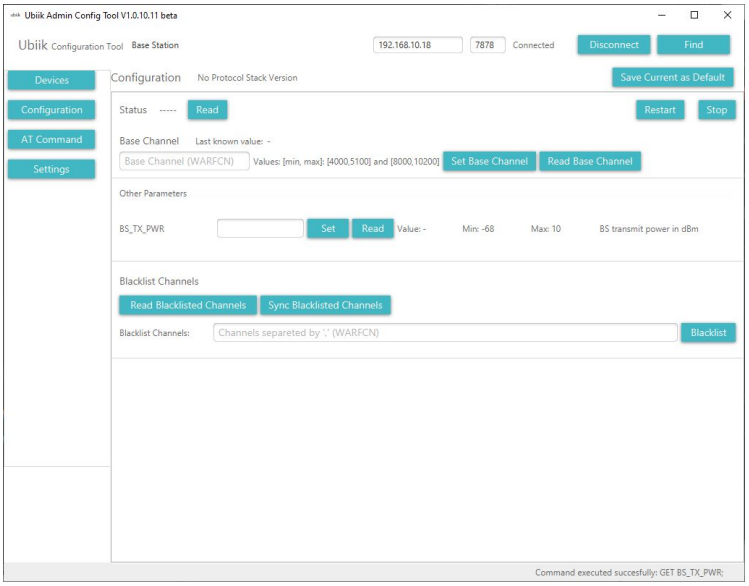


Figure 4.3-2: The Admin Configuration Tool (a standalone tool)

A. goRAN Management System

Overview, Registration and Login

A user will have received login details for the cloud-based goRAN Management System with their goRAN Small Cell package or via email after their purchase. The user should navigate to the website: https://goran.ubiik.com/. The user will be presented with a login screen as shown in Figure 4.3a-1 as shown on the right.

When the goRAN Small Cell is powered on, and connection to the internet is available, it will automatically download a remotely located default cloud configuration file created or modified via this Web GUI. This configuration file provides updated parameters to the unit allowing for plug and play, hands-off, use of the Small Cell unit. The Web GUI based Configuration Tool should be used as the primary method to customize and apply modified goRAN configurations. For power users, an additional finer grain configuration of the goRAN, a Admin Config Tool is available for download and installation via www.ubiik.com/downloads.

Figure 4.3a-1: The Web GUI login screen

Main Features & Parameters

Figure 4.3a-2 shows the goRAN Management System interface once logged in. This interface covers the configuration parameters that most customers will need when testing and preparing their goRAN for deployment. The below diagram outlines the Steps a customer should use to view/modify and apply parameters.

