BLiNQ Networks

FWC-122HG-35 Installation Guide

Release 1.4.3

Oct 2020

Revision History

DATE	RELEASE	REASON FOR ISSUE
July 2020	1.0	Initial Release – Nicki Grant
July 2020	1.1	Rearranging chapters and changes to the new bracket mount.
Aug 2020	1.2	Added configuration details for SW32 and Appendix A
Aug 2020	1.21/1.22	Removed/Update irrelevant section on old mounting bracket for PointLiNQ
Aug 2020	1.31	Removed configuration details for SW32 and Appendix A
Sept 2020	1.40	Aligns with CPE SW 01.02.01.034 and PointLiNQ App 1.1.0
Sept 2020	1.41	Rearrange chapters for better clarity
Sept 2020	1.4.2	Added LED indicators for PointLiNQ Tool
Oct 2020	1.4.3	Amendments to Tool Calibration and speed test features

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1 About This Manual

This Guide covers the installation and CBSD configurations of BLiNQ Networks' Cat 12 Outdoor CPE – FWC-122HG-35.

This installation guide will cover:

- Installation Flow Charts, both with and without the use of PointLiNQ Tool and App
- Installation Preparations
- CPE Site Installation
- CBSD Configurations
- CPE Installation Tuning
- PointLiNQ Tool and App Configurations

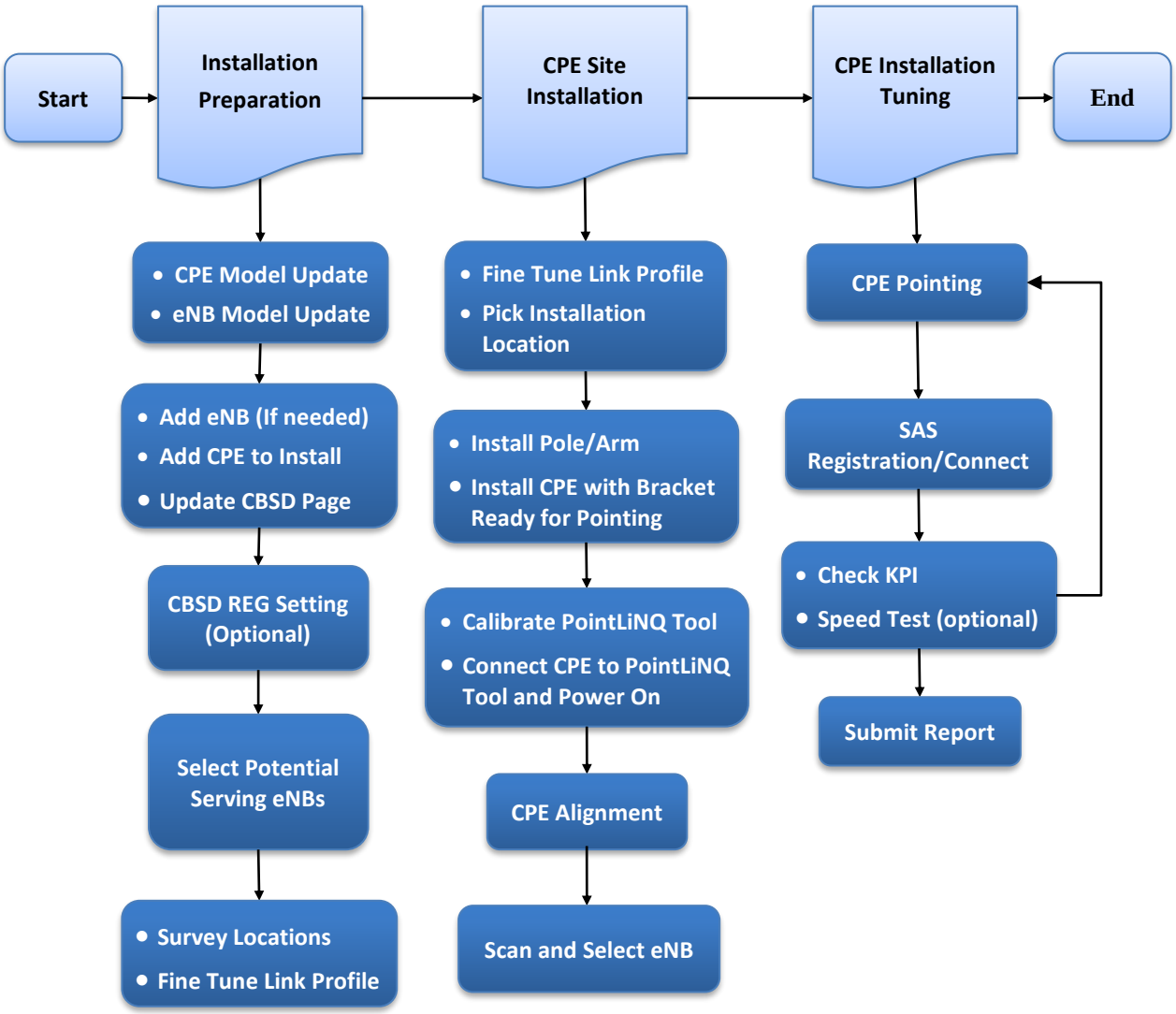
NOTE: This guide is applicable to CPE software version **01.02.01.034** and up. If your CPE is not running version 01.02.01.034 and up, please see Section **Error! Reference source not found.** in this guide for instructions on updating your CPE. This guide also applies to PointLiNQ **v1.1.0.**

2 Specifications

MECHANICAL & REGULATORY	
Dimension	13.4” x 13.4” x 2.95” (340 x 340 x 75mm)
Weight	4.41lbs (2kg)
PoE	802.3at
Power	Input: Universal range 100~240VAC Output: 56VDC
Reset/Reboot Button	Tact Switch
Survival Wind Speed	>124mph (200km/h)
Operating Humidity	5% to 95%
Operational Temperature	-40°F to 131°F (-40°C to 55°C)
MTBF ODU	300,000 at 131°F (55°C)
LTE	EN 301 908-13 V11.1.1
CBSD	Category B, FCCID MXF-WLTGG12248H
Safety	EN/UL 60950-1 & EN/UL 60950-22
EMC	EN 301 489-1 / -4 / -17 / -24
Environmental	IP67
NETWORKING & OAM	
LTE BB ASIC	GDM7243A (GCT Semiconductor)
LTE RF ASIC	GRF7243A (GCT Semiconductor)
Ethernet Ports	802.3, IEEE 802.3u, IEEE 802.3ab
LED Indicators	Signal Strength / LAN / SIM
SIM Function	1.8V, 3V SIM and USIM card, 2FF
PIN/PUK Code	Yes
Stack	IPv4, IPv6, Dual
NAT/Dynamic NAT	Yes
Router Mode	Yes
Bridge Mode	Yes
Tunnel Mode	GRE, L2TP, IPsec, PPTP (Available per request)
DCHP Server in LAN	Yes (253 Clients)
DNS Relay	Yes
DDNS Client	Yes
VPN Pass-Through – IPSec/PPTP/L2TP	Yes
UPNP	Yes
HTTP Server	Yes
ALG Support (FTP/SIP/…)	Yes

Networking Debug/Testing	IPerf, Ping, Traceroute
RADIO SPECIFICATION	
Peak Throughput	DL 440 Mbps (Config 2-7); UL 30Mbps (Config 2-7)
Carrier Aggregation	DL 2CC up to 20MHz each (w. DL 4x4)
	UL 2CC or Diversity or TM2 + 64 QAM
Frequency Band	TDD LTE Bands 42, 43, 48
Transmit Power	Up to +23 dBm
Tx Power Dynamic Range	63 dB
Receiver Sensitivity	-95 dBm
Channel Bandwidth/Carrier	10, 20 MHz
MIMO	DL MIMO 2x2 / 4x4 / 8x4
	UL 1x2 (with diversity); UL 1x2 CA; UL 2x2
LTE Compliance	3GPP Release 12 (Category 12/13/15 PHY Rate supported)
DEVICE MANAGEMENT & SECURITY	
WEB	Yes
SNMP	Yes
TR-069 and TR-0143	Yes
FOTA Upgrade	Yes
System Log/Diagnostic	Yes (Chipset embedded tool)
L2/L3 Firewall	Basic/Port Forwarding/Port Trigger/DMS/Remote/WAN Ping/Remote Web Access Control

3 Installation Flow Chart (with PointLiNQ Tool & App)



3.1 PointLiNQ Tool and App Introduction

PointLiNQ installation suite is composed of a Pointing Tool and the associated App (Android) designed to guide installer through all pre installation and installation steps.
PointLiNQ App requires input of specific information like eNB Models operating in the Network and CPE Models to install.
Device Model related parameters need to be entered once, either on server or on the app. Updates will be required only when new features (relevant to performance) have been enabled or new models are set.

- Present release of the App supports only BLiNQ Cat12HG CPE Model and BLiNQ FW-300i eNB.

For CBSD registration process, the PointLiNQ App stores and uses specific CBSD and CPI (Certified Professional Installer) information as required by SAS:

- CPI related parameters can be entered on CPI Page once and used at applicable installations
- Similarly, CBSD registration parameters can apply to every installation of the same CPE model

Through the installation process, the App computes certain performance predictions that will enable a fast and error free process prior CPE connectivity. The PointLiNQ Tool and App will help select the best installation location and best serving eNB. Using Machine Learning (ML) algorithms and statistic channel models, the App's predictions will provide solid guidance if properly used and tuned.

PointLiNQ App has two basic algorithms that are fed by user inputs.
The basic tool is **Survey Prediction**, which is solely based on installation point data (location, visual survey, installation height) and statistic wireless channel models for a certain serving eNB with varying options of CPE installation height and link profile (LOS, nLOS, NLOS, HNLOS)

- Theses estimates can be updated based on Google Maps visual, Google Planner information (or other prediction tool) or at the site visualizing the installation location
- Main purpose of Survey Information is to provide several information points:
    - Potential eNBs to connect at location; distance and direction of eNB
    - Estimated RSRP will indicate possible RSRP within +/- 10 dB error range if link profiles are correctly set.
    - Basic help in pointing and best choice installation point

Though the error margin can be large (no larger than other planning tools), these numbers will still help in deciding eNB targets, and the model can be adjusted and corrected on site without the need for expensive planning tools or internet connectivity.

Second method is **Scanning Prediction** that is based on received KPI readings of each eNB that the CPE can identify during scanning and pointing process.

