NEXTIVITY
Smarter by Design

Quatra 4000

Installation and User Guide

Rev Date: 2/9/2026

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About This Guide & Safety Information

About This Guide

There are a variety of CEL-FI QUATRA product variants available, supporting a variety of band configurations, for multiple regions. This manual is applicable to the CEL-FI QUATRA 4000 and 4000i ONLY and does not apply to any other QUATRA variants.

Safety Precautions

- Use CEL-FI QUATRA 4000 indoors. It should not be used outdoors.
- These products are designed to be used with the power supply unit that shipped with the Network Unit. When installing the equipment, all the requirements of the manufacturer and the referenced standards must be met.
- There are no user serviceable parts inside.

⚠ **Caution:** Changes or modifications to this product not expressly approved by Nextivity may void your right to operate the equipment.

1 | Introducing CEL-FI QUATRA 4000

Figure 1: CEL-FI QUATRA 4000

1.1 Understanding Cellular Coverage

Spotty cellular coverage, poor voice quality, dropped calls, and dead zones continue to plague occupants in buildings of all shapes and sizes. CEL-FI QUATRA solves that problem. It is an affordable, all-digital solution, providing uniform, high-quality cellular signals throughout a building. CEL-FI QUATRA is scalable to fit buildings of all sizes and is carrier approved and guaranteed network safe.

Unlike traditional analog boosters and passive DAS technology, QUATRA delivers a cellular signal that is up to 1000x stronger, utilizing CAT 5e (or better) cabling for the connection between the head end and each remote. The remotes are powered via Power over Ethernet (PoE), delivering an un-attenuated signal throughout the building. CEL-FI QUATRA can be installed in just days (compared to months typical of other solutions), and at a price point that meets the middle-market budgets.

1.2 The QUATRA Solution

While cellular networks are outside, the majority of calls take place inside. A recent study showed 80% of business users inside complain of poor coverage or dropped calls. Modern building materials, while improving energy efficiency, will block or inhibit cellular service from

the outside network. To exacerbate the issue, cellular coverage is increasingly critical. In fact, cellular coverage can be considered a safety or even regulatory requirement, depending on the region. Building owners need a flexible, high-quality solution. Installers and Value-Added Resellers need a product that can serve the majority of building types and not take months to deploy.

- CEL-FI created a new solution category that combines its core technology with the architecture of an Active DAS – to deliver an Active DAS Hybrid – carrier-grade but built for Installers.
- Integrators and Carriers have partnered with CEL-FI to deliver a smart solution designed for middleprise buildings - CEL-FI QUATRA solutions.
- CEL-FI provides the QUATRA BOM Estimator to help installers select the appropriate equipment in the right quantity, to eliminate the heavy cost/time of the (pre) planning effort.
- CEL-FI's all-digital, scalable, PoE Category cable-based solution makes it ideal for Single or Multi-Carrier environments.

Speed of Installation, higher quality in-building cellular solutions, and cost savings – are some of the reasons building owners, facility managers, and IT professionals are making the smart investment in CEL-FI QUATRA solutions.

A Solution Anyone Can Confidently Deploy

CEL-FI QUATRA is designed to improve indoor signal coverage without any risk of interference on the mobile network. CEL-FI QUATRA provides a sophisticated network-safe solution that has been rigorously tested globally, through multiple generations, engineered to deliver multiple levels of network protection:

- Uplink power control to prevent desensitizing the network
- Echo-cancellation and feedback control
- Uplink muting, when handsets (UE) are not detected
- Signal qualification (channels are individually qualified, so noise or very poor signals won't be amplified and degrade the network)
- The CEL-FI WAVE Platform cloud-based portal enables an operator to monitor equipment and network KPI's, such as channel configurations, RSRP, RSCP, SINR, and system gains, providing control and optimization insight.

2 | Regulatory & Compliance Reference

2.1 Comment About FCC Certification

There are two variants available for the Cel-Fi QUATRA 4000:

- CEL-FI QUATRA 4000
  - The QUATRA 4000 is FCC Part 20 certified. It supports bands 2, 4, 5, 12, 13 and 25
- CEL-FI QUATRA 4000i
  - The QUATRA 4000i is FCC Part 90 certified. It supports bands 2, 4, 5, 12, 13, 25, 26, 30, 41 and 71*

* Band 71 pending FCC approval

2.2 Regulatory Certifications

Model Number: CEL-FI QUATRA 4000

FCC Part 20 Certified

The QUATRA 4000 is FCC Part 20 certified.

This is a CONSUMER device. **FCC ID: YETQ44-1234CNU**

BEFORE USE, you **MUST REGISTER THIS DEVICE** with your wireless provider and have your provider's consent. Most wireless providers consent to the use of signal boosters. Some providers may not consent to the use of this device on their network. If you are unsure, contact your provider.

You **MUST** operate this device with approved antennas and cables as specified by the manufacturer. Antennas **MUST** be installed at least 20 cm (8 inches) from any person.

You **MUST** cease operating this device immediately if requested by the **FCC** or a licensed wireless service provider.

WARNING. E911 location information may not be provided or may be inaccurate for calls served by using this device.

Figure 2:

Bands Supported Under This FCC Certification

Carrier	Supported Band Combinations
AT&T	12 & 5 12 & 25 12 & 4 12 & 2
Sprint	5 & 25

Carrier	Supported Band Combinations
	5 & 2
T-Mobile	25 & 4 25 & 12 4 & 12 2 & 4 2 & 12
Verizon	13 & 25 13 & 4 13 & 2

Model Number: CEL-FI QUATRA 4000i

FCC Part 90 Certified

The QUATRA 4000i is FCC Part 90 certified.

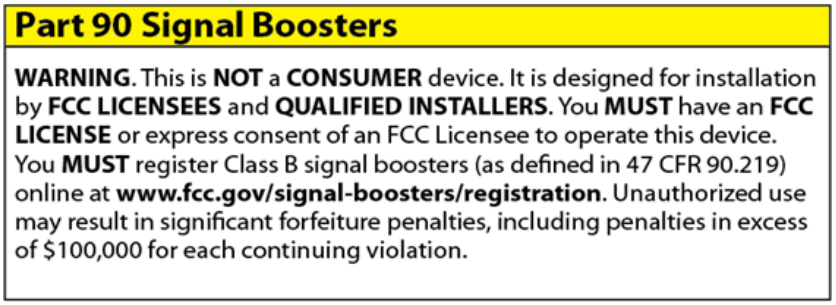


Figure 3: FCC Part 90 Signal Booster Regulatory Notice

Bands Supported Under This FCC Certification

Carrier	Supported Band Combinations
AT&T	12 & 5; 12 & 25; 12 & 4; 12 & 2; 30 & 5; 30 & 25; 30 & 4; 30 & 2
Sprint	5 & 25; 5 & 2; 26 & 25; 26 & 2; 41 & 26; 41 & 25; 41 & 2; 41 & 5
T-Mobile	25 & 4; 25 & 12; 4 & 12; 4 & 71; 25 & 71; 2 & 4; 2 & 12; 2 & 71
Verizon	13 & 25; 13 & 4; 13 & 2

3 | System Architecture & Operation

3.1 System Overview

How Does It Work?

