Installation Manual - Swiftlane Cellular Router

Parts information

Type	Product Name	Summary and Datasheets	Photo
Cellular Router	RUT240	RUT240 cell router website	
Omni-directional antenna	QuSpot	Link External antenna with antennas in 4 directions. Utilized in urban environments with lots of different tower locations nearby	
Uni-directional antenna	QuMax	Link External antenna with single direction of antenna. Strongest gain in one direction, ideal for suburban and remote locations	
Passive POE injector - 24V DC	UI Passive POE 24V DC	Link Used to power the RUT240 router, through the LAN port. Warning: RUT240 does not support standard POE, which would burn the router. Only use this passive POE that's 24V DC output.	

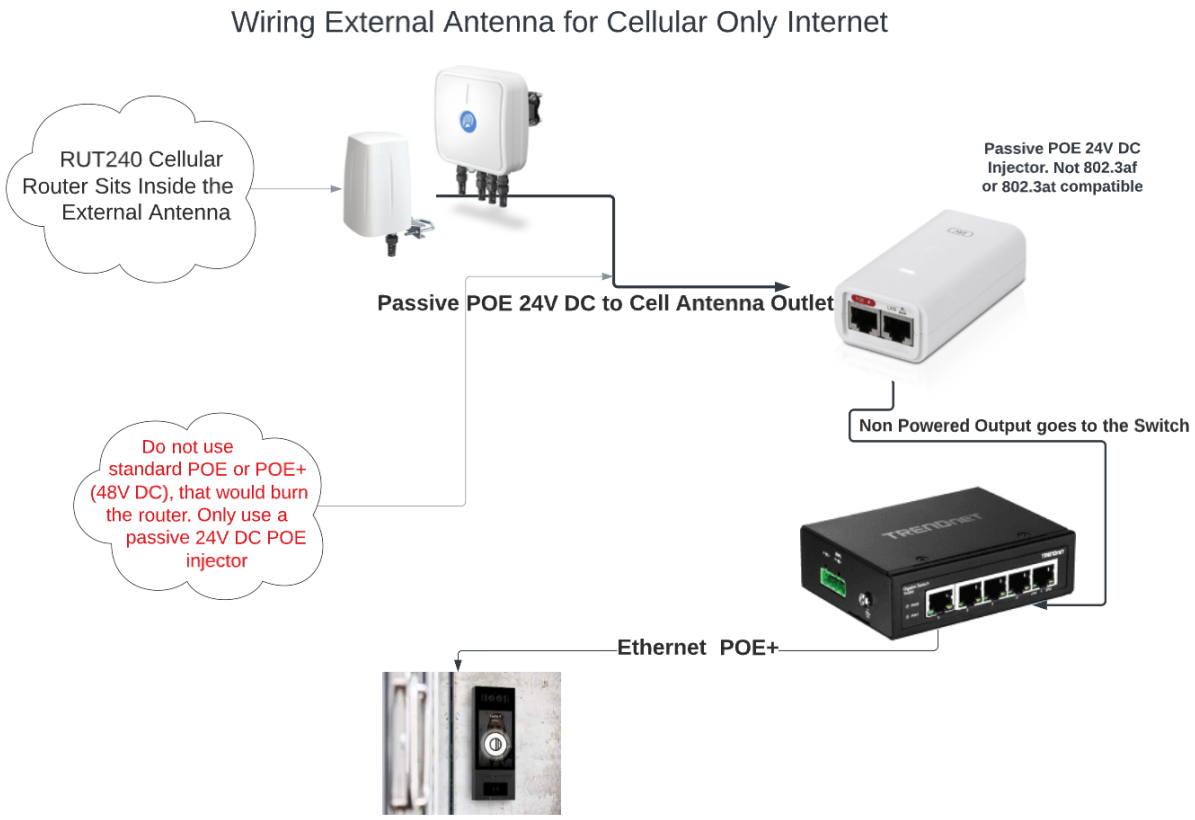
Network

Swiftlane uses AT&T as the primary provider for cellular connectivity. Please check the general signal strength at the customer site, you can request this information ahead of time from the customer or during your initial site assessment.