- These predictions are close to real performance of the installed CPE Peak Rate (assuming CPE will use entire channel bandwidth)
- For this prediction to be accurate, all operational parameters set in eNB model must be accurate: MCS, TM, Frame Configuration, MIMO support
    - The main purpose of this feature is to aid in performing optimal pointing and performance assessment before 2 critical operations: CBSD Registration process and start full Tx Power operation

- CBRS FCC requirement allows CPE to operate for a very limited time before acquiring the GRANT. With the scanning predictions, there will be no need for trial and error methods. Optimal pointing and performance assessment will be completed in a short time and thus highly increase the chances of acquiring the GRANT.

3.2 Installation Preparation

It is advisable to perform this stage of installation in a location where there is internet connectivity so that the eNB Data Base is accessible.

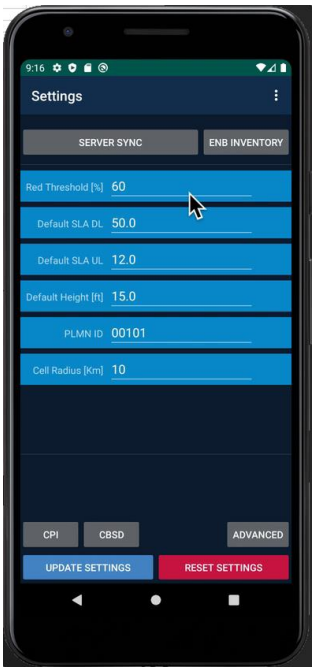
3.2.1 PointLiNQ App Settings

The server has a list of CPE Models and eNB Models with default information that is used as part of device configuration by the PointLiNQ App.
The app offers the capability to input a new eNB and /or CPE model. However, this operation should be part of deployment planning by a system engineer since it requires knowledge of eNB and/or CPE model specifications.

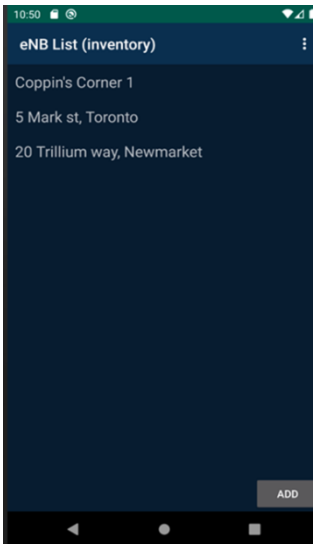
NOTE:

- These settings are saved on the phone and may be lost if the application is uninstalled.
- It is crucial that proper value is entered for the PLMNID. This should be the very first parameter that is set up. The PLMNID is specific to each client and is used for filtering BLiNQ's eNBs, server authentication etc. Thus, it needs to be configured first and saved onto the phone.

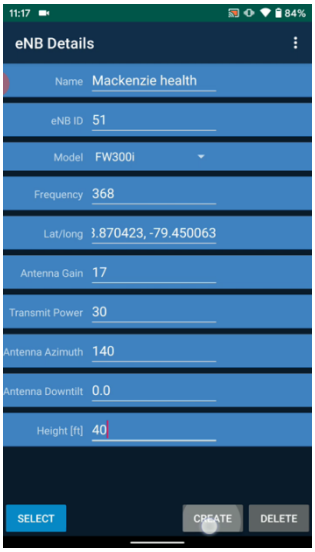
- Navigate to the menu icon on the top right corner on the first page of the app and click on "**Settings**"



- Choosing the **"SERVER SYNC"** button will synchronize app to server including the download of all available eNBs
- "**ENB INVENTORY**" displays a list with available eNBs
- "**Red Threshold**": You can set a value for colour code of estimated throughput – x%
  - Estimation > SLA → **GREEN**
  - Estimation > SLA * Red Threshold → **YELLOW**
  - Estimation < SLA * Red Threshold → **RED**
- **"Default SLA"** settings cover SLA desired on all installations. Each CPE SLA setting in the "**Add CPE**" page (see above) can be adjusted.
- "**Default Height**": Sets Default value for CPE installation height. This value can be adjusted during survey.
- **"PLMNID"** is default PLMNID value
- **"Cell Radius"** is defined per deployment design; eNBs outside cell radius will not be displayed as connectivity choice



- While the server is populated with all the deployed eNBs, there is an option to add eNB manually to the app for trial or experimental purposes.
- To add an eNB location manually, navigate to the **ENB INVENTORY** page:
  - Click on the "**Add**" button on the bottom right of the page to add new eNB location manually.

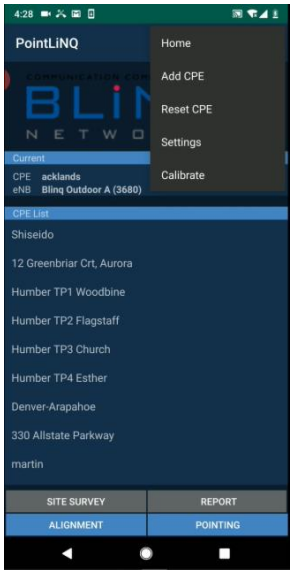


- **"Model"**: Select from the drop-down list of available eNB models.
- Enter the rest of the data manually.
- Click on "**Create**" to add the new eNB or "**Delete**" to remove the eNB.
- **Create**, **Edit** and **Delete** are options for the eNBs that are new or already listed on the **Inventory List**.

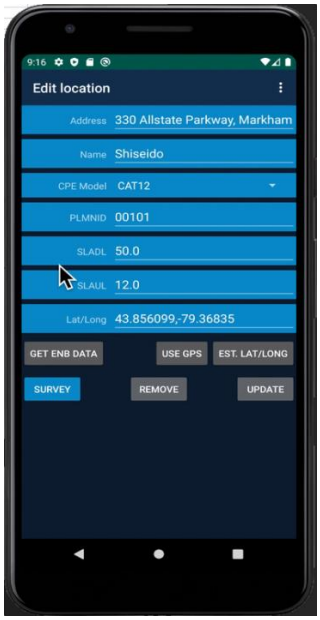
NOTE: With the current version of the PointLiNQ app (v1.1.1), the eNBs created are not uploaded onto the server. They are only saved on the phone and may be overwritten when syncing the list with the server.

3.2.2 Adding CPE to PointLiNQ App

- The first page of the app displays the current CPE that is being configured followed by a list of CPEs that also need to be configured prior to their installation. This list is saved on the phone and is available whenever the app is opened.
- To add new CPEs to the list:



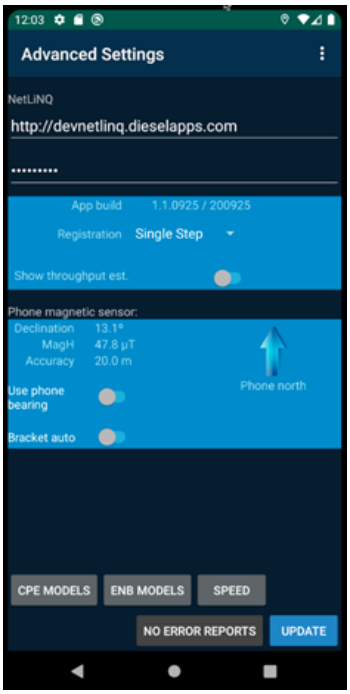
- Navigate to the menu icon on the top right corner and click on "**Add CPE**"



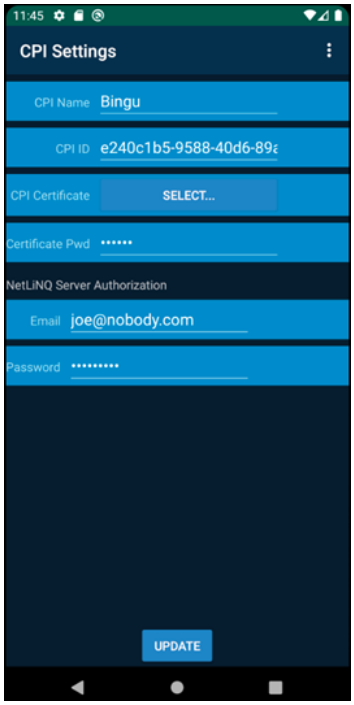
- Enter the **Address**, **Name**, **PLMNID,** and desired **SLA** if different from the default SLA (see Settings Page)
- **"GET ENB DATA"** will download list of eNBs that have the same PLMNID and are being located within cell radius from all the CPEs currently in the list.
- GPS coordinates (**Lat/Long**) can be populated in few ways:
  - Estimated, based on entered Address
  - Manual Input
  - Obtained from GPS - to be used only at installation location
- Hit the "**CREATE**" button to add CPE to the list. It will also start querying the list of eNBs from the app or server based on the information entered.

3.2.3 Advanced Settings

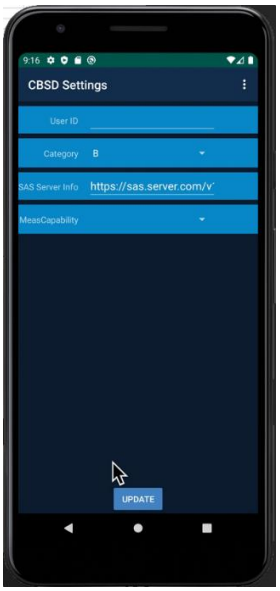
- Go to "**Settings**" and click on "**Advanced**" to get to the Advanced Settings page which contains server URL, access password and other parameters.
  - Set option to skip Registration process by means of PointLiNQ App & Pointing Tool. If **REG** is **OFF** then it means that Multistep Registration will be completed by other means (on **Advanced Settings** page). In this case, the device will skip registration process and try to connect. Therefore registration must be done prior to installation



- The most important elements on the **Advanced Settings** page are **CPE Models**, **eNB Models** and **Speed** page
- Present Release incorporates defaults with eNB and CPE models, but this is going to be the entry point to the server to describe in detail new defined CPE and eNB models. Please do not change the settings as it will affect many other parts of the app.
- **Registration:**
  - **OFF:** No App-based registration required/desired
  - **Single Step:** App-based single step CBSD registration
- **Speed**: This will open up the screen for speed test configuration. Please see Section 3.5 Speed Test for more information.



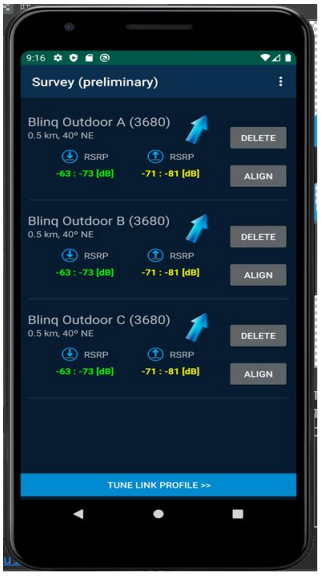
- Click on the **Menu** button from the **Advanced Settings** page and choose "**CPI**" to get to the CPI Configuration page.
- Input CPI related information that is used for SAS connectivity here. This only needs to be set up once.
  - Enter **CPI Name**
  - **CPI ID** will be automatically extracted when the uploaded CPI Certificate. (See next step)
  - Download the **CPI Certificate** file onto the phone (download from email or from any cloud storage services such as Google Drive or Dropbox). Click on the "**Select**" button and locate the file on the phone.
  - Enter the **Certificate Password**.
- For **NetLiNQ Server Authorization**, enter an authorized email (which is set up by BLiNQ). The **Password** is a default value for now and is built-in with the app.
- Remember to click on "**Update**" to save these configurations.