CEL-FI QUATRA 4000 is a powerful cellular signal distribution solution. CEL-FI QUATRA 4000 is fundamentally comprised of a Network Unit (NU) and up to six (6) Coverage Units (per NU). The Network Unit takes the donor input from up to four (4) carrier signal sources. The signal source can be off-air (over-the-air (OTA) from the macro network or delivered via a small cell.

The NU receives and individually processes channels from each carrier, allowing a higher gain for weaker channels (up to 100 dB). The channels are digitized and sent over a pair of Ethernet cables to each CU for retransmission through one or more service antennas.

The system may also be used with one QUATRA 4000 FIBER HUB, which functions much like an NU with up to six (6) additional CUs. The HUB is connected to the NU with up to 2km of optical fiber cable and SFP+ Modules (sold separately), and it uses donor signals from the connected NU.

Architecture Overview

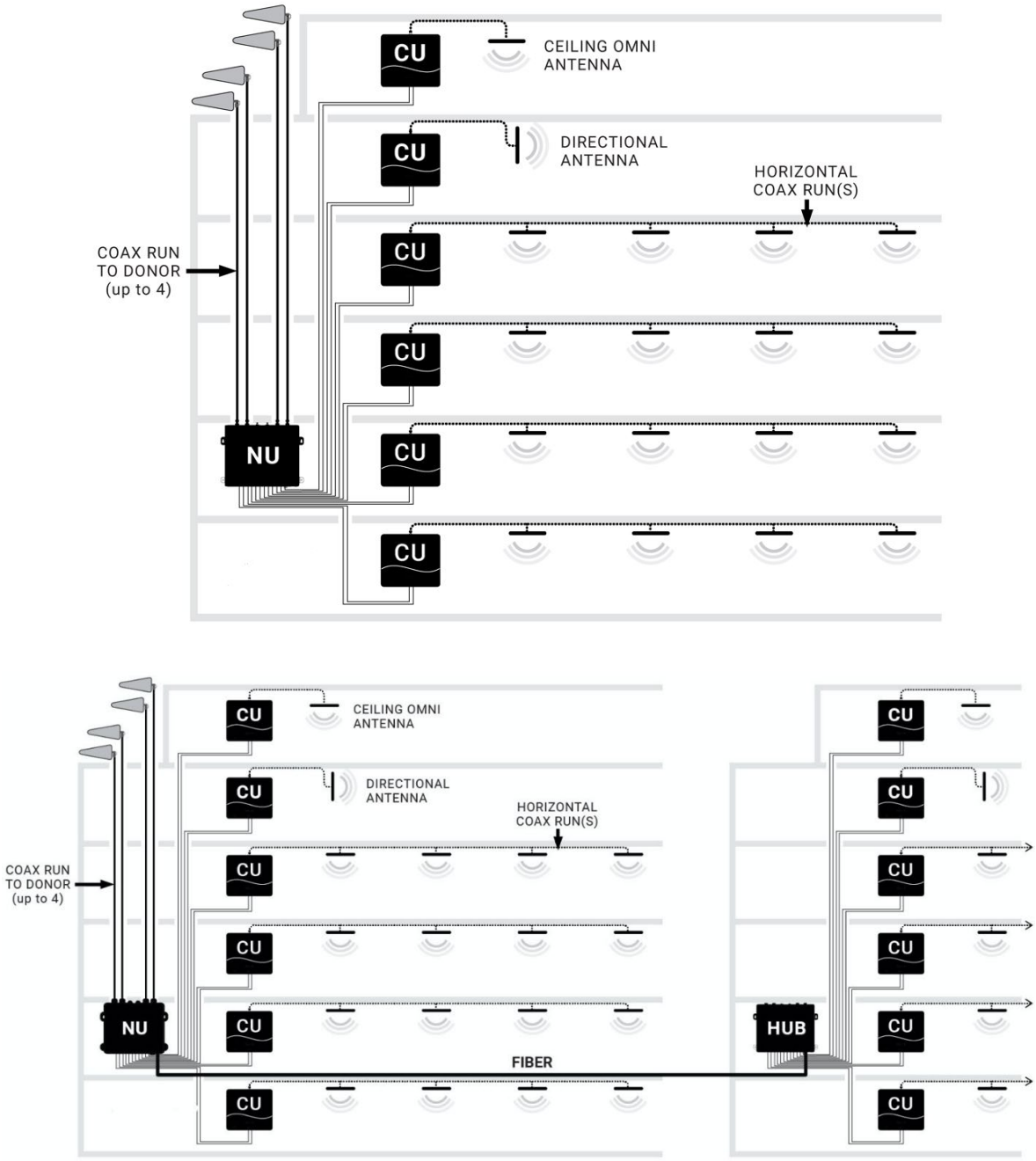


Figure 4: QUATRA 4000 System Architecture Overview (NU–CU and Fiber HUB Deployments)

3.2 Real-World Examples

1. Off Air Install, 75K ft2 building

In this example, CEL-FI QUATRA is providing cellular coverage for four carriers in a six story 75,000 ft2 building. Individual LPDA antennas are located on the top of the building to ensure the best signal-to-noise ratio for all four carriers. Four coax cables are pulled through the roof to Network Unit. A Coverage Unit is placed on each floor, and a distributed antenna system (DAS) field is run out from each CU to provide great coverage.

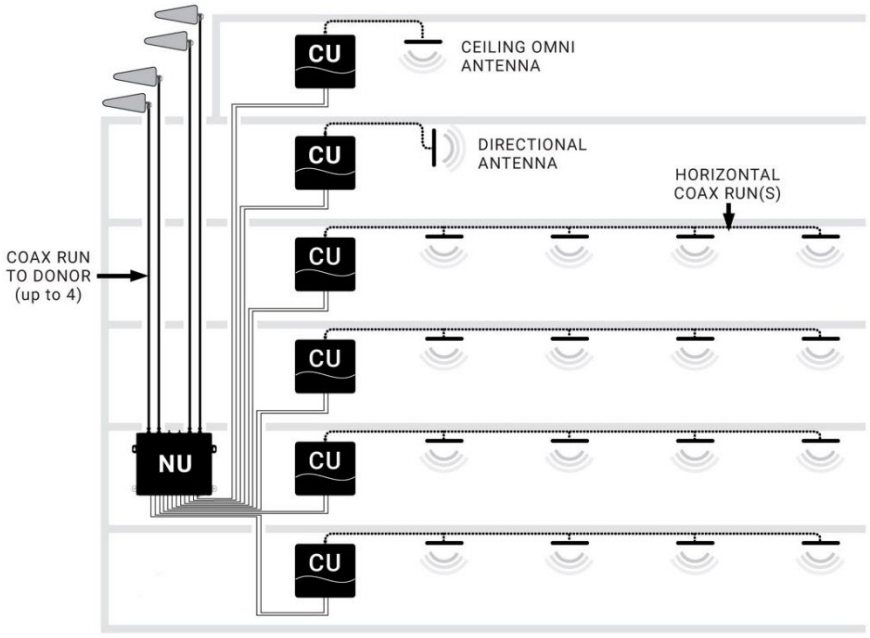


Figure 5: Off-Air QUATRA 4000 Deployment Example – Approx. 75,000 ft² Building

2. Supercell Install, 300K ft2 building

This building did not have adequate donor signals for the four Operators, so small cells were chosen as the signal sources. The system is comprised of four (4) QUATRA 4000 systems served with one small cell from each wireless operator. The small cell signals are split and input to each QUATRA 4000 NU. From the QUATRA 4000 NU the signals are distributed to CUs on each floor and then horizontally to a DAS field, providing coverage to the building.