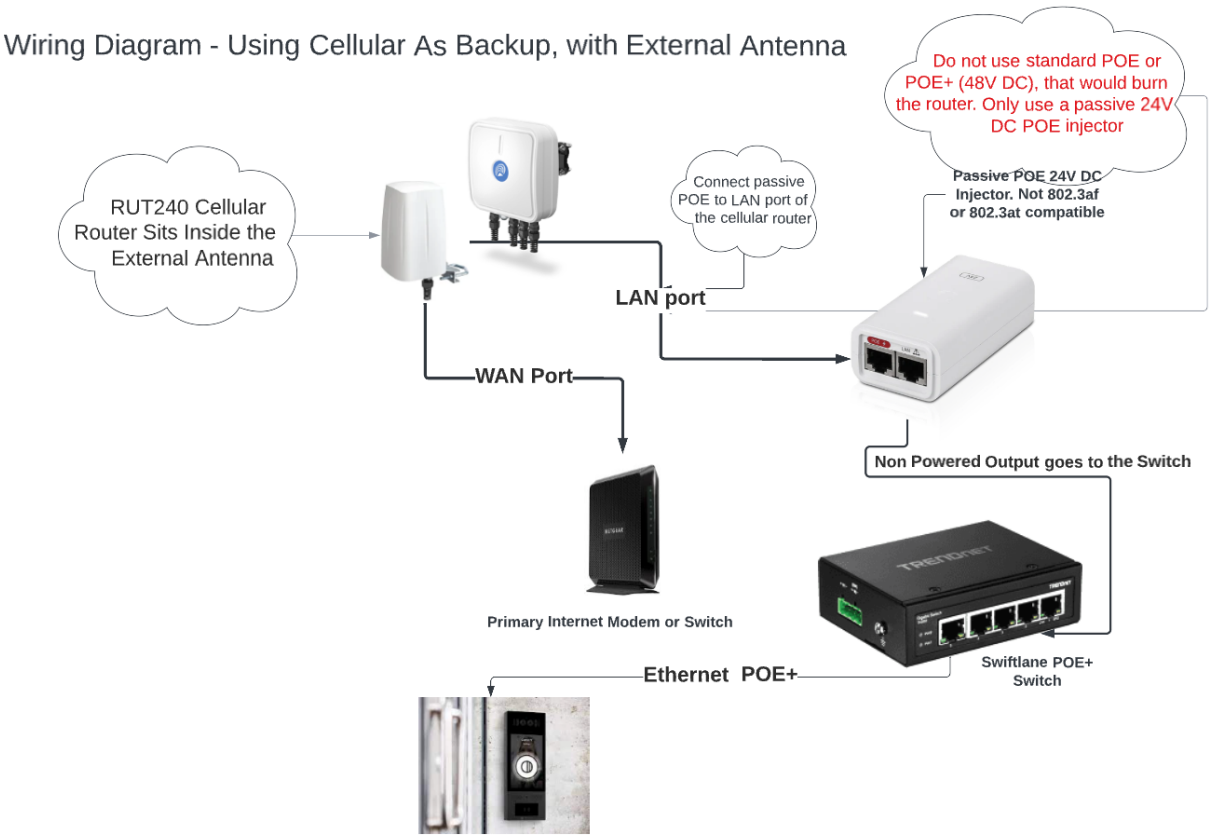
Wiring diagrams

Option 1: Using an external antenna, for cellular only internet

If Swiftlane provided internet is being used as the primary internet service, please follow these wiring options. An external antenna is strongly recommended in this scenario to maximize signal strength, especially since the signal can be weaker in server and IDF rooms

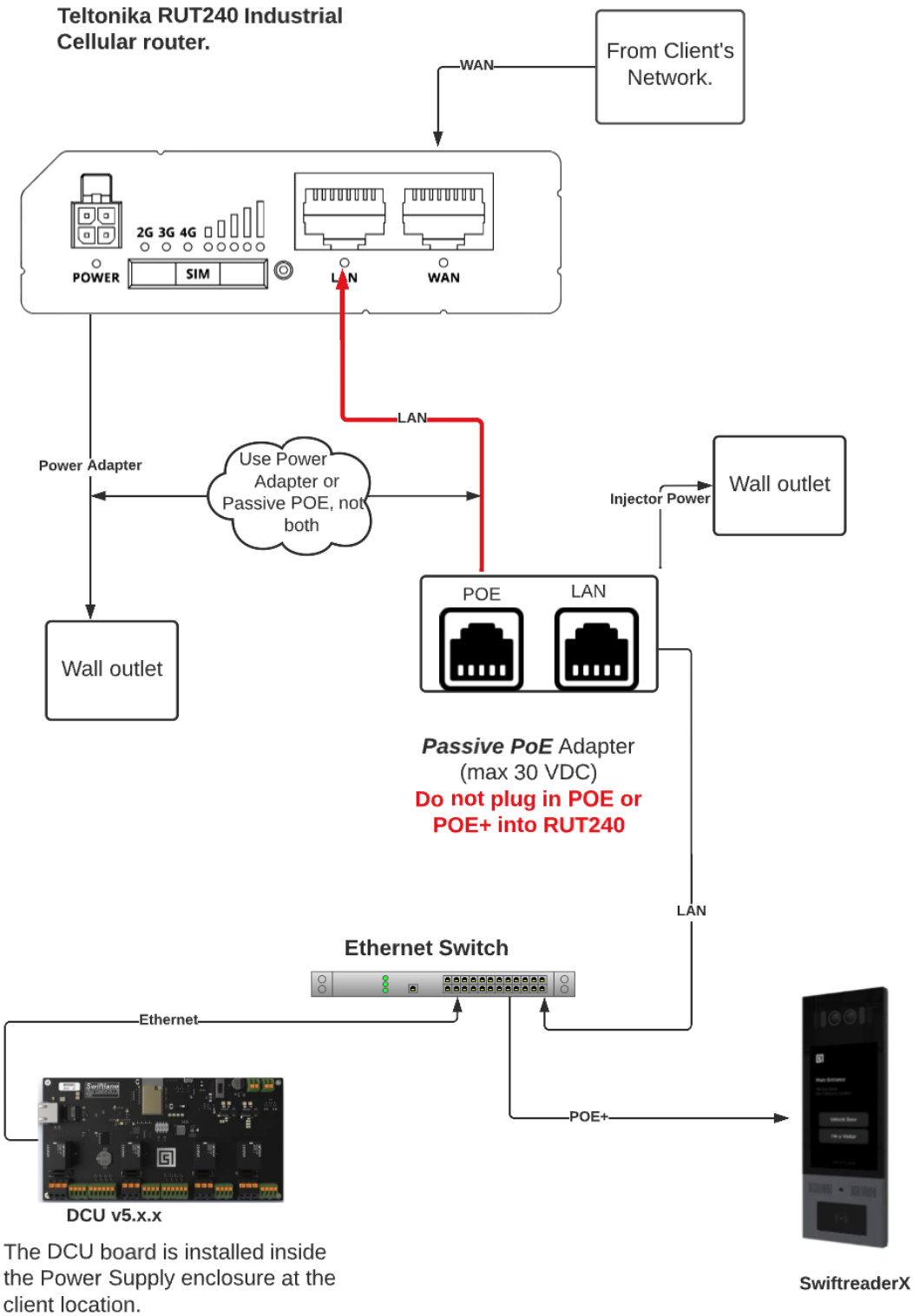


Option 2: Using external antenna and cellular as a backup to primary wired internet



Option 3: Using the cellular router without an external antenna

If the signal strength inside the server room is strong, an external antenna may not be required, and you can use the antennas that come bundled with the RUT240 router


Teltonika RUT240 Industrial Cellular router.
WAN
From Client's Network.
2G 3G 4G
POWER
SIM
LAN
WAN
LAN
Power Adapter
Use Power Adapter or Passive POE, not both
Injector Power
Wall outlet
Wall outlet
POE
LAN
Passive PoE Adapter
(max 30 VDC)
Do not plug in POE or POE+ into RUT240
LAN
Ethernet Switch
Ethernet
POE+
DCU v5.x.x
The DCU board is installed inside the Power Supply enclosure at the client location.
SwiftreaderX