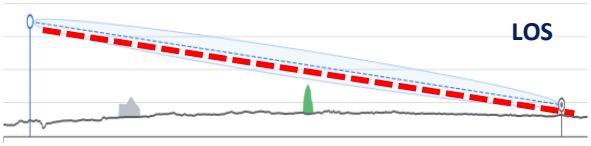
- Next, open the "**Advanced Settings**" menu bar to get to the **CBSD Configuration** page.
- Input CBSD generic information here (SAS User ID, Category – Type B, etc.)
    - These data will be used for all the installed CPEs during REGISTRATION process.

3.2.4 Select eNB and Survey Location

- Select any CPE in the list and perform the following activities:
    - Choose the eNBs that can offer desired connectivity (based on RSRP estimate) from the eNB list
    - Survey each CPE installation location on Google Maps or using a planning tool. In each location, these parameters can be updated:
        1. Installation Height based on Google Map view
        2. Survey installation direction and set Link Profile as described in section below
- After these changes, the estimations of each CPE will be updated on **Survey Preliminary** page.
- The same operations can be done for all CPE locations to be installed in next several days.
- This way the duration for site exploration can be shortened and more time can be given to planning for each location.
- eNBs that are not of interest can be removed from the list, as needed.

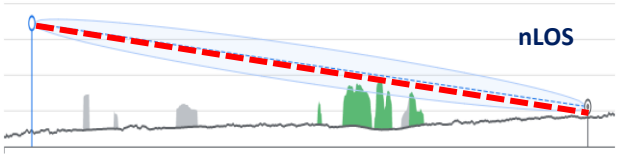


3.2.4.1 Link Profiles



LOS (Line of Sight)

- No obstacles blocking between eNB and CPE path)
- See eNB tower from CPE location



nLOS (Near Line of Sight)

- Light tree densities, sparse trees, e.g. poplar
- Blockage is in mid-path
- CPE has open space at near-field.

NLOS (Non Line of Sight)

- Medium tree densities, trees e.g. linden, elm
- Medium-to-high trees/buildings blocking the path
- CPE has decent clearance from obstacles

HNLOS (Heavy Non Line of Sight)

- Hilly terrain with heavy tree densities, e.g. maple, white spruce, pine
- High trees (30-50 feet) and/or buildings blocking the path
- CPE is very close to the obstacle

3.2.5 Hardware Check

The tools and hardware here serve as a checklist of what is needed for site installation. Please look through the items and bring them along for the installation on site.

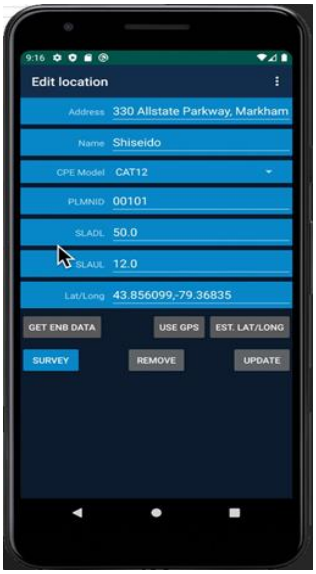
- CPE w PoE Injector
- Azimuth/Elevation Bracket
  - 10-mm Nut Driver (elevation);
  - 15-mm ratcheting wrench (Azimuth/Mount)
- Mounting Brackets
  - 18-mm Socket and Wrench
- POE Injector / Ethernet cabling/connectors / tools
- Tripod and gear to secure it for Survey
- Mounting J arm or pole for attaching to structure
  - Various hardware for attaching to structure
- AC Power Source / Power Strip
- Telescoping Pole
  - Example: https://www.gigaparts.com/mfj-1919ex.html

3.3 CPE Site Installation

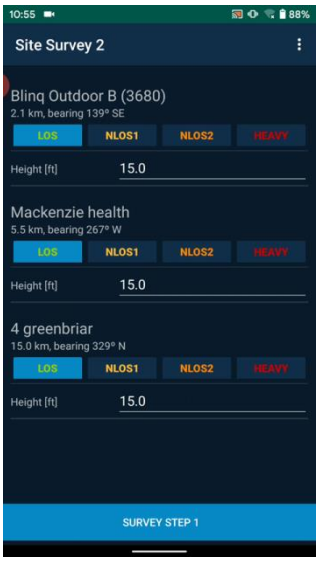
3.3.1 Pick Installation Location

Further adjustments or tuning can be done at the site based on site analysis. At this step, it is crucial to proceed to target installation point and adjust link profile and/or installation height based on site conditions. This step can strongly influence eNB ranking and final HW installation decision.

To begin, select the current location from the main screen.



- To fine tune the link profile further, update the CPE location by using GPS to get a more accurate location specifics. This is an optional step.
- "**Use GPS**" will update the current location based on the phone's current GPS location.
- Then click on "**SURVEY**" to continue to the list of eNBs.



- The next step is to go to each possible installation location and open up the PointLiNQ App to **Site Survey 2** page (Link Profile Tuning) and adjust:
  - Link profile (LOS, nLOS, NLOS and HNLOS) can be adjusted by observing direction indicated by the eNB pointing arrow. Many digital maps used for planning and/or Google Views are not updated at times, so they might generate errors in assessing link profile.
  - Height (if it differs from existent data)
    - Different heights can be tried to obtain the best option

- Finally go back to eNB list to visualize predicted performance (RSRP), select the installation spot and proceed to HW installation.

Tips:

- If more installation locations are available select the highest installation point and avoid heavy foliage in immediate CPE proximity as much as possible.
- If it is winter and foliage is not completely developed, remember that every single link profile can change when foliage returns.
- Usually an nLOS (NLOS1) link at 6 km distance can produce way better performance than a HNLOS link at 2 km distance, therefore distance is not the only selection process.

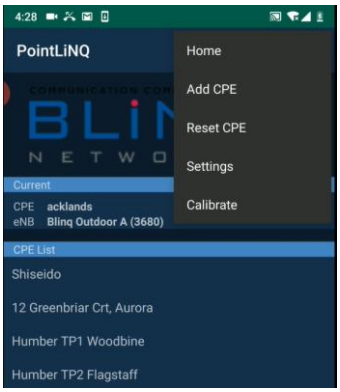
3.3.2 Calibrate PointLiNQ CPE Pointing Tool and App

The PointLiNQ CPE Pointing Tool needs to be calibrated on site to make sure that it points North accurately. This enables the tool to map out the precise locations of the eNBs.

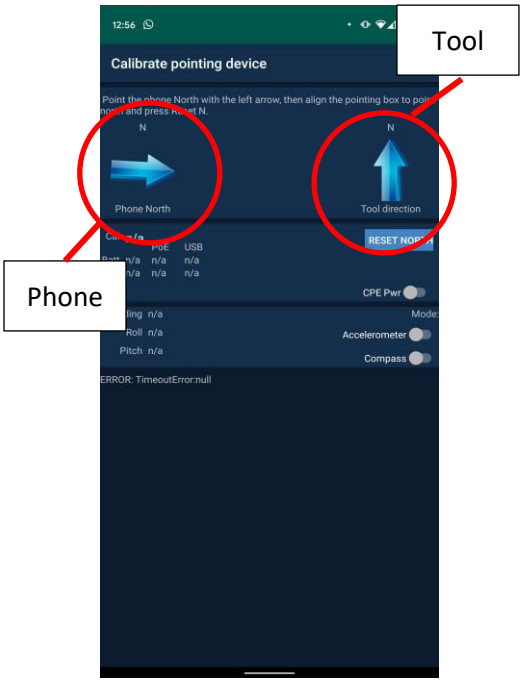
Please keep in mind that the part of the tool that needs to point North (during the calibration process) is the BACK of the tool, where the clip is (See figure below).

NOTE: The PointLiNQ CPE Pointing Tool has not been mounted on the CPE yet.

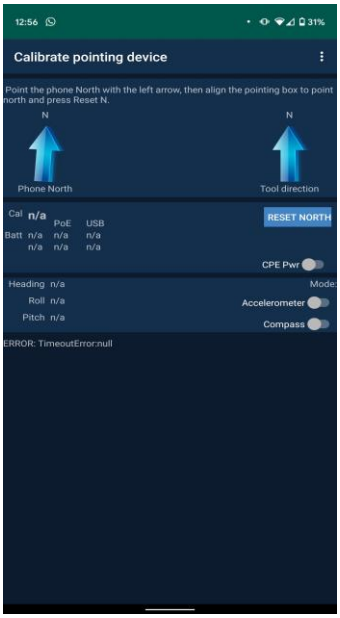
To calibrate the PointLiNQ CPE Pointing Tool:



- Go to the menu and select "**Calibrate**" from the home page.



- On the **Calibrate Pointing Device** page, there are two arrows on the page – left arrow indicates the position of the phone.
- Please ignore the Tool Arrow on the right for now as the Tool had not been calibrated
- Move the phone until the Phone North arrow (left) is vertical, pointing at the "N".
- Now, move the Tool so that its bracket mount (See Tool picture above) is pointed in the same direction as the physical phone orientation.

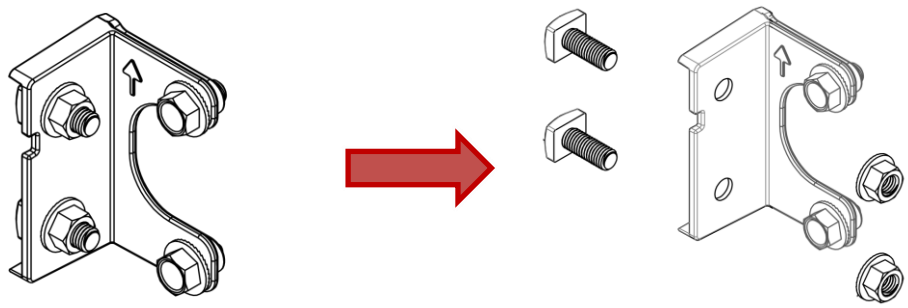


- At this point, hit the "**Reset North**" button and both arrows should be almost parallel to each other, as shown in the screen shot here.
- The tool has been successfully calibrated.