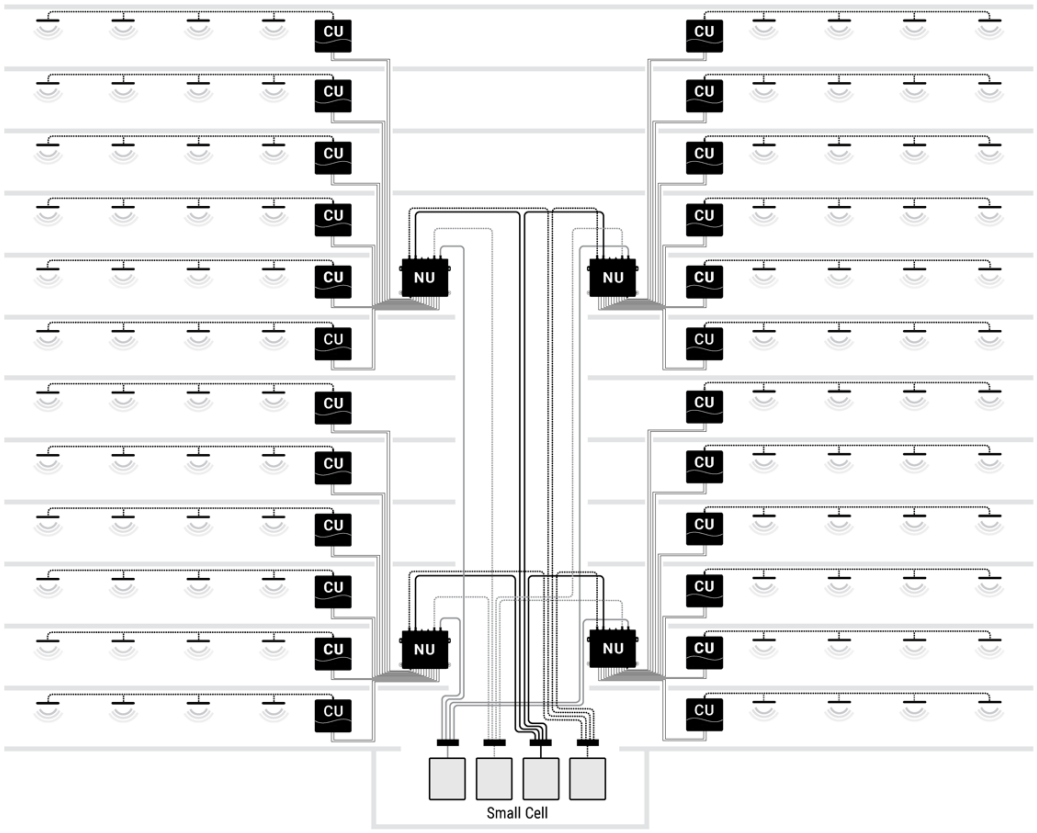


Figure 6: Supercell QUATRA 4000 Deployment Example – Approx. 300,000 ft² Building

3. Hybrid Install, Off-Air + Small Cell

In this example, the building site has excellent (exterior) network service for two carriers, but the other two carriers' outside signals are very poor. The System Integrator has decided to use a hybrid approach, taking off-air signals from the two carriers with good service and implementing small cells for the two remaining carriers.

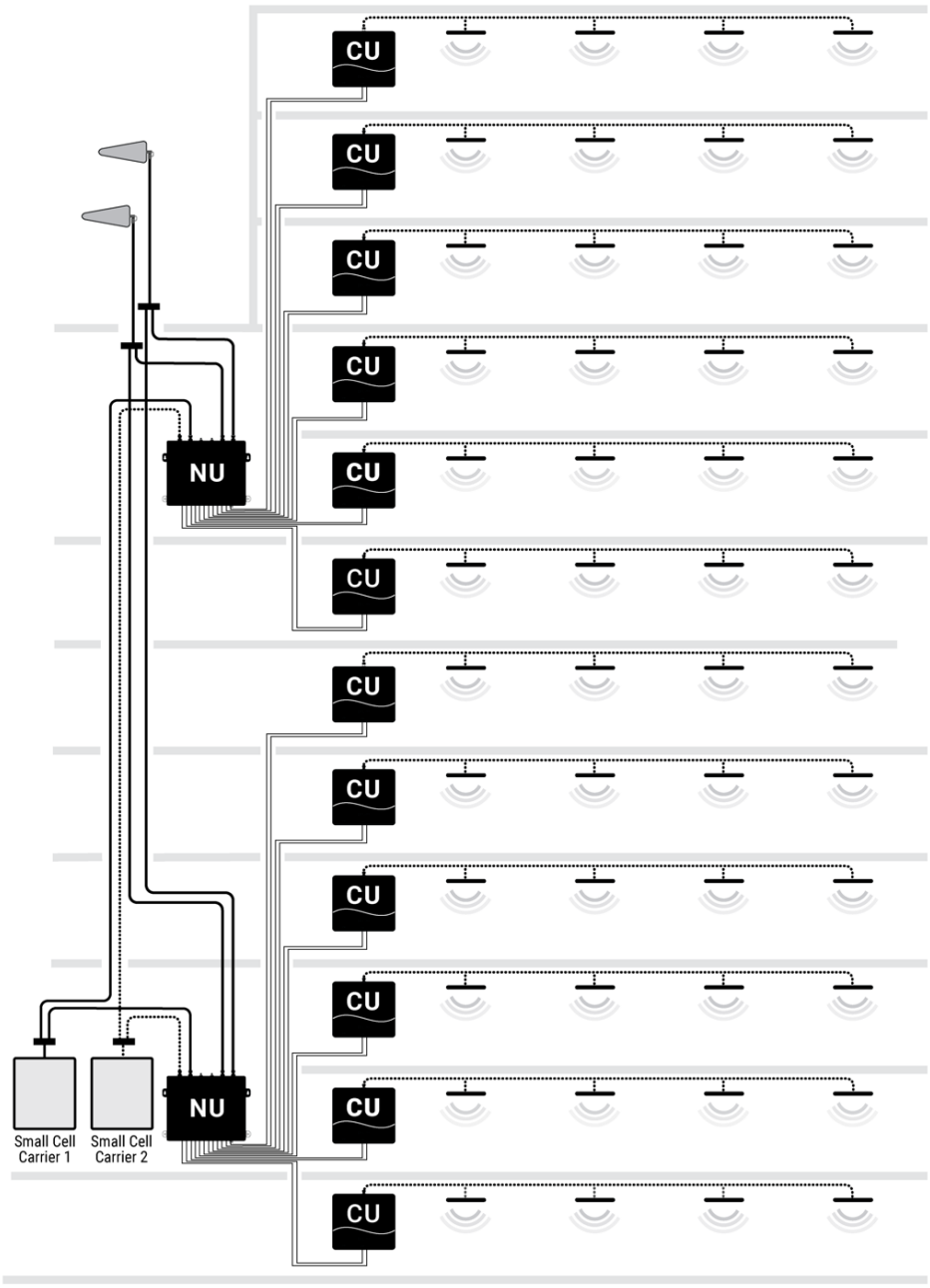


Figure 7: Hybrid QUATRA 4000 Deployment Example – Off-Air and Small Cell Donor Sources