Mounting Considerations for External Antenna

External antennas should be mounted outside the building with minimal obstruction from nearby buildings. Identify the location that balances ease of installation with the maximum unobstructed views, in order to achieve best gain from the antenna

- Balance ease of installation with aesthetic considerations for the building, and minimal obstructions from nearby building
- For uni-directional antenna, the mount provides a 45 degree rotation angle, in order to adjust the antenna horizontally and align with the nearby tower
- Use cellmapper.net to identify nearby towers to ensure maximum gain on the antenna

Height

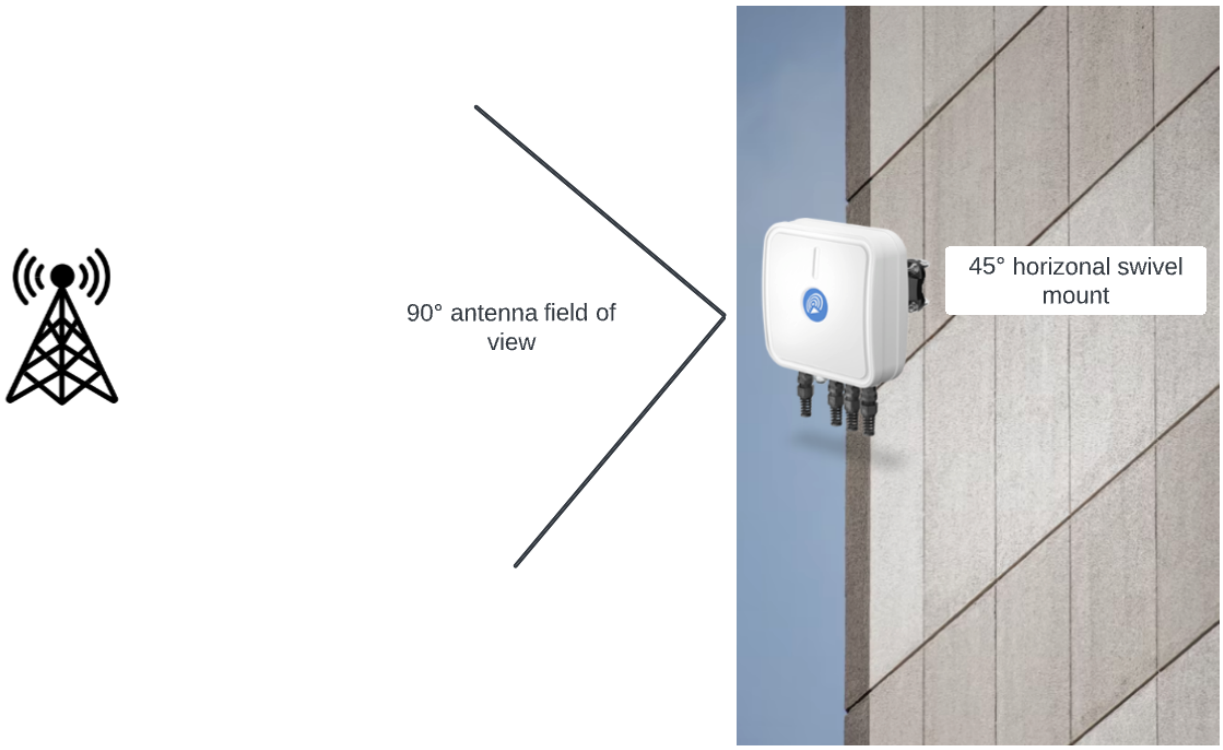
In general, the taller the antenna is placed, the better it will perform. However, 10-12 ft is a good installation height to start. This protects it from easy access to vandalism, while also getting few obstructions to the nearby towers. You can connect the antenna and hold it up at that height and check the signal strength indicators by connecting to the local management dashboard over an IP connection. Follow the instructions below to get familiar with the various parameters for signal strength.

Direction

Omni - directional antennas capture signal strength from all directions so they dont to be pointing in any specific direction

Uni-directional antennas must be pointed in the general direction of the nearest cell towers for AT&T. You can use https://www.cellmapper.net/ to insert the full address and look up nearby 4G towers.

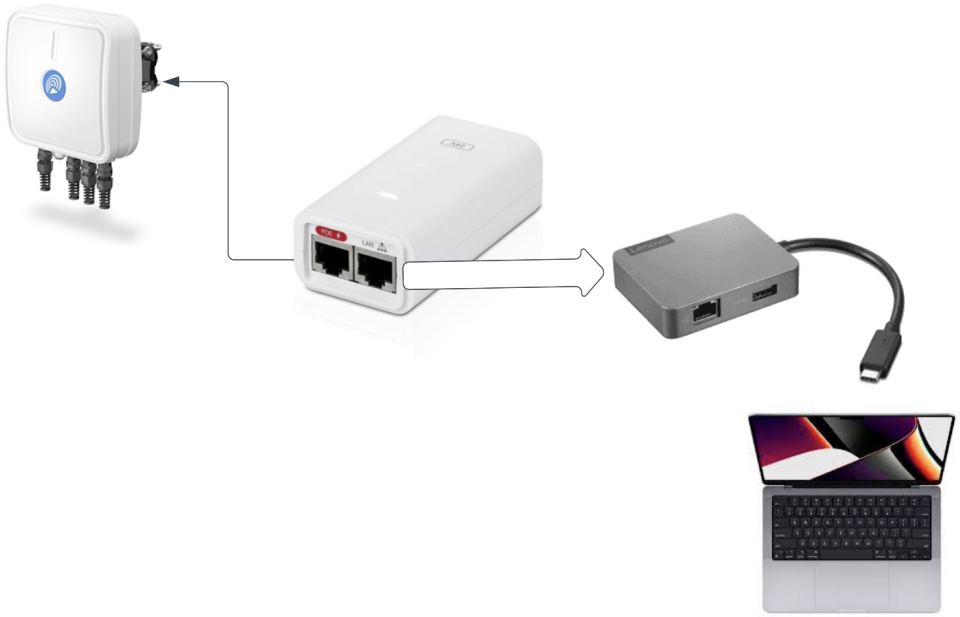
Make sure the uni-directional antenna is facing towards the nearest tower with the strong RSSI



Checking Signal Strength and Connectivity

Please use an Ethernet to USB converter so that you can connect to the cellular router locally on a computer.