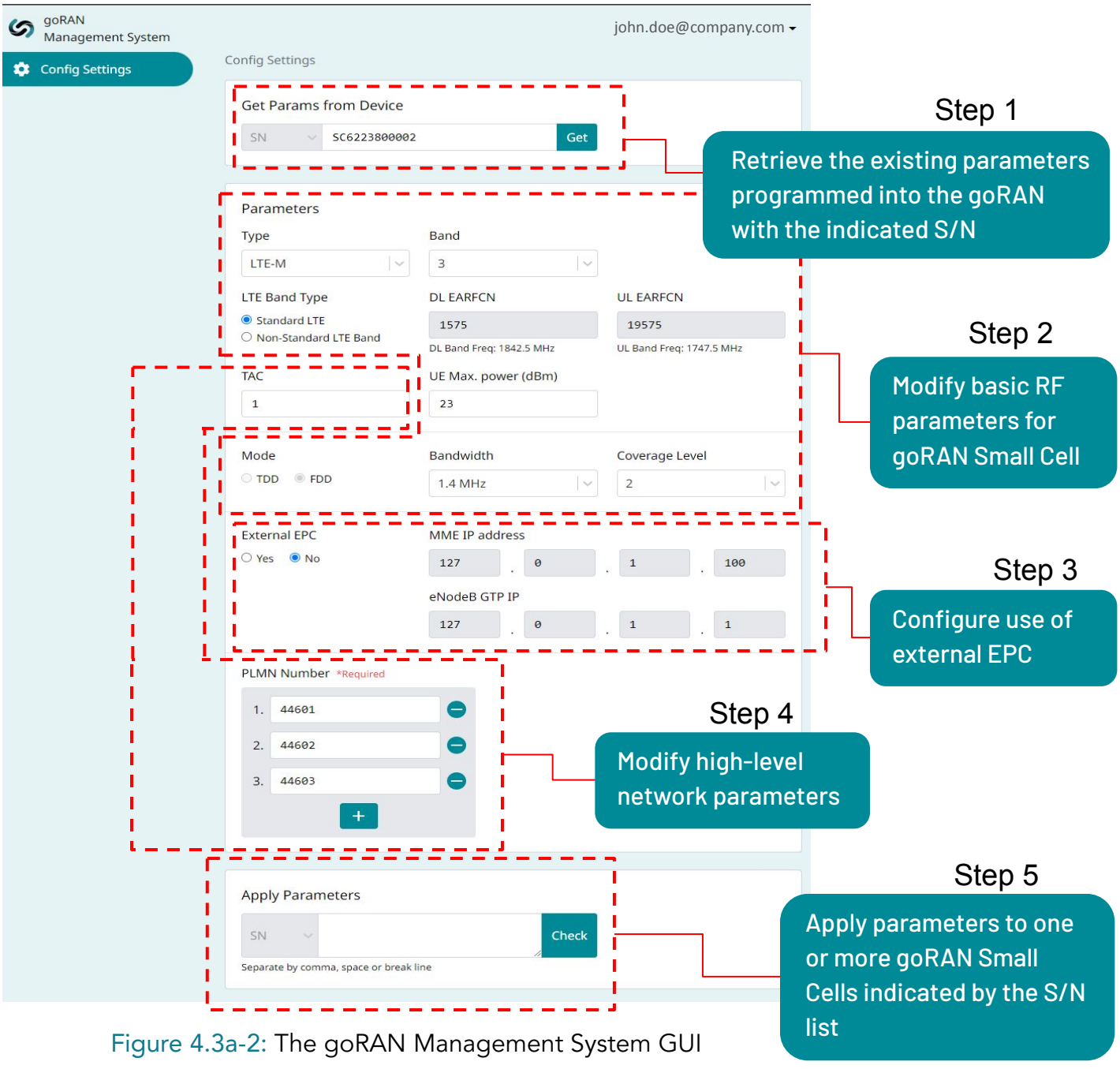


Figure 4.3a-2: The goRAN Management System GUI

Configuring Basic RF Parameters

After entering in the Serial Number (S/N) of the goRAN Small Cell unit and retrieving the default pre-configured parameters it is now possible to modify operation with the following options. Depending on whether the user has access to a Band-Agnostic or Band Specific (Full Band) version of the goRAN unit. Some sub-options within a given parameter may or may not be accessible. For instance the goRAN with S/N: SC6223800002 shown in the below example can only be configured for Bands 3 and 8. The unit can be operated as either as an LTE-M device or an NB-IoT device. The below two options allow this configurability.

Figure 4.3a-3: Basic RF band and protocol parameters

For a Band-Agnostic version , the user may want to operate in non-standard LTE bands, and so the LTE Band Type option can be used to manually configure DL EARFCN and UL EARFCN parameters as shown below - it is recommended that non-expert users avoid modifying this setting.

Figure 4.3a-4: Basic RF frequency band parameters

Duplex communication mode (for uplink and downlink channels) can also be configured as either Time Division Duplexing (TDD) or Frequency Division Duplexing (FDD). The need for one or the other is largely dependent on the goRAN's signalling environment. For a given band, communication can proceed for a 1.5MHz, 3MHz and 5MHz bandwidth. Coverage Level can be further used in conjunction with bandwidth and mode to provide coverage enhancement. These additional options are shown below:

Figure 4.3a-5: Basic RF bandwidth, duplexing and coverage parameters

Additionally, the user can also set the maximum allowable transmit power of the UE's connected to the goRAN Small Cell to try and optimize communication reliability as well as shown in the below option.