3.3 Key System Features

- Carrier-grade, FCC-certified smart signal booster
- Supports AT&T, Verizon, T-Mobile, and Sprint
- Simultaneously relays two (2) bands per operator
- Independent donor ports for each operator, enabling individual antenna optimization
- Single combined Coverage Unit (CU) server port capable of driving either a serving antenna or a passive DAS field
- Up to 100 dB maximum system gain
- 140 MHz total relay bandwidth

Coverage and Scalability

- Supports up to six (6) Coverage Units (CUs), or up to twelve (12) CUs when used with a HUB
- Supports NU-to-CU cable distances up to:
  - 100 m using Cat5e cabling
  - 150 m using 22/23 AWG CAT6/7 cabling
- QUATRA Range Extender (QRE) doubles supported CU cable distance, up to 300 m

Hardware and Connectivity

- N-type RF connectors for both donor and server connections
- Internal modem with SIM slot for remote management
- Industrial, powder-coated aluminum housing

Power Specifications

- 20–22 dBm uplink power per operator per band
- 16 dBm downlink power per operator per band

4 | Hardware Components

4.1 Overview

CEL-FI QUATRA 4000 is a modular solution with two (2) foundational components: the Network Unit (NU) and the Coverage Unit (CU). In traditional DAS terminology these could be known as the Head End (NU) and the Remote Unit (CU).

Power is provided to the entire system through AC power at the NU. The CUs are powered via Power over Ethernet (PoE), and therefore do not require a separate power source at their location. Signal source is brought into the system at the NU, via a wired connection, like a small cell, or through a donor antenna and an RF connection.

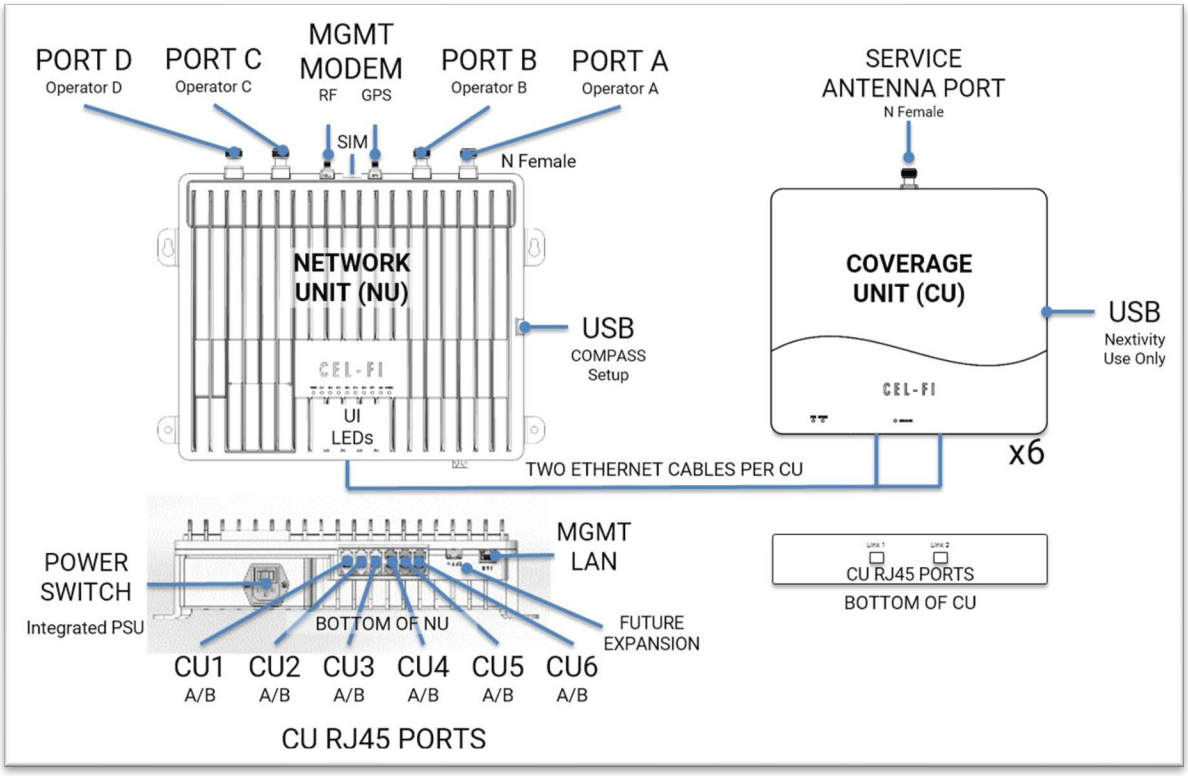


Figure 8: QUATRA 4000 Network Unit (NU) and Coverage Unit (CU) – Port Layout and Interconnections

4.2 Quatra 4000 Network Unit (NU)

The Network Unit, referred to as the **NU**, is the **head end for the QUATRA 4000 system**. The signal sources (one for each port/carrier) are connected to the NU. Then they are digitized and distributed over two Category "Ethernet" cables to the Coverage Units (CU).

Figure 9: QUATRA 4000 Network Unit (NU)

➲ **Note:** Only cellular signals may be connected to the donor ports. Other types of radio signals will not work, and may damage the system.

The NU has four (4) N-type RF ports on the top. Each RF port is assigned, and marked, to a specific carrier.

There are two (2) SMA-female ports on the top of the NU. One functions as the external antenna connection for the unit's internal cellular modem, and the other is for GPS. (The GPS port is for future functionality)

Power

- AC Power Supply (inside the NU)
- AC power cord

Physical Interface

- RJ45 ports (13)
  - Twelve RJ45 ports (2 for each of the 6 CUs)
  - One LAN port for remote management
- SFP+ module dock (for use with a Fiber HUB)
- N-type Female RF Ports (4) for Donor Antennas
  - One for each carrier
- SMA ports (2 for the internal LTE modem)

User Interface

LED interface (front) to indicate system status. (For detail on the LED go to LEDs.)

- Power
- CU1
- CU2
- CU3
- CU4
- CU5
- CU6
- SFP+
- LAN
- MODEM

Power Supply Cable

The QUATRA 4000 system is powered from the Network Unit (NU). The NU comes with a power cord that plugs in to the back of the unit. The Coverage Units (CU) are Powered-over-Ethernet (PoE) and therefore do not have independent power supplies that need to be plugged in.

The entire system should be installed before the system is powered-on.

Figure 10: QUATRA 4000 Network Unit (NU) Power Supply Cable

➲ **Note:** It is recommended to zip-tie or otherwise secure the power cord once the system is powered-up, to prevent accidental unplugging.