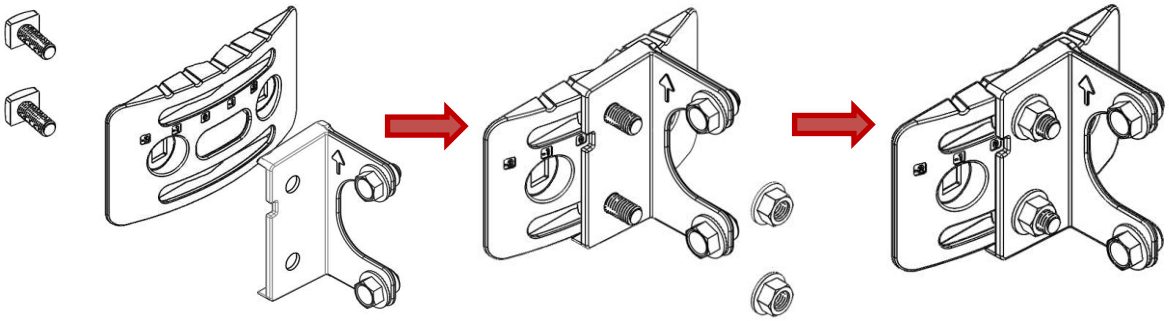
3.3.3 Install and Align CPE

3.3.3.1 Azimuth/Elevation Bracket Installation

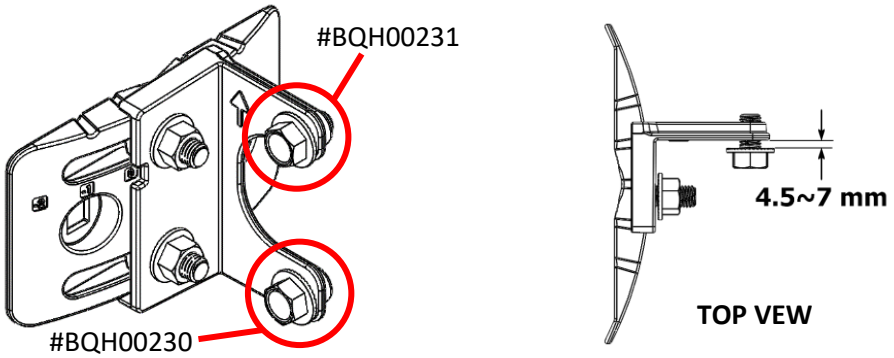
1. Locate the mid bracket (#BQF00310) and remove the two M10x1.5 (25mm L) screws (#BQH00235) from it by unscrewing the two #BQH00232 M10 lock nuts. Set the screws and nuts aside.



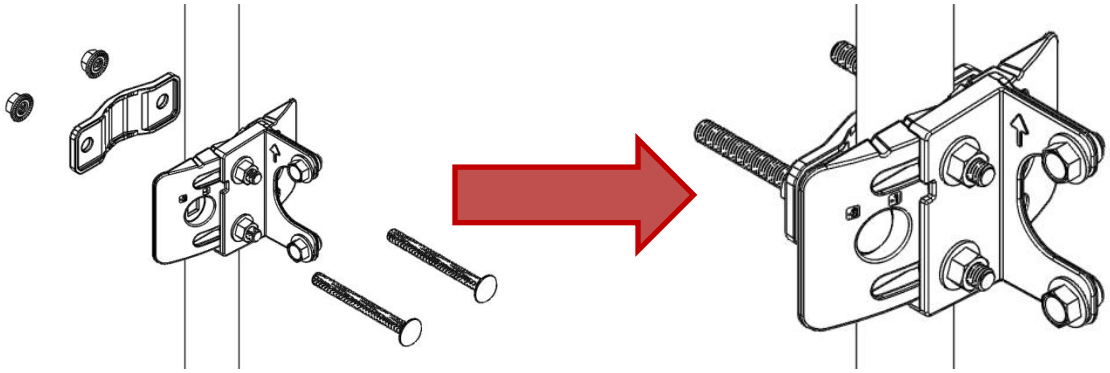
2. Secure the pole side bracket (#BQF00309) with the mid bracket by inserting two M10x1.5 (25mm L) screws through both brackets and fastened with two M10x1.5 lock nuts. Please take note of the mid bracket's orientation, ensuring that the arrow is pointing up. Position the mid bracket in the middle position of pole side bracket and adjust it only after attaching the CPE (See Step 9).



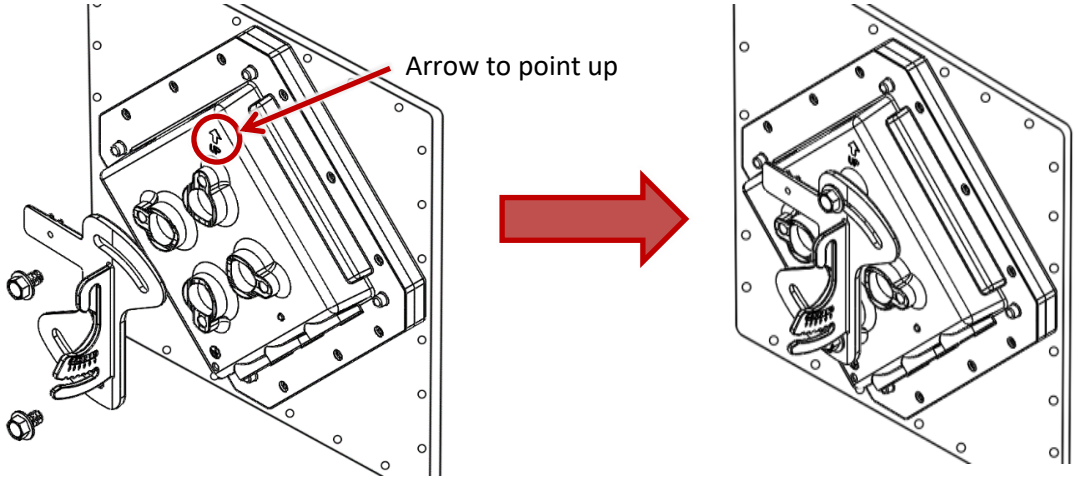
3. Please ensure that the M10x1.5, 16mm L screw (#BQH00231) on the top hole and the M6 enlarged hex head screw (#BQH00230) on the bottom hole of the mid bracket have a distance of 4.5-7mm between the screw heads and the mid bracket surface as shown in the top view figure below.



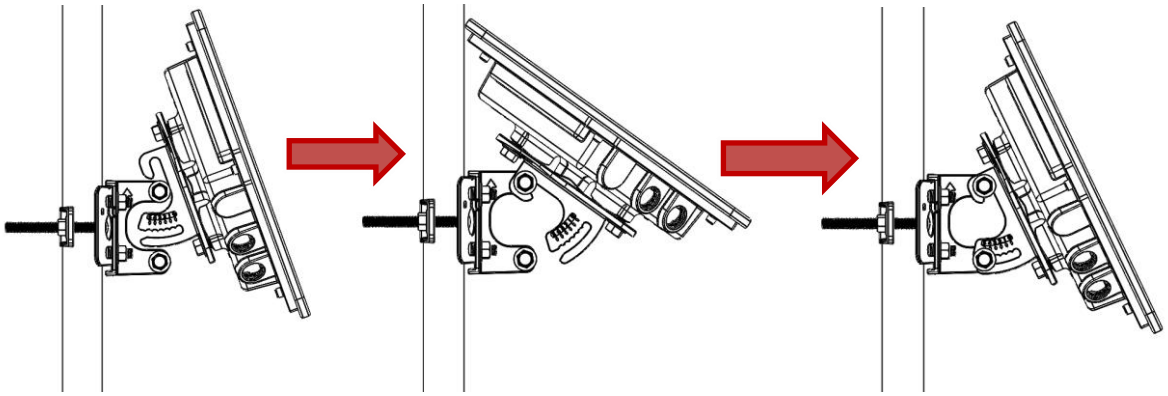
4. SECURING BRACKET ON POLE: Take the assembled pole side bracket, hold it on one side of the pole. Slot the two M10 carriage bolts (#BQH228) through the holes of the bracket and hold it there; take the clamp (#BQF00308) and slot it through the carriage bolts. Fasten the bolts with two M10x1.5 lock nuts (#BQH00232).



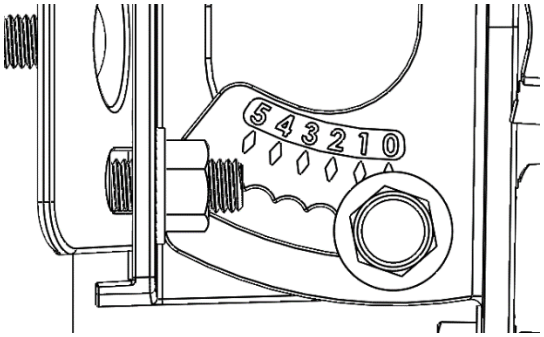
5. To assemble the unit side bracket, take the CPE and ensure that it is oriented with the arrow pointing upwards. (see figure below)
6. Align the unit side bracket (#BQF00307) with to the back of the CPE and secure it with two M10x1.5 (#BQH00231) screws.



7. Bring the CPE up to the previously secured bracket on the pole. Hook the unit side bracket (there is a small hook on the top) onto the loosely fastened M10x1.5 screw on the mid bracket – such that the hook is on the screw itself. Tighten the screw to secure the unit.



8. Then, slide the curved bottom part of the bracket onto the M6 enlarged hex head screw. There are scorings every 5 degrees of tilt-angle, from 0 (Vertical position) to 5 (25° uptilt). Adjust the tilt to the desired angle and tighten the screw to secure the position of the CPE.

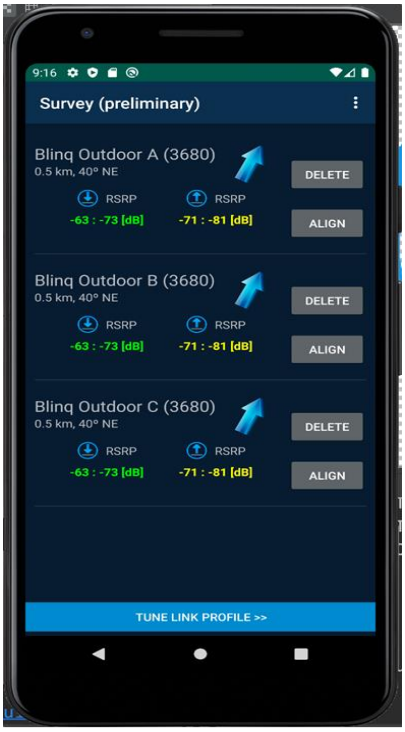


9. The CPE can be adjusted by sliding the mid bracket left and right after loosening the lock nuts installed in Step 2 (above).
   There are scorings every 7° of azimuth-angle from 0 (0° position) to ±2 (14° position left or right). Tighten the lock nuts when satisfied with the position of the CPE.