Remove the ethernet cable connected to the non-red side of the white POE injector, and plug that into your computer.

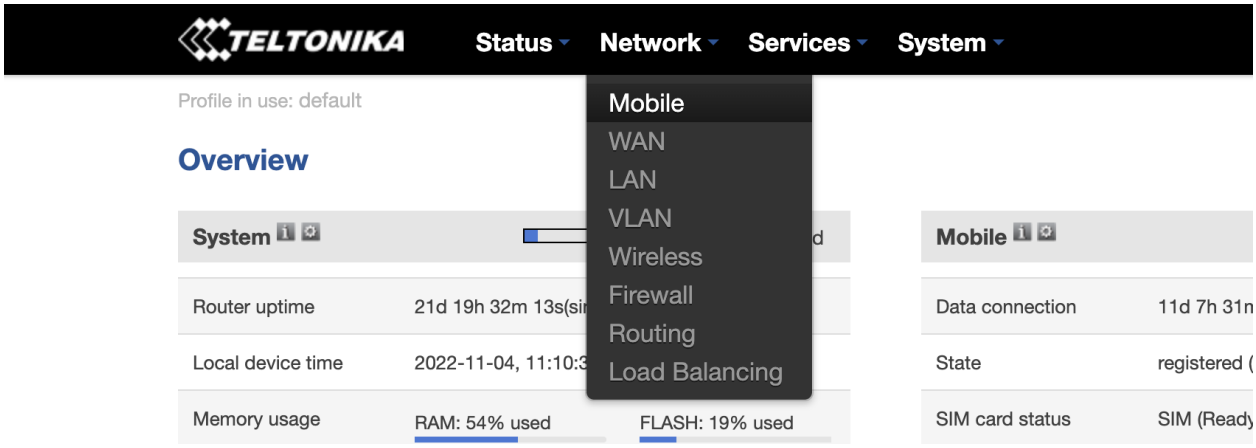


In a browser, connect to
192.168.1.1

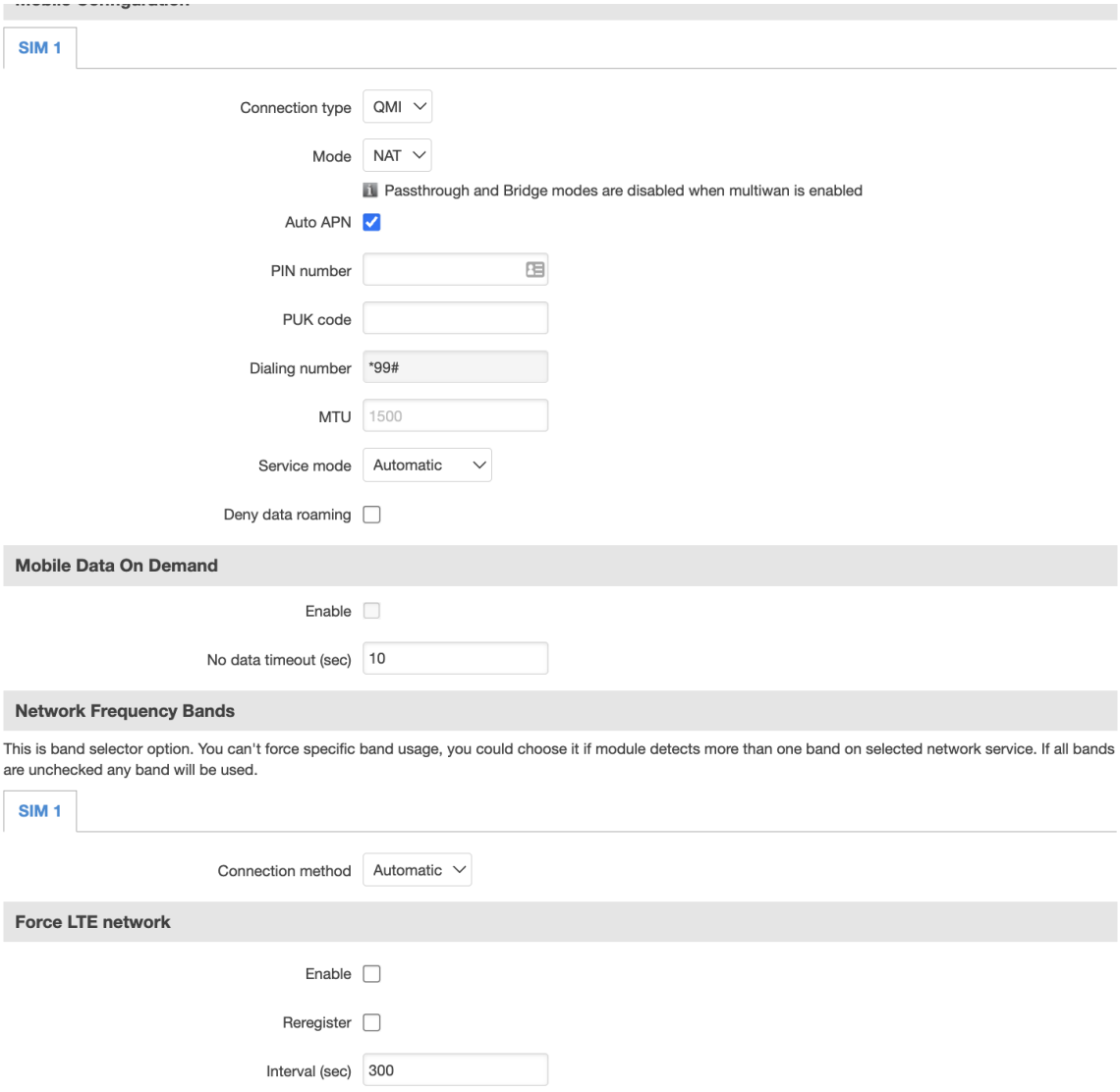
Router login

Username: admin
Password:
Please contact support@swiftlane.com to request the password
Connect to the IP address 192.168.1.1 in the browser.