Figure 4.3a-5: Basic RF power limit parameter

High Level Network Configuration

A user can change, check and verify the Mobile Country Code (MCC) and the Mobile Network Code (MNC) values assigned to the goRAN through the goRAN Management System. Here the Public Land Mobile Network (PLMN) number together forms the MCC and MNC. Note that the PLMN forms the first digits of the IMSI number. Unlike the PLMN which provides a global code, the Tracking Area Code (TAC) provides a location code within a given Mobile Network Operator's (MNOs) network.

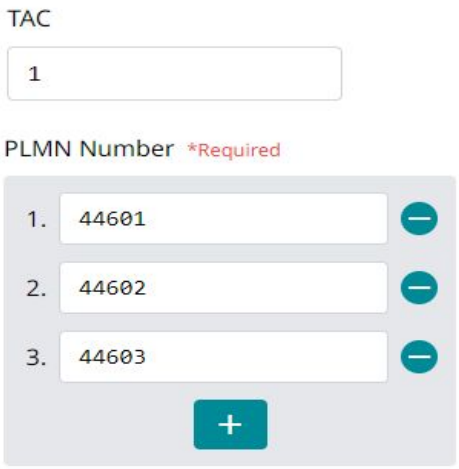


Figure 4.3a-6: High-level network parameters

EPC Configuration Parameters

The goRAN is configured by default to operate in standalone mode. In this mode, an internal EPC is present to provide immediate out-of-the-box plug and play useability. There will be many use cases in which the user may want to attach the goRAN to an external EPC rather than use the default internal one. Setting the External EPC option allows the user to enter in the MME IP and eNodeB GTP IP addresses for this purpose as shown below:

Figure 4.3a-7: EPC configuration parameters

Applying Parameters to goRAN

Once parameters have been modified, the user can apply them to one or more goRAN Small Cells in their network. The user simply enters in a space separated list of S/N's for their goRANs and clicks the check button as shown below. This then provides a list of goRANs for which the settings modified can be applied. Hence it is possible to apply settings in bulk.