4.3 Quatra 4000 Coverage Unit (CU)

The Coverage Unit (CU) receives the digitized cellular signal from the NU, converts back to RF, amplifies, and distributes the service from its RF port. Service can be deployed through a single connected antenna, or through a DAS field.

Figure 11: Quatra 4000 Coverage Unit (CU)

The Coverage Unit includes a multi-band blade style antenna that can be connected directly to the CU.

Figure 12: QUATRA 4000 Coverage Unit

CEL-FI Blade Antenna

Accessories

QUATRA 4000 FIBER HUB
Model Number: Q40-1234FNU

The HUB functions much like an NU, except it does not have donor antenna ports. It connects to an NU over optical fiber cable (up to 2km) using SFP+ modules, and it adds up to six more CUs to an NU (twelve CUs total).

Figure 13: CEL-FI Blade Antenna (Direct-Mount Server Antenna)

QUATRA 4000 FIBER HUB

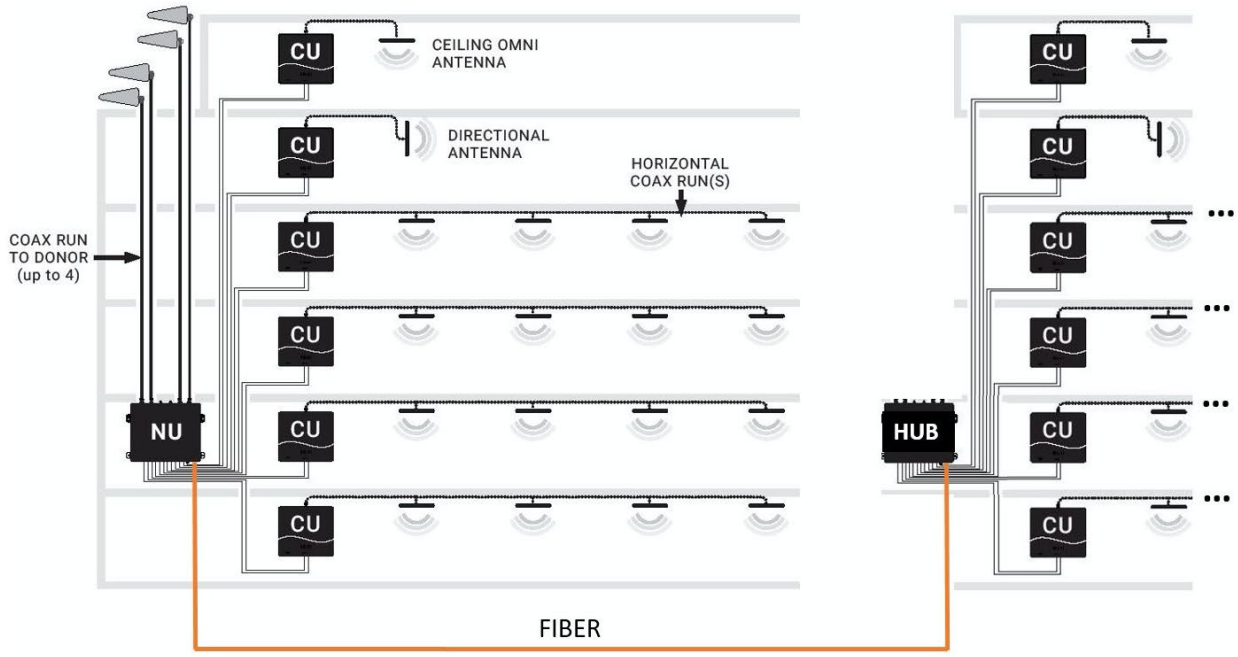


Figure 14: QUATRA 4000 Fiber HUB Deployment Example

QUATRA 4000 Range Extender (QRE4K)

Model Number: Q40-OE

The QRE-4K unit is a device that extends the standard 100-meter cable length from NU to CU up to 200 meters with Cat5e, or up to 300m if CAT6/7, 23AWG cable is used. It is inserted in-line between the NU and CU and requires no external power. The RJ45 connectors are on each side (two per side). Traditional Ethernet extenders will not work with QUATRA.

Figure 15: QUATRA 4000 Range Extender (QRE-4K)

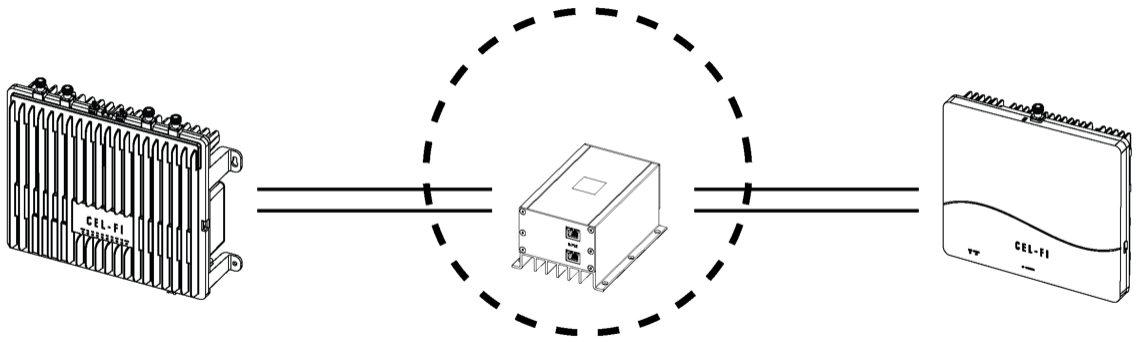


Figure 16: QRE-4K Installed Inline Between Network Unit and Coverage Unit

The donor antennas are used to provide off-air signals to individual carrier donor input ports. The objective is to provide the best quality carrier signals to the NU. A variety of donor antennas are available from Nextivity. The right donor antenna choice can make the difference between a good outcome and a great outcome. Please refer to other antenna-specific documents for choosing the right donor antenna.

CEL-FI LPDA-R Antenna

Model Number: A62-V44-200

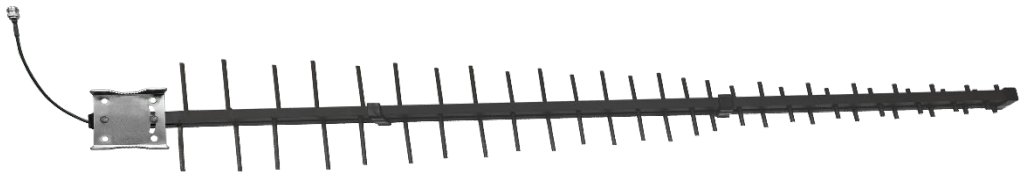


Figure 17: CEL-FI LPDA-R Antenna

Nextivity recommends its LPDA-R antenna for use as a great donor antenna for most situations. Learn more about our Antenna options.

Server Antenna

The server antenna connects to the RF port on the CU.