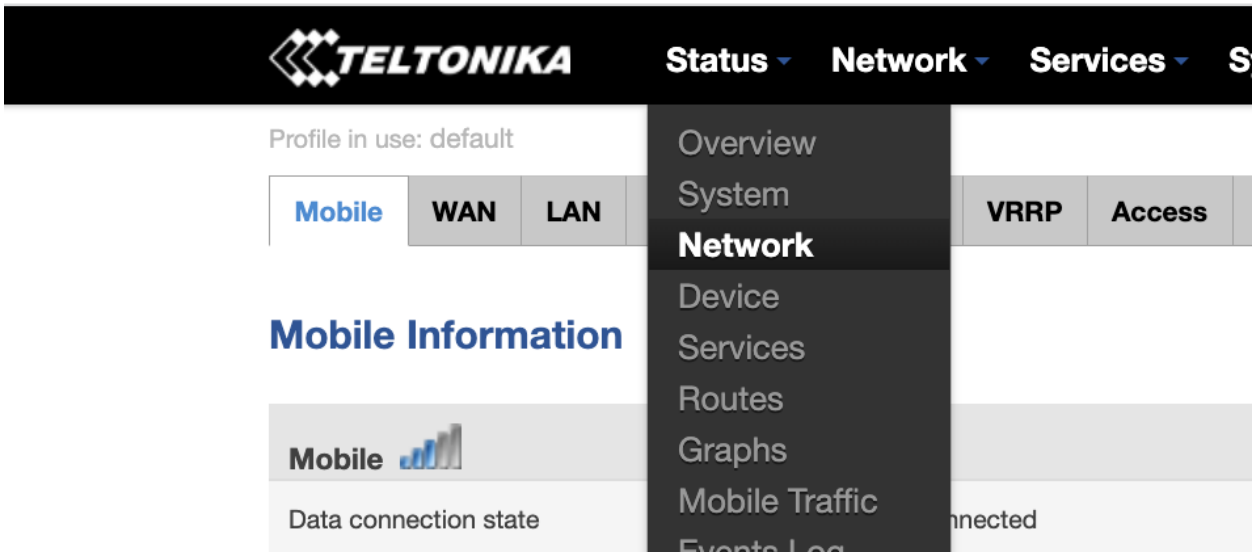
Go to network - mobile tab
Look under the section called “Network Frequency Bands” -> Connection Method



Set the “connection method” to automatic



This will restart the router. After a few min, you can log back in again and check this page
Go to Status -> Network
It wi



It will show you the signal strength and the “connected Band” in there.

Mobile

Data connection state	Connected
IMEI	861641044428356
IMSI	310410372155219
ICCID	89014103333721593297
Sim card state	Ready
Signal strength	-53 dBm
Cell ID	53967887
RSRP	-88 dBm
RSRQ	-14 dB
SINR	8.3 dB
Operator	AT&T
Operator state	Registered (home)
Connection type	4G (LTE)
Connected band	LTE BAND 12
Bytes received *	29.8 MB (31247792 bytes)
Bytes sent *	10.6 MB (11137907 bytes)

You can see the meaning of various signal strength indicators here https://wiki.teltonika-networks.com/view/Mobile_Signal_Strength_Recommendations#4G_(LTE)
The main indicators are

- RSSI - Received Signal Strength Indicator. RSSI is a negative value, and the closer to 0, the stronger the signal
- RSRP - the Reference Signal Received Power is the power of the LTE Reference Signals spread over the full bandwidth and narrowband
- RSRQ - Reference Signal Received Quality is a C/I type of measurement and it indicates the quality of the received reference signal (similar to EC/IO)
- SINR - Signal to Interference plus Noise Ratio (A minimum of -20 dB SINR is needed to detect RSRP/RSRQ). Indicates the throughput capacity of the channel. As the name implies, SINR is the strength of the signal divided by the strength of any interference

RSRP

RSRP	Signal strength	Description
>= -80 dBm	Excellent	Strong signal with maximum data speeds
-80 dBm to -90 dBm	Good	Strong signal with good data speeds
-90 dBm to -100 dBm	Fair to poor	Reliable data speeds may be attained, but marginal data with drop-outs is possible. When this value g performance will drop drastically
<= -100 dBm	No signal	Disconnection

RSRQ

RSRQ	Signal quality	Description
>= -10 dB	Excellent	Strong signal with maximum data speeds
-10 dB to -15 dB	Good	Strong signal with good data speeds
-15 dB to -20 dB	Fair to poor	Reliable data speeds may be attained, but marginal data with drop-outs is possible. When this value g performance will drop drastically
<= -20 dB	No signal	Disconnection

SINR

SINR	Signal strength	Description
>= 20 dB	Excellent	Strong signal with maximum data speeds
13 dB to 20 dB	Good	Strong signal with good data speeds
0 dB to 13 dB	Fair to poor	Reliable data speeds may be attained, but marginal data with drop-outs is possible. When this value g performance will drop drastically
<= 0 dB	No signal	Disconnection

RSSI for LTE is a calculated from several other signal related measurements: RSSI = wideband power = noise + serving cell power + interference power. For exa modem might report an RSSI of -68 dBm, but:

There are many different factors that influence signal strength and quality, including but not limited to:

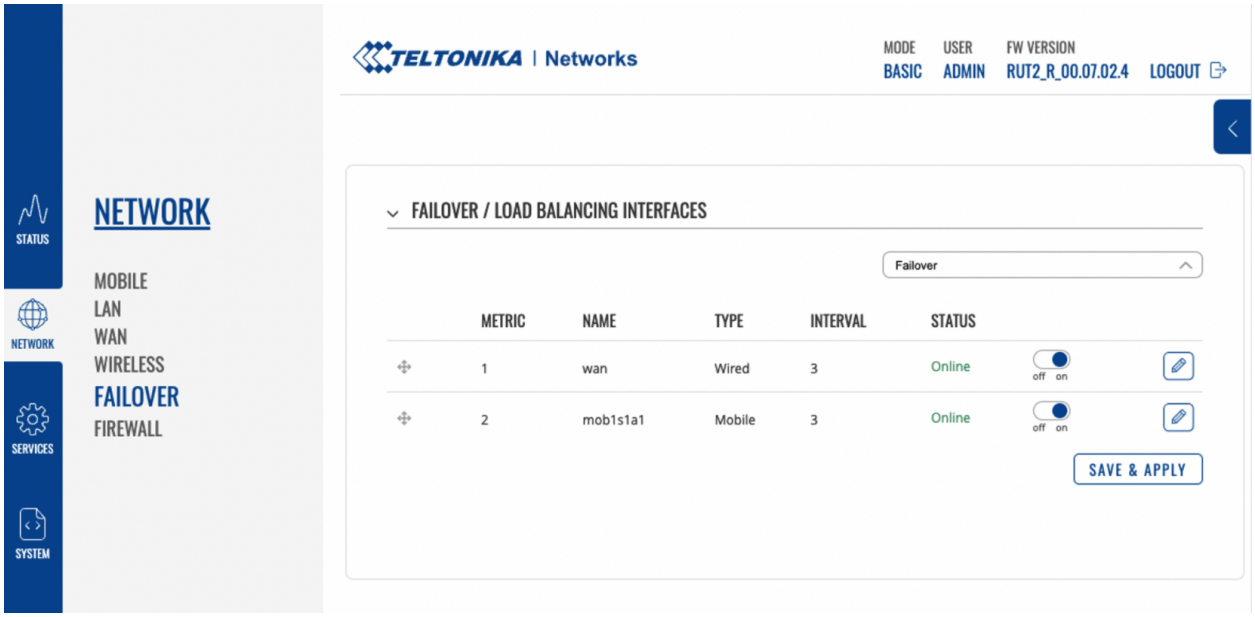
- Tower load

- Proximity to the cellular tower
- Signal going through a cellular repeater
- Competing signals
- Physical barriers (mountains, buildings, trains, etc.)
- Weather

Setting up cellular failover to the WAN (wired internet)

In order to ensure that the router is able to fallback to the cellular/mobile signal whenever the internet is down, make sure Failover is enabled in the router setting.

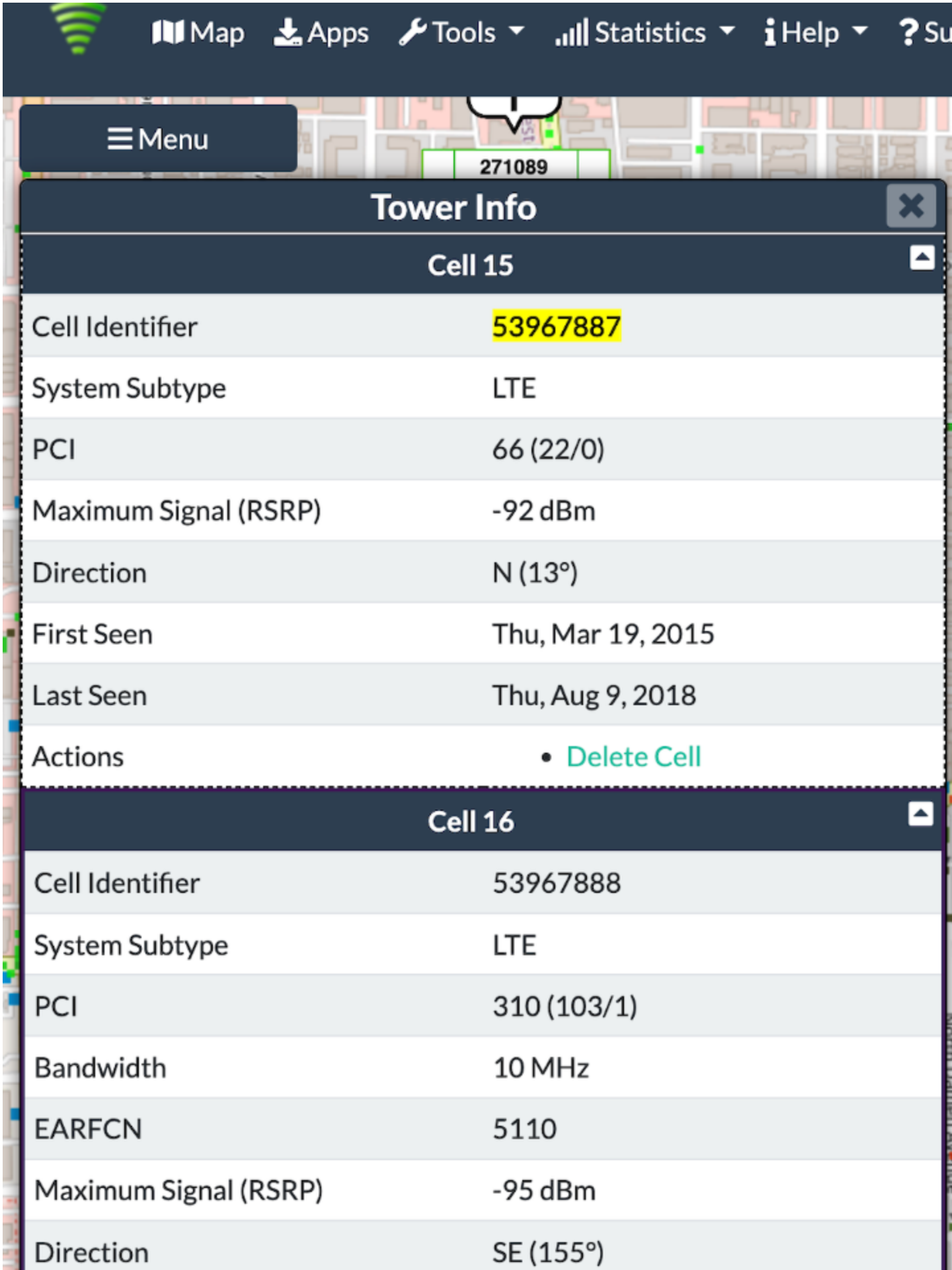
Go to Network -> Failover and then Toggle ON both both WAN and Mobile
The order of the records in this table matters as well. Please make sure to have WAN at the top, and Mobile at the second row. This means WAN would be primary and Mobile is a failover.