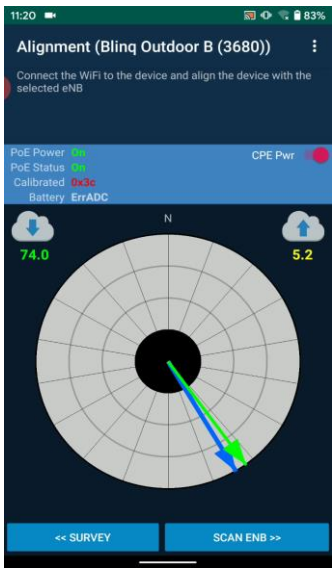
3.3.3.2 Aligning CPE with PointLiNQ CPE Pointing Tool and App

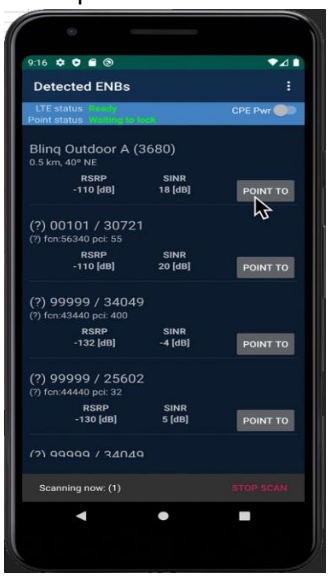
1. Point CPE and Bracket in the direction of target eNB direction by using the app
2. Make sure that the CPE bracket was installed on the center position for azimuth and no tilt on elevation as a starting point
3. Power on the PointLiNQ CPE Pointing tool
4. Connect app to tool's Wi-Fi
5. Attach PointLiNQ CPE Pointing Tool to CPE bracket. It should slide in easily on the unit side bracket that is attached to the back of the CPE.

6. Connect CPE to PointLiNQ tool's PoE
7. **To select eNB** – Select the CPE that is being installed and click on the "**Survey**" button from the "**Edit Location**" page. Choose the desired eNB by clicking the "**ALIGN**" button.



8. The **Alignment** CPE screen on the app to show the direction that the CPE is aiming (in **GREEN** and target eNB direction (the **BLUE** arrow points to the eNB)
    a. Rotate brackets all together until both arrows overlap



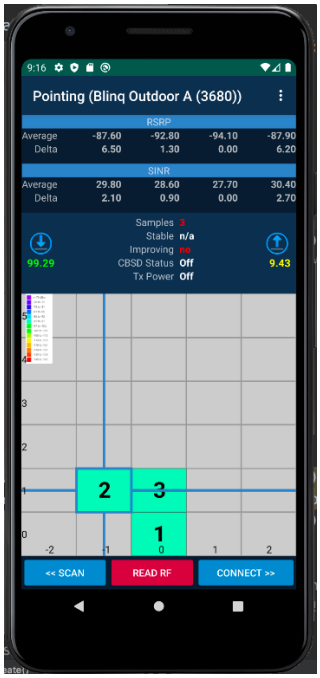


    b. The screen will show **PoE Power**, **Status** and an **ON/OFF Power** button, as well as the battery status
    c. Turn on the power to the CPE with the **CPE Pwr** toggle button and wait a few seconds
    d. Secure bracket main screws and press **“SCAN ENB”** button
    e. Scanning process will return a list of eNBs detected and surveyed plus possibly additional eNBs that are in the area as a part of Operator’s network or from other networks. Such a list is displayed (see the right screen shot above with “**(?) eNBs**”). The CPE can point to one of the other eNBs if part of same network.
    f. Click on the “**POINT TO**” button and proceed.

3.4 CPE Installation Tuning

3.4.1 Pointing

- CPE starts from middle azimuth position and elevation as seen in the screenshot here.
- **Average** values are for each DL stream and each **Delta** value shows the difference between Min. value and Read Value.
  - Large imbalance between each stream KPIs indicates possible link instability



- Other display fields show **CBSD status** and **Tx Power** Value
- Each pointing position is coloured according to RSRP signal strength map from upper left corner
- Estimated throughout values are colored in accordance to SLA matching value and threshold
- At this point, the CPE scans and collects KPI values every time "**READ RF**" button is pressed. More samples can be acquired in each pointing position; their numbers are displayed next to the Samples field.

- The app records and remembers the best 3 positions (the best one labeled "1"), marking by the color function of RSRP Map.
- Once the best position is achieved, press "**CONNECT**"

3.4.2 Registration

- Before connecting, **CBSD Registration Review** is displayed for examination/review
- All fields are automatically populated from:
  - CPE
  - Pointing Tool
  - App Defaults
- The option to skip Registration is still available at this point, only if registration in **Settings** > **Advanced** has not been disable.
- Every field on this page can still be adjusted manually.
- Once inspection is complete, press **REGISTER** and CPE will connect.

- This is a screenshot of a typical registration example.
- Note that the registration file was uploaded successfully.
- However, in this example, the eNB did not have an open internet connection so the ping test failed.
- In most cases, it will take a few minutes before the CPE is fully connected. As such, the ping tests may fail for a while.

3.5 Speed Test

Once the CPE achieved connectivity and is registered, a speed test can be executed from the app. The speed test runs in two stages – the downlink speed and then the uplink speed.

3.5.1 Speed Test Server Side Setup

The iperf3 server must be installed on an equipment (PC, server) northbound of the EPC and needs to be running when the test is done. Typically, the users should have iperf3 server running all the time on a server in their network.

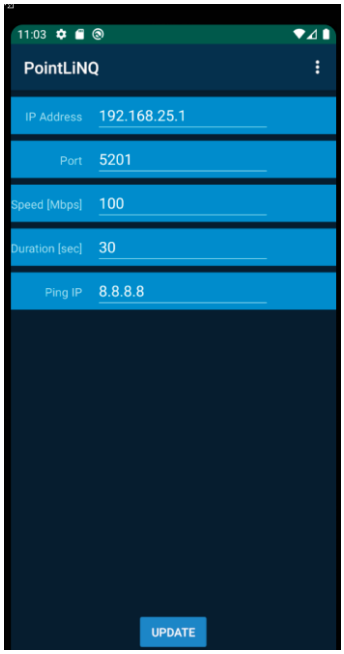
The server is started with the simplest command possible, using only the port option -p (if not using default 5201), and, in case the host equipment has multiple interfaces, the bind option -B

E.g. Assuming the iperf3 server address is 192.168.25.1, it can be started on the host with:
iperf3 -s -B192.168.25.1

The operator can also use the -D option to run the server as a daemon.

3.5.2 Configuring the Speed Test

Go to **Settings** > **Advanced Settings** > **Speed** and configure the settings:



- **IP Address**: IP address of the iSpeed test server
- **Port:** Port of the iSpeed test server (default is set at 5201)
- **Speed:** The maximum speed to attempt to push through, in Mbps (default is set at 100 Mbps)
- **Duration:** Duration of the test in seconds (default is set at 30 seconds)
- **Ping IP**: IP used for the ping test. The default is set at 8.8.8.8
- Click on **"Update"** to save the settings.

3.5.3 Running the Speed Test

To start running the speed test, go to **Settings** > **Advanced Settings** > **Speed** and click on the **Menu** button.

The test will run in the following manner:

- The app will ask the tool to start the test
- The tool will start UDP traffic at the requested rate
  - Note that the tool cannot support traffic higher than around 75 Mbps
  - The real traffic is measure by the CPE
- The final numbers reported are:
  - Tool Traffic – Speed measure by the tool (may be lower than real speed)
  - CPE traffic – Speed measured by CPE

NOTE: If the speed test is completed in less than a few seconds, it means that the CPE is not connected or the Tool cannot contact the iSpeed server and the reported numbers cannot be relied upon. Please go to **Settings** > **Advanced** > **Speed** (on the app) to change the port number of the iPerf server and rerun the test again.

3.6 CPE Installation Complete

If the installation meets expectations, notes can be made (if needed) and reports can be submitted (See screenshot below).
At this point installation is complete.

However,

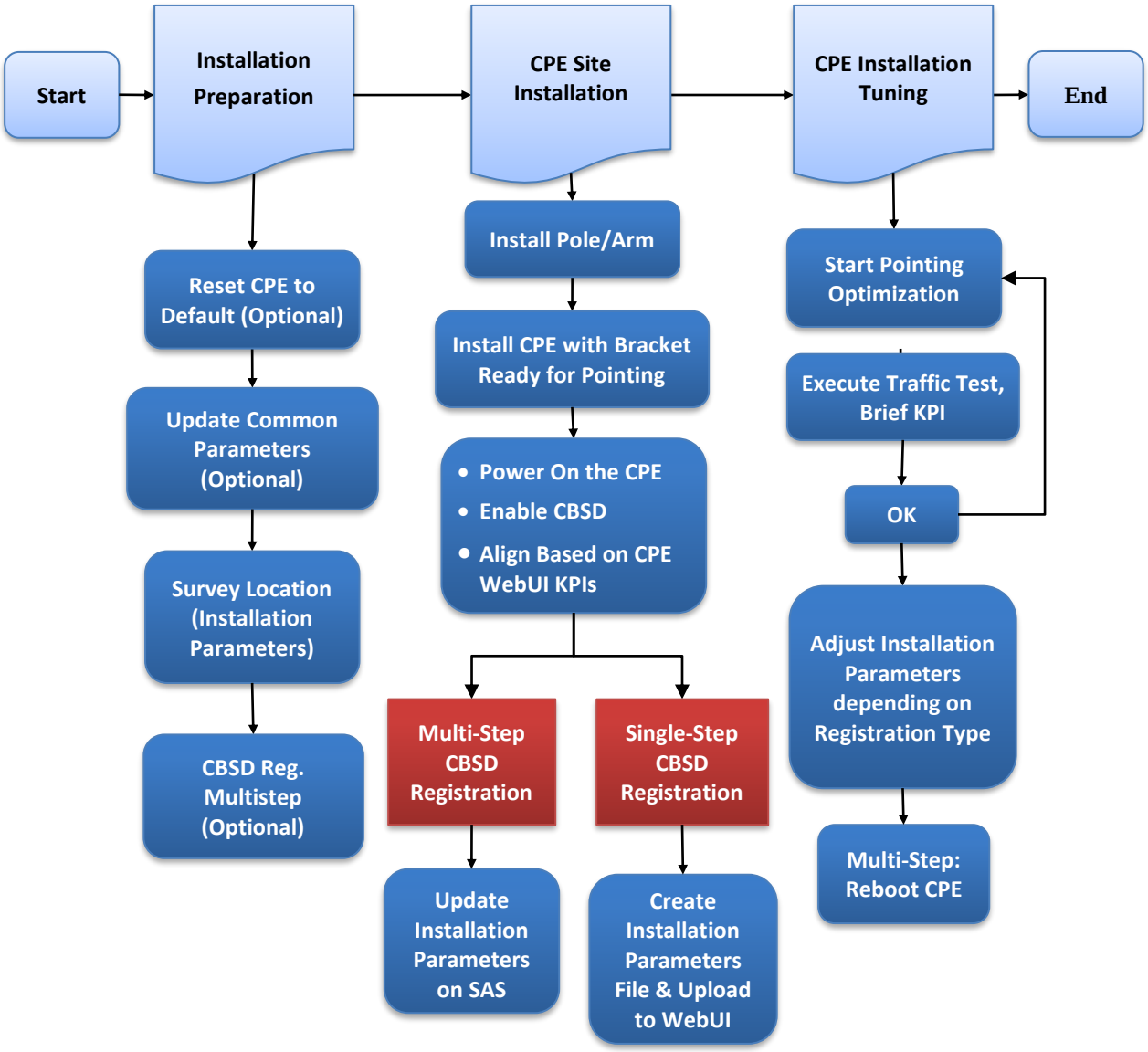
- Possible GRANT can be denied or Tx Power Limited to lower value that does not meet expected performance
    - **Tx Power** and **CBSD Status** can be seen on report

These events might trigger a decision to seek another target eNB for connectivity
Once CPE Speed Test is implemented, report can submit detailed information of CPE performance, including BER, number of RBs used and many other KPI indicators.