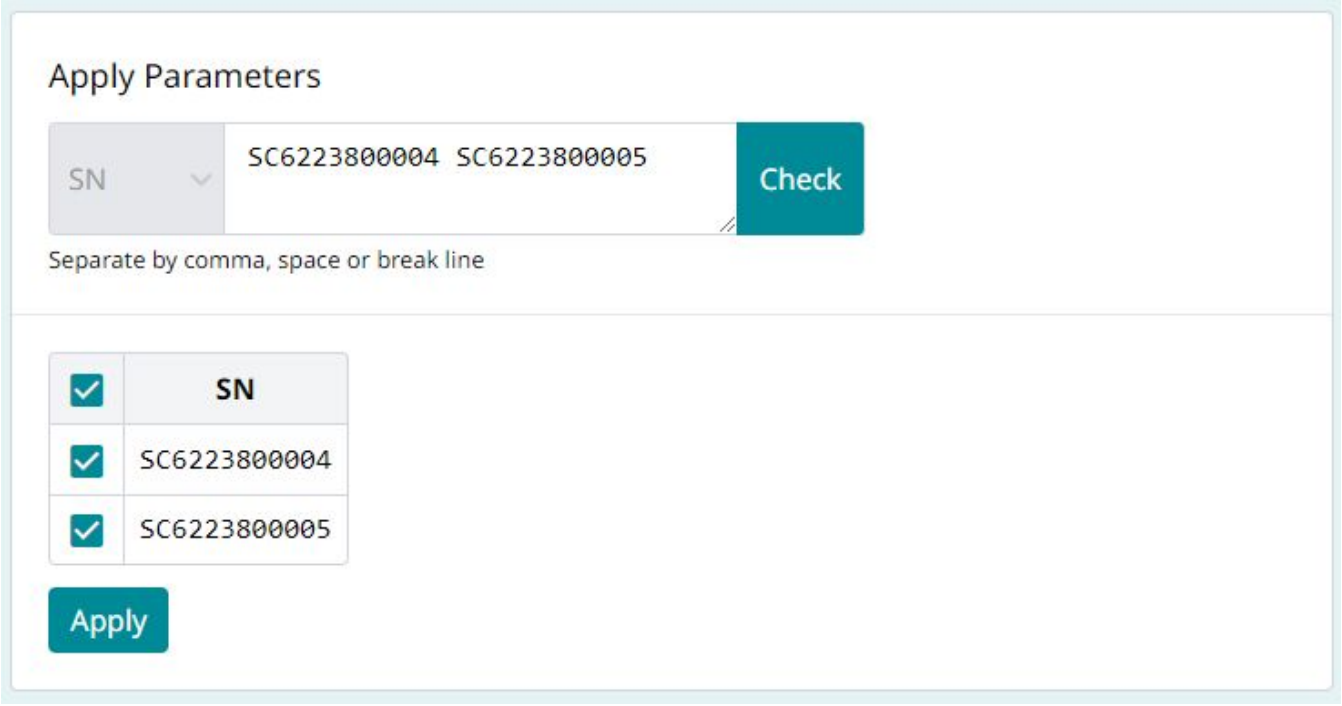
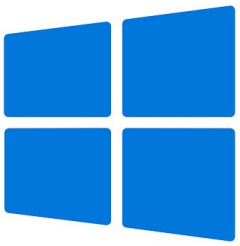


Figure 4.3a-8: Applying parameters to goRAN individually or in bulk

B. Admin Config Tool

Software Installation

This tool operates using Java with JDK version 17 development kit or higher. For Windows and Linux users this version of JDK is packaged with the ZIP installation file provided via www.ubiik.com/downloads. For MacOS users this is not the case and no installation file is currently available - please contact Ubiik Support. The installation instructions for each of OS is provided below:



Windows

1. Download and extract the ZIP file provided at https://www.ubiik.com/downloads for the goRAN Admin Config Tool.
2. Navigate to the unzipped file contents at .\jdk17_AdminConfigTool\jdk17
3. If JDK is not present on your system, install JDK via the file: jdk-17_windows-x64_bin.exe.
4. Follow the installation instructions for JDK. Once complete. Go to the folder: .\jdk17_AdminConfigTool and execute the: run.bat file by double clicking.

Linux

1. Download and extract the ZIP file provided at https://www.ubiik.com/downloads for the goRAN Admin Config Tool.
2. Open a bash terminal and navigate to the root folder of the extracted ZIP file.
3. Change file permissions for the run.sh shell script for execution: chmod +x run.sh
4. Run the shell script as super user: sudo ./run.sh
5. In the case where, the Admin Config Tool fails to run check and update JDK versions using: sudo update-alternatives --config java