Antenna Location

Currently, the antenna is connecting to the tower to the south of the condo building. You can see the cell tower location with respect to the fargo condos. Our goal should be to tilt, the tower further south, and “refresh connection” from the System-> Network tab, and see

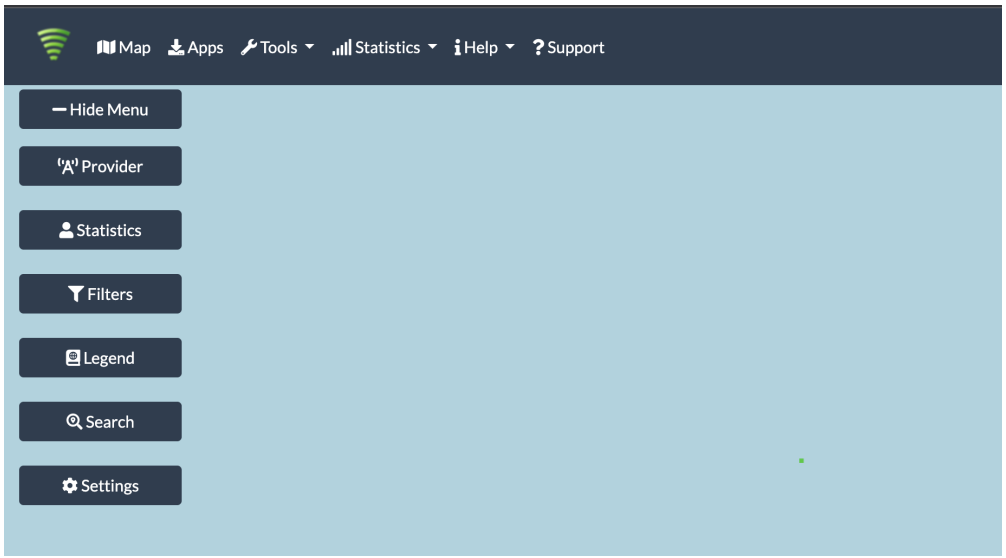
if the SINR, RSRP and RSRQ improve. Ideally, we can move the antenna to a south facing location, to further improve these metrics. If the SINR goes above 20 Dbm this will result in an excellent reliable signal long term. But it would be better even better at 15 or higher.


Map
Apps
Tools
Statistics
Help
Menu
271089
Tower Info
Cell 15
Cell Identifier
53967887
System Subtype
LTE
PCI
66 (22/0)
Maximum Signal (RSRP)
-92 dBm
Direction
N (13°)
First Seen
Thu, Mar 19, 2015
Last Seen
Thu, Aug 9, 2018
Actions
Delete Cell
Cell 16
Cell Identifier
53967888
System Subtype
LTE
PCI
310 (103/1)
Bandwidth
10 MHz
EARFCN
5110
Maximum Signal (RSRP)
-95 dBm
Direction
SE (155°)

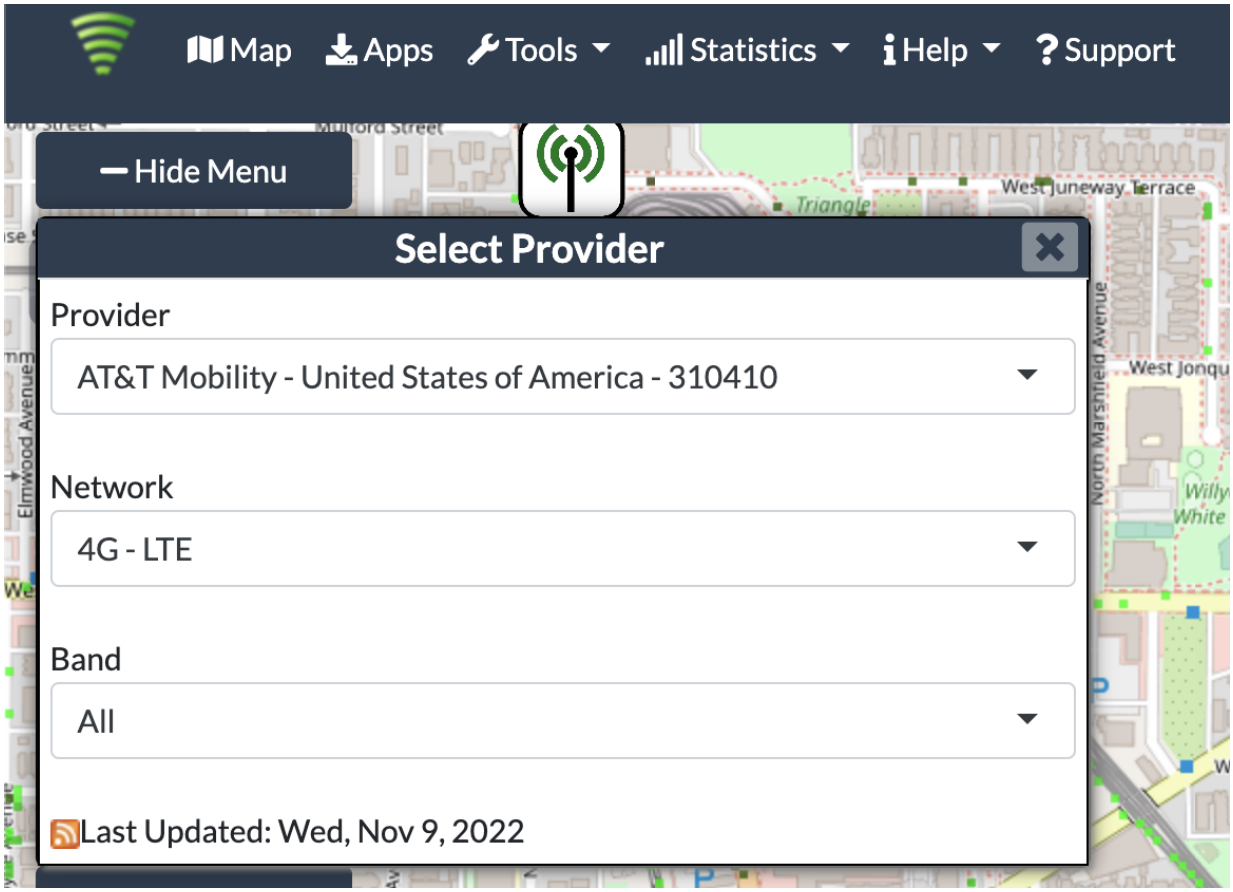
Cell ID	53967887
RSRP	-88 dBm
RSRQ	-14 dB
SINR	8.3 dB

Location of towers

Look up the address in cellmapper - 1442 West Fargo Avenue, Chicago, IL, USA
https://www.cellmapper.net/
Search for the address in there, using the Search option on the left side.