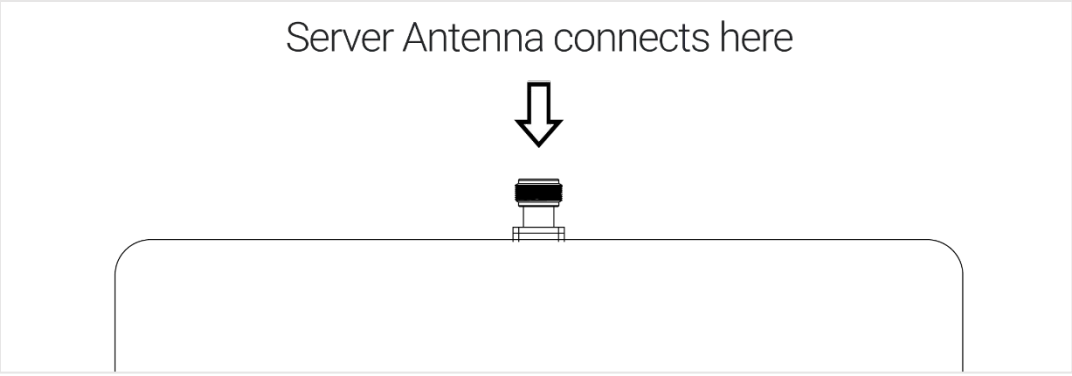


Figure 18: Server Antenna Connection Point on the Coverage Unit (CU)

Server Antenna port

A variety of Server antennas are available from Nextivity. Visit the Antenna Product page for details and updates.

Couplers

RF couplers or tappers may be used with Coverage Units when multiple service antennas are desired. Careful system design should be implemented to ensure sufficient power levels into all antennas.

5 | Antennas and RF Design Considerations

5.1 Overview

This section provides guidance on antenna roles, donor signal sources, and RF considerations that directly impact QUATRA 4000 system performance. Proper donor signal quality, antenna selection, and placement are critical to achieving optimal coverage, voice quality, and data throughput.

For step-by-step installation instructions, see Section 7.3, Installing Coverage Units (CU).

5.2 Donor Signal Sources

The QUATRA 4000 has four independent RF ports for connecting the donor signal. Each port:

- Is an N-type Female connector
- Is specific to the supported operator
- Is designed to support a variety of band configurations

Each RF port can be fed by a donor signal consisting of either a small cell or an antenna. Nextivity offers a number of donor signals perfect for use with CEL-FI QUATRA 4000.

➲ **Note:** Small cell inputs and off-air inputs can be used in the same system, but not for the same donor port.

5.3 Donor Antennas (Off-Air Sources)

The donor antenna is used to collect the external (over-the-air) carrier signal and deliver it to the NU.

Key considerations:

- Higher-quality donor signals result in improved customer experience, including better voice quality and higher data throughput.
- A signal-to-noise ratio (SINR) greater than 0 dB is strongly recommended for each carrier's source signal.
- Better SINR generally results in better system performance.

Each donor antenna should:

- Be mounted securely in a location with access to the desired cellular network
- Be connected to the appropriate NU donor port using coaxial cable

5.4 Small Cell Donor Sources

If a small cell is used as the donor source then it should be connected at this time. The input signal level for the donor port should be between -60 and -50 dBm.

Requirements:

- The small cell must be fully operational in standalone mode prior to connection.
- Recommended donor input level is –60 dBm to –50 dBm.

➲ **Note:** Verify small cell operation before connecting it to the QUATRA 4000 system.

5.5 Server Antennas (Indoor Coverage)

Server antennas are connected to the Coverage Unit (CU) and are responsible for distributing signal within the building.

- Each CU provides a single N-type female RF output port.
- An omni-directional antenna is included with each CU.
- Alternatively, a coaxial cable may be connected to feed a passive distributed antenna system (DAS).

Server antenna selection and placement should align with the desired indoor coverage pattern and building layout.

6 | Antenna Kitting & Approved Options

The QUATRA 4000 and 4000i are designed to be used with the following antennas.

6.1 Donor Antennas

1. LPDA Antenna

Model Number: A62-V44-100

Figure 19: LPDA Antenna

The CEL-FI LPDA Antenna offers a powerful 12 or 14dBi gain (depending on carrier frequency) over 698-2700 MHz and is designed to reduce out of band noise, to improve SiNR and overall signal quality. Mounting is made simple with a mast down-tilt bracket and U-Bolts. This enables you to mount the antenna on a flat surface or a pole. A 45-degree mount attachment enables the antenna to be mounted at a tilt, for optimal matching of macro donor signals.

- Suitable for all mobile carriers
- 5G-ready
- Comes with mast down-tilt bracket and U-Bolt mounts
- Includes 27 cm RG58 Cable N-type Female connector
- Fully welded construction

➲ **Note:** Use the LPDA-R Antenna (A62-V44-200) if you require Band 71 (617MHz+).

2. LPDA-R Antenna

Model Number: A62-V44-200

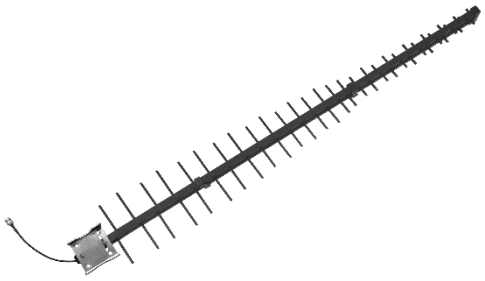


Figure 20: LPDA-R Antenna

The CEL-FI LPDA-R Antenna offers a powerful 12 to 14 dBi gain (depending on carrier frequency) over 617–4000 MHz and is designed to reduce out of band noise, to improve SiNR and overall signal quality. Mounting is made simple with included U-Bolts. This CEL-FI product also features a 10K ohm resistor that enables the antenna connection to be validated by CEL-FI Network Units equipped with the capability.

- 12–14 dBi gain
- 5G-ready
- Narrow beam-width to reduce noise
- Rugged construction for harsh environments
- Includes a 10K ohm resistor for special CEL-FI applications

3. CEL-FI Wideband Directional Antenna

Model Number: A32-V32-100/101

The CEL-FI Wideband Directional Antenna is an outdoor vertically polarized highly directional antenna for Cellular Boosters; with 10 dB gain in the low bands and 11 dB gain in the high bands. The weather resistant housing is built with UV stabilized ABS plastic casing. Optimized for CEL-FI products, the CEL-FI Wideband Directional Antenna works great with the CEL-FI WAVE Antenna positioning app. The unit includes standard brackets for mounting, and can also be used with the CEL-FI Pole Mount.

- Boosts Cell Signal by up to 11 dBi
- 5G-ready
- 700 – 2700 MHz Frequency
- Vertical Polarization
- Uni-Directional

6.2 Server Antennas

1. Indoor Omni Antenna

Model Number: A11-V43-100/101

Figure 21: Indoor Omni Antenna (Model A11-V43-100/101)

The Indoor Omni Antenna receives and transmits signal in a 360° pattern and are compatible with the 698 - 2700 MHz frequency ranges that include 3G and 4G signals. They come with an SMA Male Connector.

- 3G/4G/LTE wideband cellular antenna
- SMA-male connector
- Omni-directional

➲ **Note:** -101 part number includes an N-type connector

2. (Low-Profile) LP SISO Indoor Omni Antenna

Model Number: A11-H43-201

Figure 22: Antenna – A11-H43-201

Nextivity's CEL-FI LP SISO Indoor Omni Antenna provides a 360-degree horizontal coverage pattern in an ultra-modern, low-profile, high performance industrial design.