4 LED Indicators on PointLiNQ Tool

LED	State	Status	Remarks
Charge LED	OFF	Not Charging	
Charge LED	ON	Charging	
Status LED	Blinking Amber	Normal Operation Mode	This is 30secs after pressing the Power Button. This is also when the SSID will show up
Status LED	Blinking Fast	Shutting Down (Power Off)	This is after hold the power button for 2seconds
WI-FI LED	Blinking Amber	Wi-Fi enabled	This is every time the Wi-Fi Module is active, even during the boot period
Ethernet LED	Blinking Green	Wi-Fi Activity	Whenever there is any Wi-Fi Activity

5 Installation Flow Chart (Without PointLiNQ Tool)



5.1 Installation Preparation (Office)

Connect a computer to the Ethernet port of the CPE power adaptor. Give the computer an IP on the **192.168.15.0/24** subnet as the CPE works in bridge mode by default and an IP address would not be automatically assigned.

NOTE: Remember to click "**Apply**" to commit any of the changes made and save to the CPE device. You may be required to reboot the CPE for the changes to take effect.

5.1.1 Login to WebUI

1. Open the Web browser (Ex: Internet Explorer, Firefox or Chrome) and enter the default IP address of CPE, which is : https://192.168.15.1
2. Enter default USERNAME/PASSWORD: **administrator / _BLiNQ_**
3. The above credentials should give Superuser privileges, which will be needed to make most of the changes in the WebUI.

5.1.2 Software Version

Ensure that the CPE is running approved SW version.

If not, please upgrade the SW.

1. Go to **About** page on the CPE WebUI to verify the current software/firmware version (under "**Firmware Version**")
2. Please contact BLiNQ Technical Support to obtain the latest software and proceed with the following steps to load the build onto the unit.
3. Navigate to **Management** > **Software**
4. Click "**Browse**" to select the IPKG file to upload, and then click "**Upgrade**" to install the selected file. The Upgrading window will pop up. Once upgrading is completed, the CPE will reboot to load the new software. The IPKG file you have uploaded will be shown on the page, under "**Device Software Version**".

NOTE: Clicking on the "**Upgrade**" button will trigger an automatic reboot of the CPE to upgrade the firmware with the specified file. You will be prompted to re-login to the CPE after upgrade is completed.

5.1.3 Restore Default Settings

Reset the FWC-122HG-CPE to default if it was used before, or if new SW version had been upgraded and the release notes for that SW version indicate that the default values for some parameters have changed.

1. Go to **Management** > **Restore Default**

2. Click on the "**Restore**" button under "**Restore Default Settings**"

5.1.4 Optional Parameters

1. Enable GPS (optional)
    a. Go to: **GPS** > **Settings** > **Enable**
2. Change Time Zone (optional)
    a. Go to: **Management** > **Time Settings** and modify "**Time Zone"** and "Auto adjust for Daylight Saving Time" accordingly

5.2 CPE Site Installation

5.2.1 Installing CPE on Pole/Arm

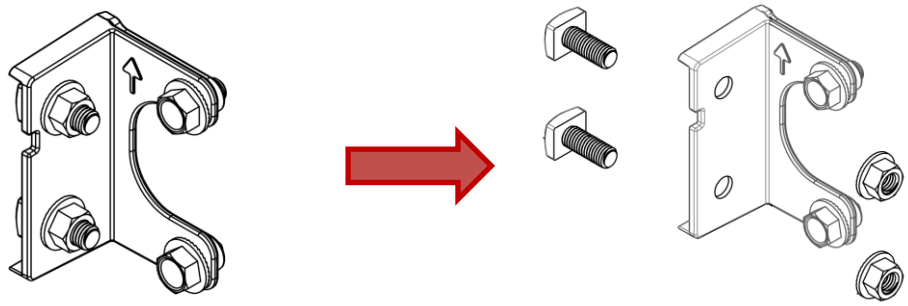
Once on site, mount the CPE onto a pole or an arm. There are 3 different CPE brackets that can be used for this purpose:

- Azimuth/Elevation Bracket
- Adjustable Mounting Bracket
- Fixed Bracket

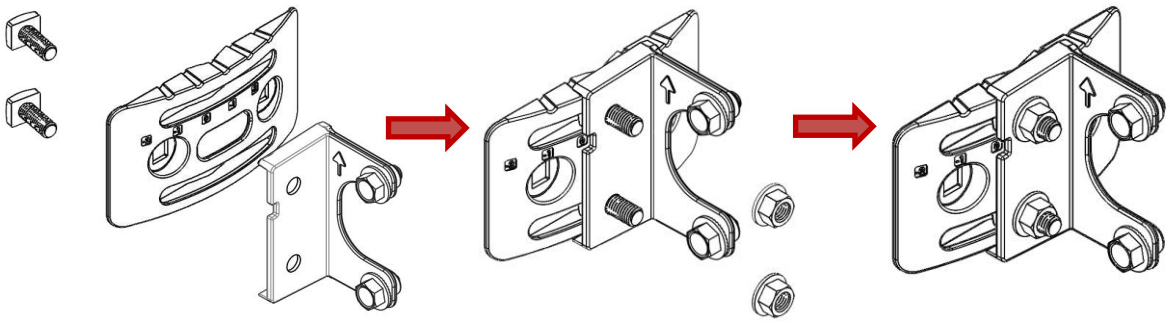
If the bracket required did not arrive with the CPE package, please contact BLiNQ Technical Support.

5.2.1.1 Azimuth/Elevation Bracket Installation

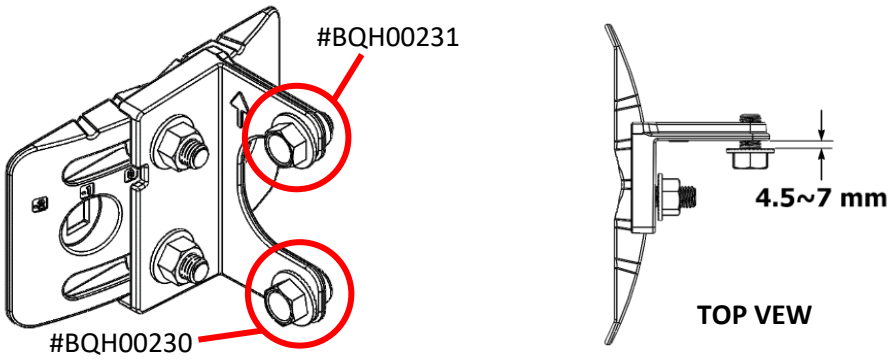
1. Locate the mid bracket (#BQF00310) and remove the two M10x1.5 (25mm L) screws (#BQH00235) from it by unscrewing the two #BQH00232 M10 lock nuts. Set the screws and nuts aside.



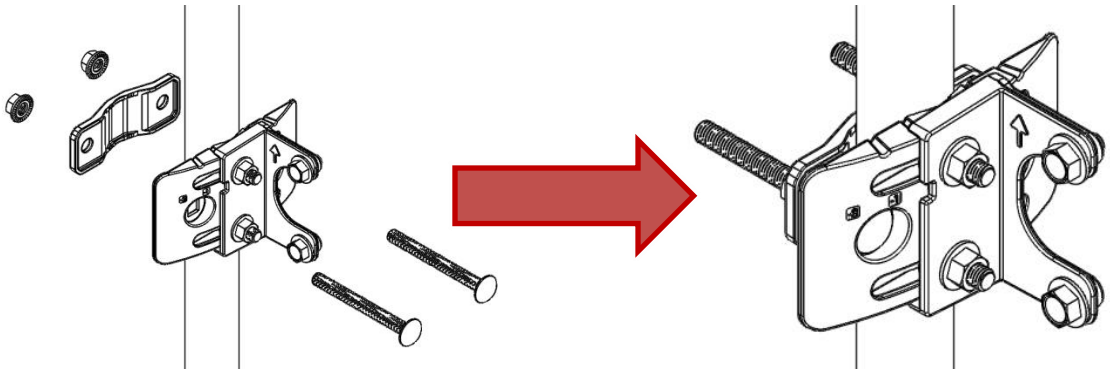
2. Secure the pole side bracket (#BQF00309) with the mid bracket by inserting two M10x1.5 (25mm L) screws through both brackets and fastened with two M10x1.5 lock nuts. Please take note of the mid bracket's orientation, ensuring that the arrow is pointing up. Position the mid bracket in the middle position of pole side bracket and adjust it after attaching the CPE (See Step 9)



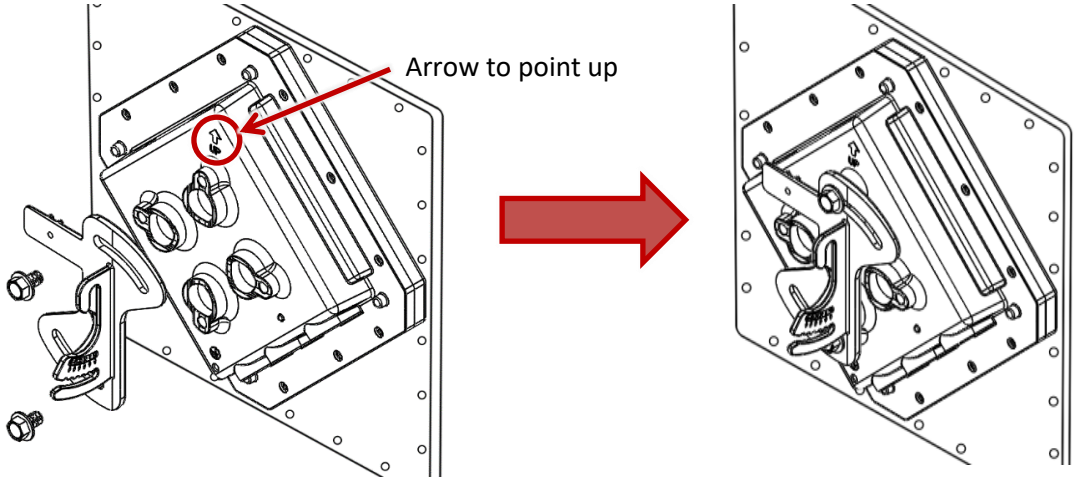
3. Please ensure that the M10x1.5, 16mm L screw (#BQH00231) on the top hole and the M6 enlarged hex head screw (#BQH00230) on the bottom hole of the mid bracket have a distance of 4.5-7mm between the screw heads and the mid bracket surface as shown in the top view figure below.