Make sure to filter the provider as AT&T Mobility and Network as 4G

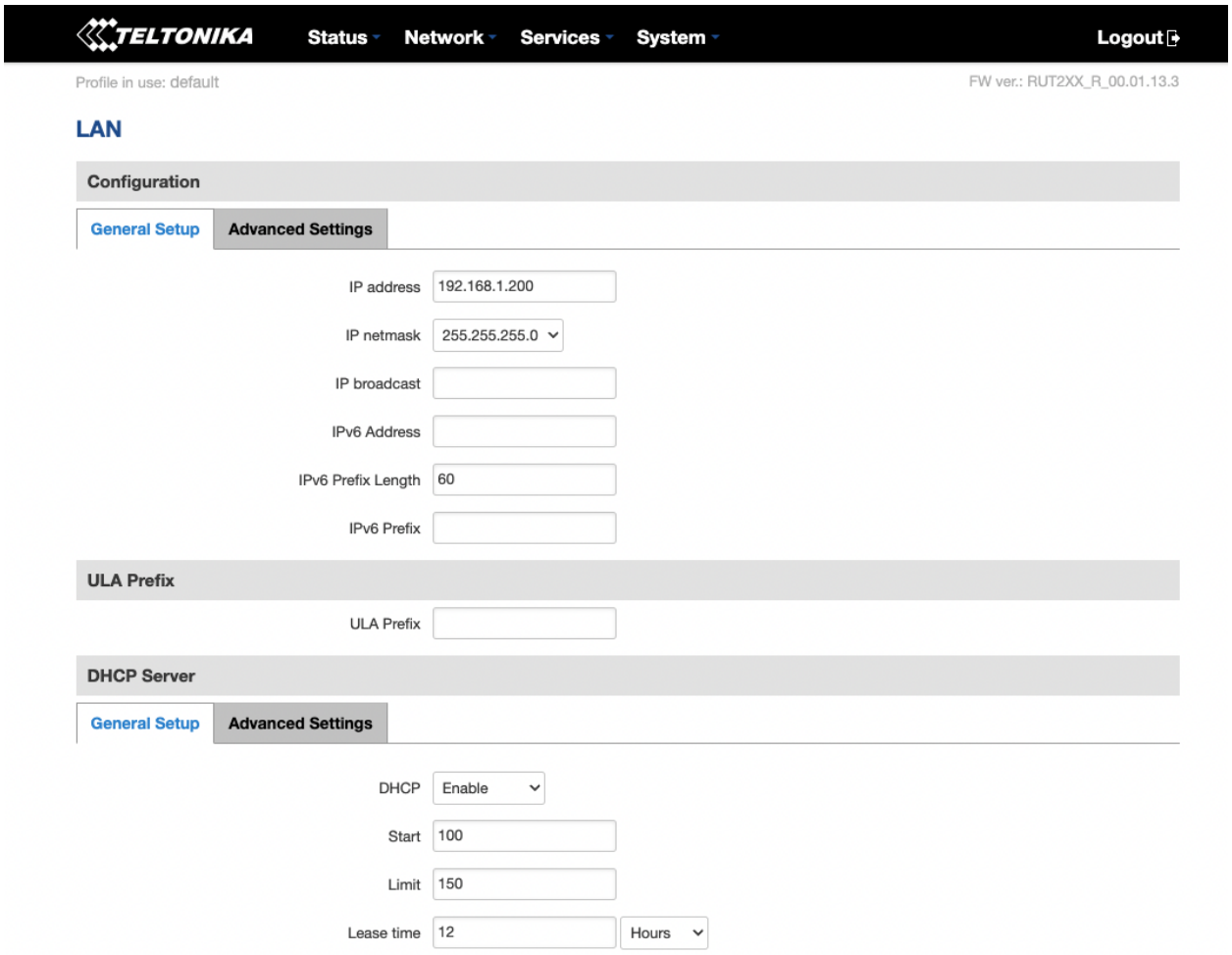


Debugging

Changing the static IP of the RUT240

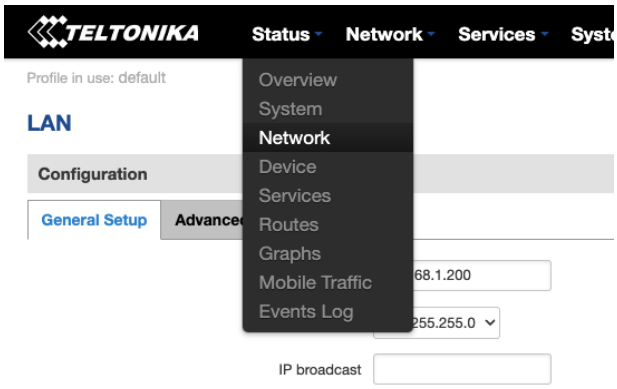
Sometimes, the main internet router and the RUT240 might have the same default IP address of 192.168.1.1 and this can cause the wired connection to keep failing. The installer can update the static IP of the RUT240 using these steps

The default IP address of the RUT240 is 192.168.1.1 . It that conflicts with the main wired router, you can manually change it under Network-> LAN



Checking what devices are connected to the router

Go to Network -> LAN. It will show the list of devices and their IP address



References

https://help.venntelecom.com/support/solutions/articles/44001931194-how-to-interpret-sinr-parameters-in-2g-3g-and-lte-routers-
Apps for finding cell tower location and signal strength - https://www.wilsonamplifiers.com/blog/finding-cell-tower-locations-the-complete-guide/