- Indoor use

- 5G-ready
- SISO
- 50 ohm
- 617–4000 MHz
- N-type connector (other options available)
- Ultra low-profile

6.3 Advanced Information - Antennas and QUATRA 4000

Donor Antennas

Donor Signals

A good donor signal, arriving as cleanly as possible, to the NU, is perhaps the most important consideration in driving the best experiences and outcomes with QUATRA 4000.

With regard to 4G LTE, there are two metrics of particular importance to monitor and optimize:

1. RSRP – Reference Signal Reference Signal Receive Power

- It is the power of the LTE Reference Signals spread over the full bandwidth and narrowband. A minimum of -20 dB SINR (of the S-Synch channel) is needed to detect RSRP/RSRQ.
- In the context of CEL-FI QUATRA 4000, the following stratification of quality is recognized:

RSRP	Signal Strength
> -90 dBm	Excellent
-90 dBm to -105 dBm	Good
-106 dBm to -120 dBm	Fair
< -120 dBm	Poor

Figure 23: RSRP Signal Strength Classification

2. SINR – Signal to Noise Ratio

- The SINR is the ratio of the usable (desired) signal over the noise. The following metrics should be used when assessing SINR in the context of CEL-FI QUATRA 4000.

SINR Value	Throughput
> 10	Excellent
6 to 10	Good
0 to 5	Fair
< 0	Poor

Figure 24: SINR Quality and Throughput Classification

Antenna Selection

There are a few considerations to make when determining the donor antenna.

1. How many serving sites? If there are multiple serving sites, and the design goal is to select a specific site, for loading, or any other reason, then directional antenna would be required. If there is a single donor site, and not much RF contention, than an omni-directional antenna could be considered, which would save a little time and energy in the install process, as it would not need to be aimed.
2. How much noise? If the site location is very noisy, then a strong directional antenna would be a good choice, as it will filter out some of the unwanted signal.
3. How strong is the serving signal? Although CEL-FI QUATRA 4000 has the highest gain of any antenna in its class, if the serving signal is extremely weak, then a high-gain antenna may be required to connect the uplink calls and to get the optimal DL power on the serving side.

Grounding and Lightning Protection

Installers of CEL-FI QUATRA 4000 are encouraged to follow the lightning protection guidelines documented in the National Electrical Code (NEC) and NFPA 780, and/or local codes.

Server Antennas

The QUATRA 4000 Coverage Unit has a single RF output port in the form of an N-type female connector on the top of the unit. A single whip or blade-style antenna can be attached directly, or a distributed antenna system can be deployed.

Antenna Selection

There are two types of indoor antenna to choose from:

1. **Omni-directional dome antennas** broadcast and receive signals from all sides. They are designed for central locations with 360º coverage requirement. Like outdoor antennas, their power is measured by their “gain”. They are typically mounted to a ceiling for best results.
   - Nextivity has standard dome antennas and also offers ‘low-profile’ server antennas that are thin and occupy less visual space.
2. **Panel antennas are directional antennas**. Panel antennas allow optimum reception to targeted areas. Like with outdoor antennas, a directional antenna is stronger than an omnidirectional antenna which means the signals it broadcasts are stronger. It can be mounted to either the wall or ceiling. We usually recommend placing it on the ceiling for maximum coverage but in some spaces (like a long narrow hallway) the panel antenna can be placed on the wall.
   - Nextivity has a few different panel antenna options, with different levels of gain and directivity.

MIMO vs SISO

MIMO (multiple in, multiple out) antennas have multiple feeds and typically more than one coaxial (pigtail) cable or connector. Therefore, a MIMO antenna should only be used with a system that supports MIMO. (CEL-FI QUATRA 1000 supports MIMO.)

A SISO (single in, single out) antenna has a single coaxial (pigtail) cable feed and/or connector and works best with SISO systems. CEL-FI QUATRA 4000 is a SISO system.

Coverage Unit Mounting Options and Physical Considerations

For standard CU installation instructions, see Section 7.3, Installing Coverage Units (CU).

Drop Ceiling Mounting (Coverage Unit)

The QUATRA 4000 Coverage Unit is fitted with two ¼”-20 inserts in the center of the bottom side of the unit. This is designed to mate perfectly with standard drop-ceiling infrastructure components. The mounting bracket also has four (4) ¼”-20 threaded inserts which can be similarly used. A variety of mounting methods can be employed through the integration of off-the-shelf accessories.

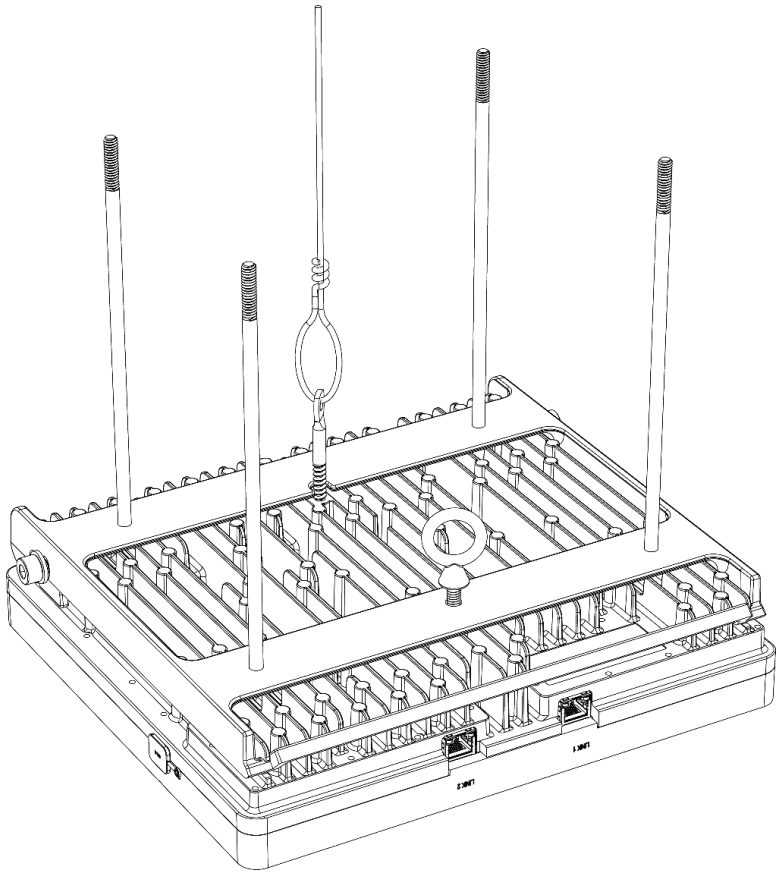


Figure 25: Coverage Unit (CU) Drop Ceiling Mounting Interface

➲ **Note:** The CEL-FI QUATRA 4000 Coverage Unit is plenum rated.

7 | Installation Procedures

> **Important:** Before any permanent installation, make sure all the components are planned and accounted for, as well as any wiring, cabling, power, mounting, antenna placements, and system access.

7.1 Overview

Several things need to be determined as part of installation planning and preparation.