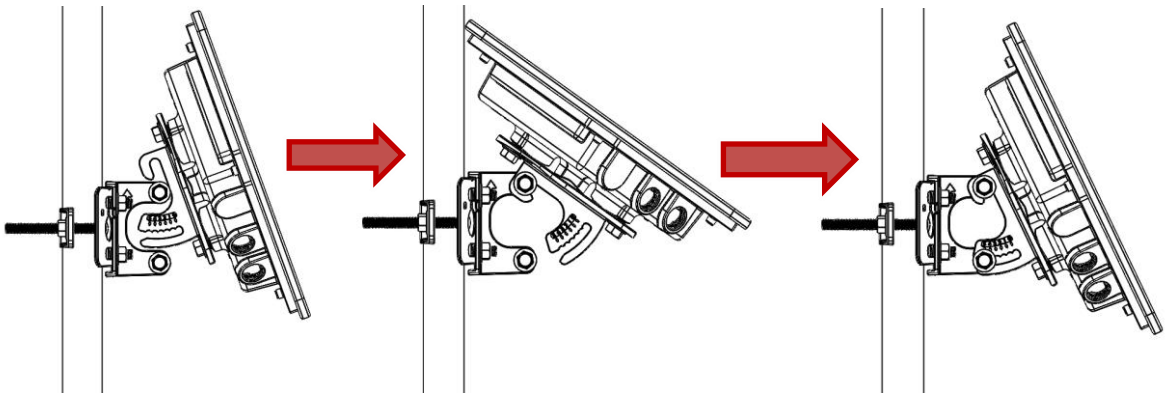
4. SECURING BRACKET ON POLE: Take the assembled pole side bracket, hold it on one side of the pole. Slot the two M10 carriage bolts (#BQH00228) through the holes of the bracket and hold it there; take the clamp (#BQF00308) and slot it through the carriage bolts. Fasten the bolts with two M10x1.5 lock nuts (#BQH00232).



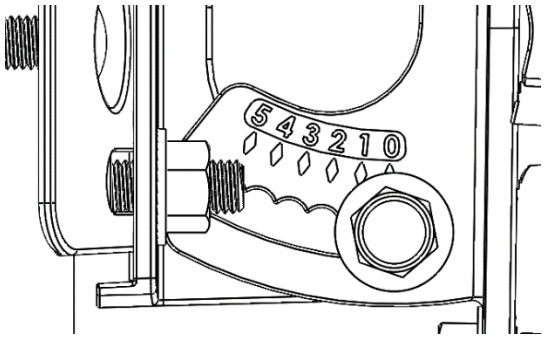
5. To assemble the unit side bracket, take the CPE and ensure that it is oriented with the arrow pointing upwards. (see figure below)
6. Align the unit side bracket (#BQF00307) to the back of the CPE and secure it with two M10x1.5 (#BQH00231) screws.



7. Bring the CPE up to the previously secured bracket on the pole. Hook the unit side bracket (there is a small hook on the top) onto the loosely fastened M10x1.5 screw on the mid bracket – such that the hook is on the screw itself and tighten the screw to secure the unit.



8. Then, slide the curved bottom part of the bracket onto the M6 enlarged hex head screw. There are scorings every 5 degrees of tilt-angle, from 0 (Vertical position) to 5 (25° uptilt). Adjust the tilt to the desired angle and tighten the screw to secure the position of the CPE.

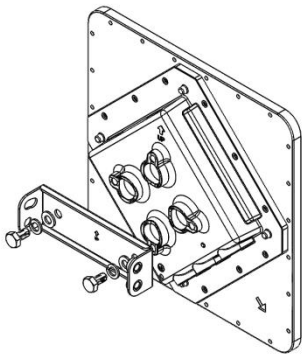


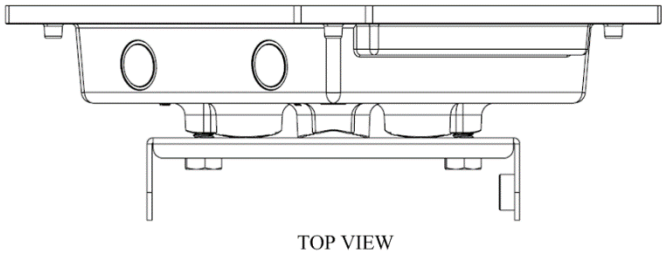
9. The CPE is adjustable by sliding the mid bracket left and right after loosening the lock nuts installed in Step 2 (above).
   There are scorings every 7° of azimuth-angle from 0 (0° position) to ±2 (14° position left or right). Tighten the lock nuts when satisfied with the position of the CPE.

5.2.1.2 Adjustable Mounting Brackets Installation

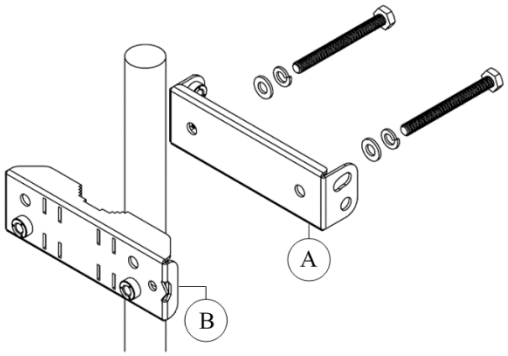
The Adjustable Mounting Bracket can be mounted on poles with diameters between 1” to 4”.

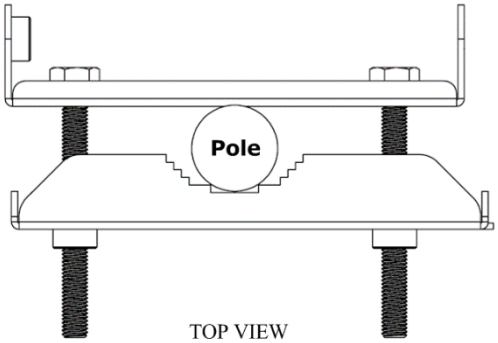
1. Thread the M10*20mm bolt through a spring washer, flat washer and the bracket holes, and tighten the bolts to the LTE Outdoor CPE. (See below)



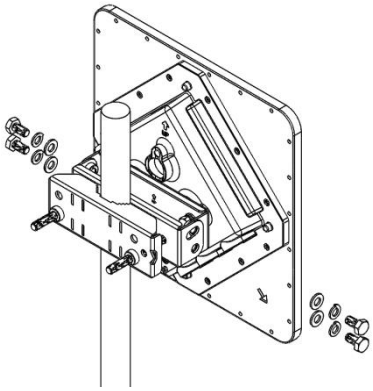


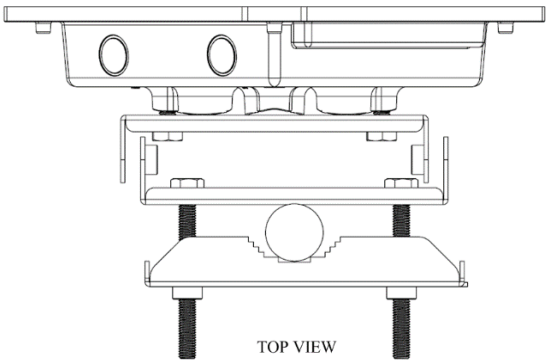
2. Thread the M10*100mm bolt through a spring washer, flat washer and the holes of bracket A. Attach the bracket A to the other side of the pole and through both holes of the bracket B on either side, and tighten the bolts.





3. With the connector facing downward, assemble the two brackets together Thread the M10*20mm bolt through a spring washer, flat washer and the bracket holes.





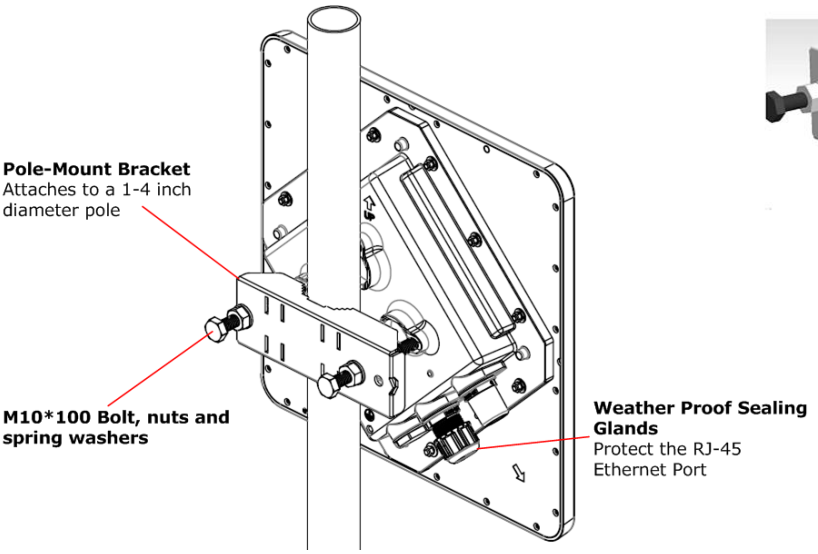
4. Adjust the required angle (a 10 degree adjustable tilt) and tighten the screws.

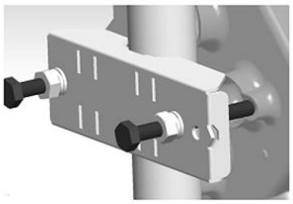
5.2.1.3 Fixed Bracket Installation

The Fixed Bracket is compatible with poles between 1” to 4” in diameter.