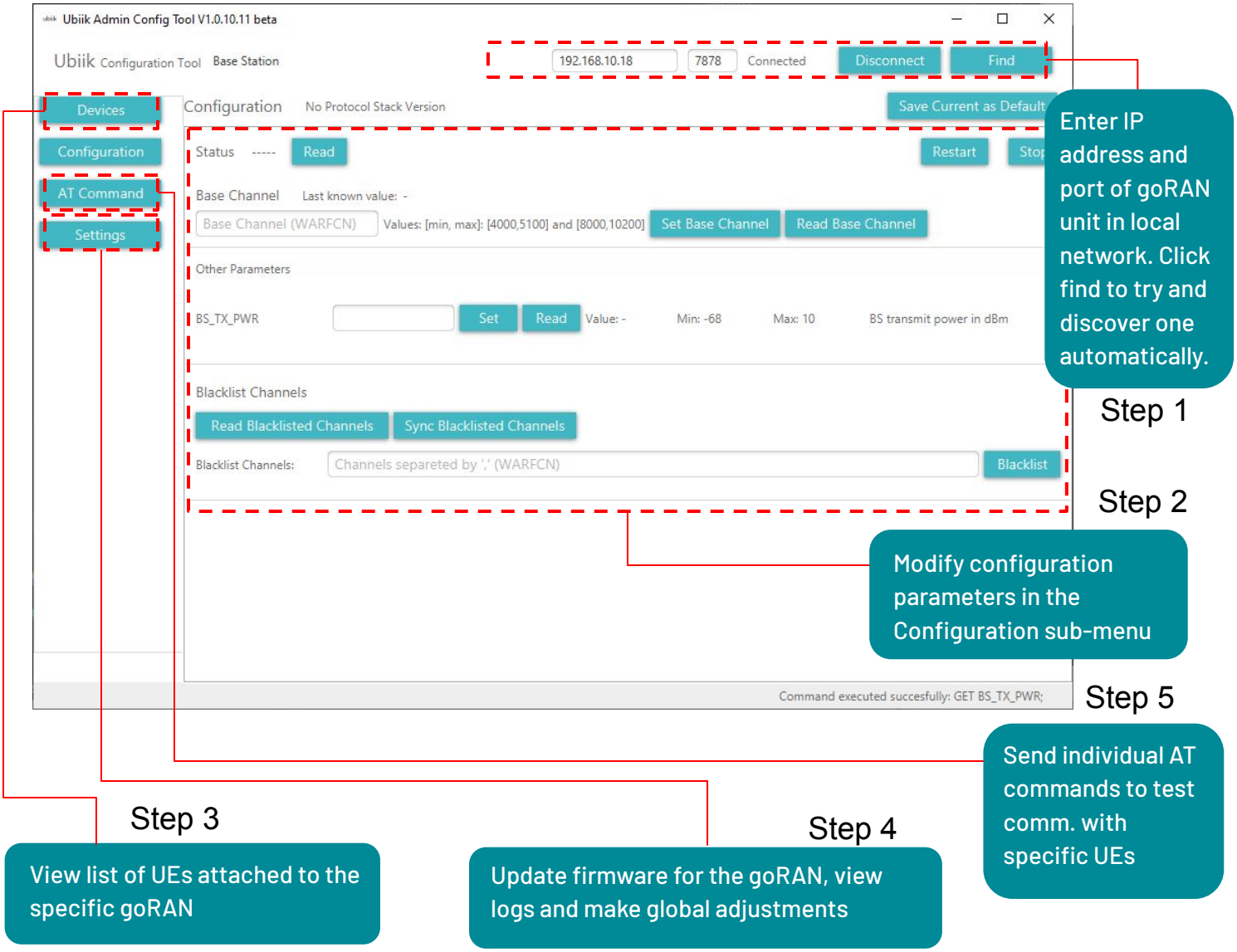
NOTICE: Currently no MacOS installation file is available. For MacOS support please contact **Ubiik Support** directly for added instructions.

CAUTION: Using the Admin Config Tool requires expert knowledge and should be limited to power users only.

Main Features

Once Installed, the Admin Configuration Tool provides a method of connecting to the IP of a particular goRAN Small Cell unit in a user's local network. In the below example, a goRAN unit is located at the IP: 192.168.1.85:7878. Step 1 is to connect to this goRAN. After connection the configuration options become available.

Figure 4.3b-1: Admin Config Tool Interface



Once connected, this tool is designed for expert users who understand the various variables and parameters that can be configured on the goRAN (Step 2). It is strongly recommended that changes only be made if you are an experienced user. A detailed discussion of these follow. Some additional steps that can be taken include viewing individual UEs attached (Step 3), updating firmware or viewing logs (Step 4) and sending AT commands (Step 5).