1. Thread the M10*100mm bolt through a spring washer, flat washer and the bracket holes.
2. With the connector facing downward, attach LTE Outdoor CPE to a 1”-4” pole.
3. Attach the bracket to the other side of the pole.

4. Thread the M10*100mm bolts through both holes on either side and tighten the nuts.





5.2.2 Power On the CPE and Connect Computer

1. Give the computer IP address in **192.168.15.0/24** range and connect to https://192.168.15.1
2. Login as **administrator/_BLiNQ_**

NOTE: Remember to click "**Apply**" to commit any of the changes made and save to the CPE device. Rebooting the CPE may be required for the changes to take effect.

5.2.3 Enable CBSD and Enter User ID & SAS URL

1. In the WebUI, go to **LTE** > **CBRS** > **Basic**
2. Make sure that CBSD is enabled under "**Operation Mode**"
3. Enter the company **User ID** under "**Basic Information**"
4. Enter **SAS Server URL** under "**Basic Information**"

5.2.4 Configure CBSD Installation Parameters

You will need to decide if you will be using Multi-Step Registration or Single Step Registration when configuring CBSD installation parameters

5.2.4.1 Multi-Step CBSD Registration

1. Set **Registration Type** to "**Multi Step**" and **Apply** changes
2. **Align the CPE until you get the best RF signal from eNB**
3. Once you are satisfied with the CPE's position, collect **Installation Parameters** and provision them in the tool used for communication with SAS
    - This could be SAS WebUI, or the SW your company developed.

- For this to work, there has to be an alternate way to connect to this tool (e.g. LTE via phone); the CPE will not transfer user data until it gets authorized by SAS

5.2.4.2 Single Step CBSD Registration

1. Set **Registration Type** to "**Single Step**" and **Apply** changes
2. Align the CPE until best RF signal from eNB is attained
3. Once you are satisfied with the CPE's position, open the program provided by BLiNQ **(CPI Signed Data Generator)** and create installation parameters file:
    a. Enter installation parameters (see Appendix A for an example)
    b. Point the program to the CPI certificate
    c. Enter the password required to read CPI certificate (this password should have been given along with the certificate)
        - Note: the program will remember the CPI certificate location, but for security reasons, the program will ask for password every time.
    d. Click on "**Generate**". This will create a file in format **ROR_1001_<CPE CBSDID>.txt** in the same folder where the program is
4. Upload installation parameters file to the CPE:
    a. Go to **LTE** > **CBRS** > **Basic**
    b. Ensure that **Registration Type** is set to "**Single Step**"
    c. Upload the file by clicking the "**Upload**" button and guiding the WebUI to the proper directory on the computer.

5.3 CPE Installation Tuning

- Configure the computer to obtain address through DHCP
- Ensure that computer gets IP address on the data PDN
- Perform speed test to ensure link quality is satisfactory
    - If the performance is NOT satisfactory, **realign CPE**
- If the performance is improved by moving the CPE, **update the installation parameters**
    - For Multi-Step: update installation parameters on SAS
    - For Single-Step: update installation parameters using external program and upload the new file to the CPE
- For Multi-Step: **reboot the CPE** so it can get authorized with new installation parameters
    - If there are changes in installation parameters for Single-Step, the CPE will automatically re-register to SAS using the new parameters
- **Repeat above steps until obtaining satisfactory performance**

5.4 Monitoring

5.4.1 Diagnostic Tools

The FWC-122HG-35 CPE has built-in tools - "**ping**" and "**traceroute**". Use these tools to test internet connectivity after the installation is complete.

"**ping**" is used to test if CPE can reach an IP address by sending the ICMP "ECHO_REQUEST" packet and receiving the ICMP "ECHO_RESPONSE" packet.

"**traceroute**" records all the relay points from CPE to an IP address.

The result of "**ping**" and "**traceroute**" will be presented in "**Diagnostic Result**".

1. Go to **Monitoring** > **Diagnostic Tools**
2. Set up the parameters of the test (**Dianostic Type**, **Protocol Type**, **IP Address/Domain, Max Hops**) If you are doing a ping, set the **Ping Count**, **Packet Size** and **Ping Timeout** too.
3. Click on "**Start**" under **Status** to run the test.
4. Results of the test will be shown under "**Diagnostic Result**"

5.4.2 Signal Reference Table

Use the table below as a guide for your CPE values.

RSRP Value	RSRP Quality
>-90dbm	Excellent
-90 dbm to -105 dbm	Good
-106 dbm to -115 dbm	Fair/Average
< -115 dbm	Poor

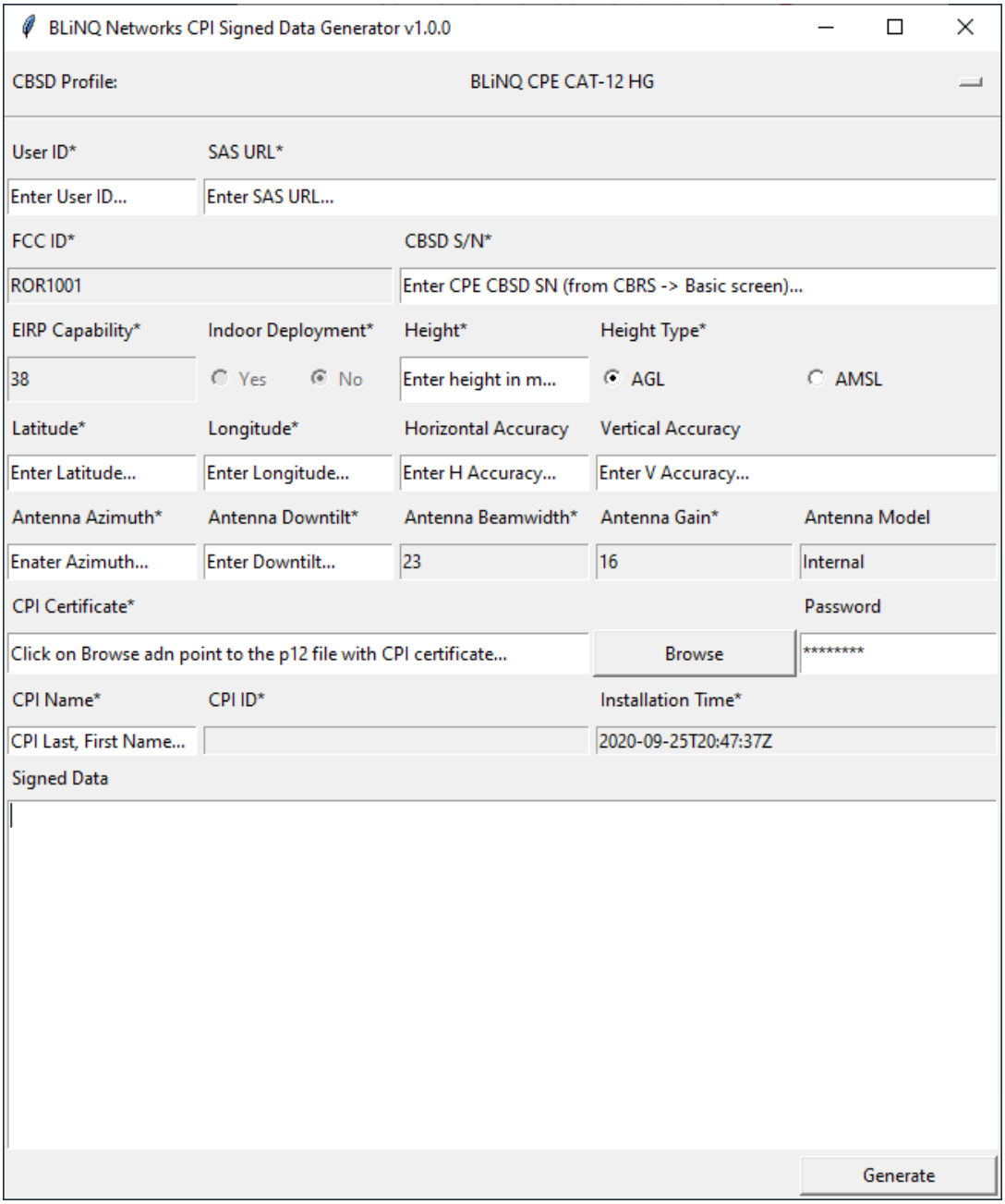
SINR Value	SINR Quality
>13.5	Excellent
10.5 - 13	Good
5 - 10.5	Fair/Average
<5	Poor

6 LED Indicators on CPE

LED name	Location	Color	LED Behavior	Status Indication
LED List				
MAIN power		**Blue**	**ON**	Power On
			OFF	Power Off
Ethernet status		**Yellow**	**Steady ON**	Detect Ethernet Device Connected
			Blinking	N/A
			OFF	No Ethernet action
SIM status		**Green**	**Steady ON**	SIM Detected
			Blinking when On-hook	PUK / PIN Code
			OFF	No SIM Detected
LTE Status LED : Link Status			When CPE is power on, each LED indicates each link status ; change upon customer requirement	
LTE 1		**Blue**	**Steady ON**	SINR < 7
LTE 2		**Blue**	**Steady ON**	7dB ≤ SINR < 11dB
LTE 3		**Blue**	**Steady ON**	11dB ≤ SINR < 18dB
LTE 4		**Blue**	**Steady ON**	18dB ≤ SINR < 23dB
LTE 5		**Blue**	**Steady ON**	23dB ≤ SINR

Appendix A BLiNQ CPI Signed Data Generator

This is the program that should be used to create a file with installation parameters and CPI signed data. The file needs to be uploaded to CPE using "Single Step Registration" dialog on CPE's **LTE** > **CBSD** > **Basic** page. Please be sure to use **CPI Signed Data Generator** SW version 1.0.0 or later.



Notes:

- **User ID** – User ID defined on SAS
- **SAS URL** – The URL of SAS that the CPE needs to connect to

- **CBSD S/N** - This is essentially CPE MAC address. Proceed to CPE's WebUI (**LTE** > **CBRS** > **Basic** > **CBSD Serial Number**) and copy the hardcoded value from there.
- **Height/Latitude/Longitude/Accuracy/Azimuth/Downtilt** - These are standard installation parameters. Note that if you uptilt the CPE, the Antenna Downtilt value should be negative.
- **CPI Certificate** - The CPI Certificate is the p12 file that was given upon completion of the training. Similarly, the password would also have been given at the same time. The program will automatically extract the CPI ID from the certificate, but **CPI Name** is not in the certificate, so it needs to be entered manually.
- Click on "**Generate**" button and the content of the generated data will be shown. More importantly, in the same folder where the program is, there will be a file called **ROR1001<CBSD S/N>.txt**. This is the file that needs to be uploaded to the CPE when using the single step registration
- The program will remember the last entered non-installation parameters.