Two versions of the goRAN are provided with options to support various configurations for the EPC, Backhaul interfaces and Mounting. A discussion of these additional configuration options is provided in the prior section on Options and Limitations. The sections below provide a detailed overview of the specifications for the two main versions of the goRAN.

5.1. Band Specific Version

Performance	3GPP Release 15 Cat-M1, Cat-NB1/2; *Cat-1bis under development* SDR-based (Linux/ARMv8-A); > 200 concurrent RRC connections
Bandwidth	LTE-M: 1.4MHz & 3 MHz (TDD/FDD) NB-IoT: 180 kHz (FDD) in-band, guard band and standalone
System	Linux Ubuntu 18.04
Memory	8GB eMMC flash and 2GB DDR4
Frequency Bands	All FDD and TDD bands from 400MHz to 2.6GHz.
Output Power	27dBm Typical
GPS	-1.8~3.5 dBi
Antenna Peak Gain	5dbi gain (TBC)
Backhaul Specifications	Ethernet (10/100/1000 Mbps) or LTE Cat-1 (optional)
LED Indication	1 x System Power 1 x Network Connection Status (Ethernet or Cat-1)
I/O Interfaces	3 x external antennas for GPS and Cat. M1/NB-IoT 1 x internal antenna for Cat. 1 backhaul 1 x Gigabit Ethernet port, LAN/WAN 1 x Reset button 1 x USIM slot 1 x Micro SD slot 1 x DC 12V or Power-Over-Ethernet (POE)
Physical and environmental	Dimensions: 254mm × 254mm x 83.4mm Operating temperature: -20°C to 55°C Storage temperature: -20°C to 70°C Operating humidity: 5% to 90% non-condensing Ingress protection rating: IP67

5.2. Full Band Version

Performance	3GPP Release 15 Cat-M1, Cat-NB1/2; *Cat-1bis under development* SDR-based (Linux/ARMv8-A); > 200 concurrent RRC connections
Bandwidth	LTE-M: 1.4MHz & 3 MHz (TDD/FDD) NB-IoT: 180 kHz (FDD) in-band, guard band and standalone
System	Linux Ubuntu 18.04
Memory	8GB eMMC flash and 2GB DDR4
Frequency Bands	All FDD and TDD bands from 400MHz to 2.6GHz
Output Power	10dBm Typical
GPS	-1.8~3.5 dBi
Antenna Peak Gain	5dbi gain (TBC)
Backhaul Specifications	Ethernet (10/100/1000 Mbps) or LTE Cat-1 (optional)
LED Indication	1 x System Power 1 x Network Connection Status (Ethernet or Cat-1)
I/O Interfaces	3 x external antennas for GPS and Cat. M1/NB-IoT 1 x internal antenna for Cat. 1 backhaul 1 x Gigabit Ethernet port, LAN/WAN 1 x Reset button 1 x USIM slot 1 x Micro SD slot 1 x DC 12V or Power-Over-Ethernet (POE)
Physical and environmental	Dimensions: 254mm × 254mm x 83.4mm Operating temperature: -20℃ to 55℃ Storage temperature: -20℃ to 70℃ Operating humidity: 5% to 90% non-condensing Ingress protection rating: IP67

REVISION HISTORY

Revision	Date	Description	Contributors
0.1-0.4	Aug. 2022	Migrated from configuration guide	Siraj Sabihuddin
0.45-0.51	Aug. 29 to Sep. 8, 2022	Minor textual corrections. UE config. changes. Template update.	Siraj Sabihuddin, Gosta Kallner, Annie Li, Cathy Lin
0.55-0.9	Oct. to Nov. 2022	Separated UE and small cell guides. Updated led state table and configuration guide. Diagram corrections.	Siraj Sabihuddin, Eric Shen, Fabien Petitgrand, David Hsu

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