- Perform indoor and outdoor signal surveys to understand current signal problems and to assess candidate donor antenna locations
- Determine where the NU(s) will be mounted
  - Ensure adequate power source (outlet)
  - Determine donor signal sources and cabling/routing
  - Ensure access to the Category cable runs, connecting to the CU(s)
- Determine where the CU(s) will be mounted and how coverage is to be distributed
  - Determine if the (included) Mini Panel Antenna will be used or a DAS field, for each CU
  - If coaxial cable and antennas are planned for use then that should be considered at this point

Note: IBWAVE (or other RF planning tools) designs are not required but are a good way to ensure the best performance outcomes.

7.2 Installing the NU

Mounting

The CEL-FI QUATRA NU is designed for simple wall mounting. Mounting accessories, including screws and anchors, for common material types (drywall, plywood, etc.) are included with each NU.

Equipment Required for Mounting

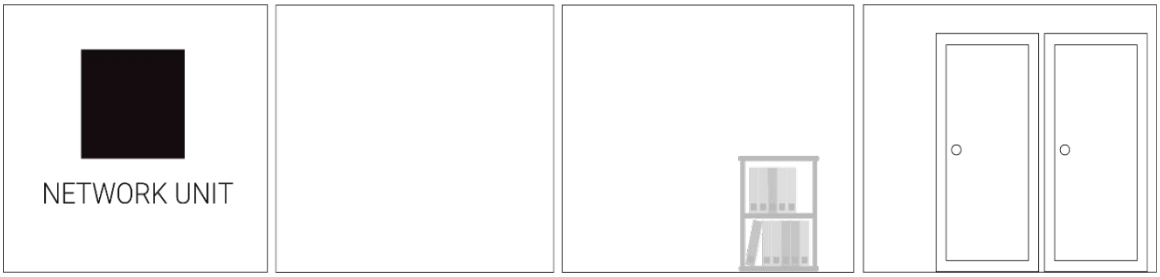
- Drill
- Drill bit extender (3”+)
- Hammer
- Pencil, or other similar marker
- Level

⚠ **Caution:** Make sure the area behind any surface is free of electrical wires or other dangerous elements prior to drilling.

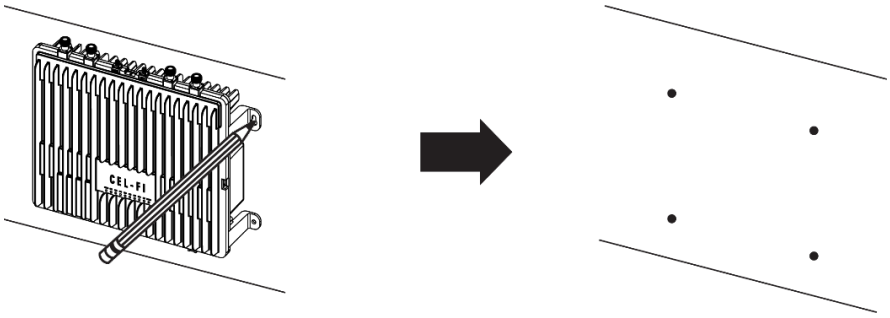
The QUATRA 4000 NU has four (4) secure mounting tabs, two on each side. The two topmost tabs have been keyholed.

➲ **Note:** The Mounting Instructions below use the standard drywall mounting anchors and screws included with the unit. If the NU is to be mounted onto other surfaces, make sure the appropriate anchors and screws are used (not included).

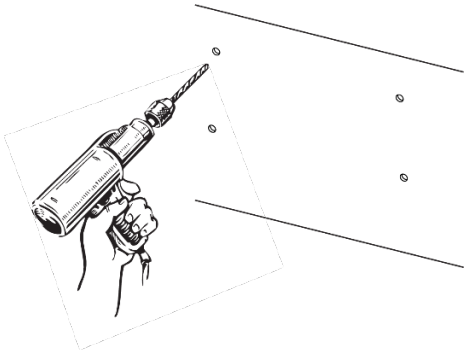
3. To mount the NU, first determine the approximate location on the wall for the unit.



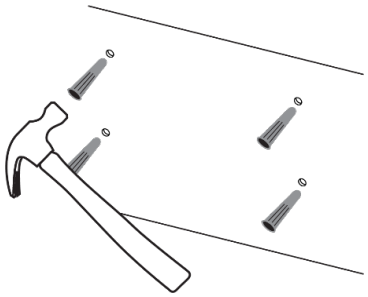
4. Hold the unit up on the wall and, using a pencil or similar marker, mark one of the top (right or left) points.



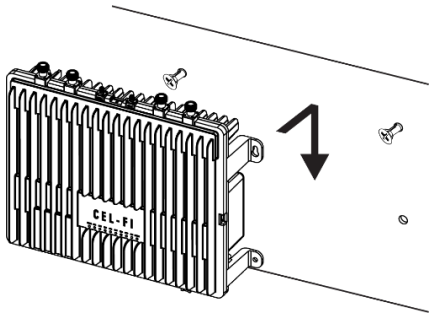
5. Drill the holes for the anchors.



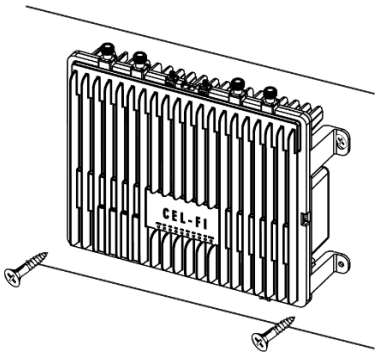
6. Hammer in the anchors.



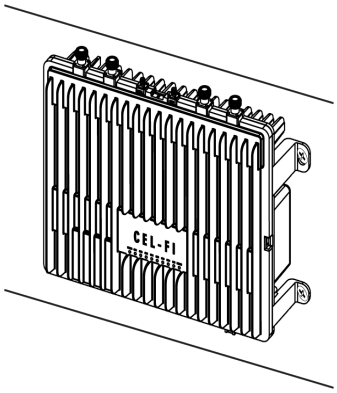
7. Partially screw in the top two screws.
8. Hang the unit from the top two screws, through the eyeholes. Adjust the unit to level and then tighten the screws.



9. Screw in the bottom two screws.



10. Mounting is complete.



7.3 Installing Coverage Units (CU)

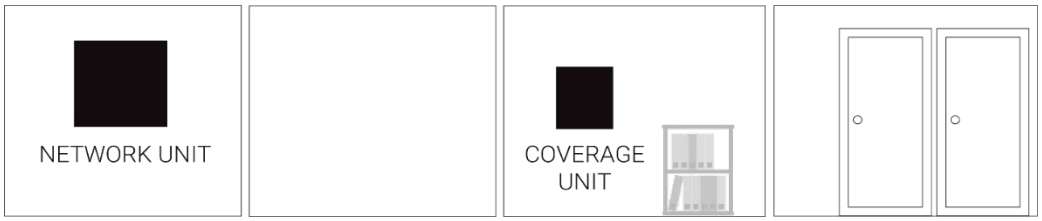
Wall Mounting

The Coverage Unit (CU) comes with a wall mounting bracket in the box. To mount the QUATRA 4000 CU simply follow these steps:

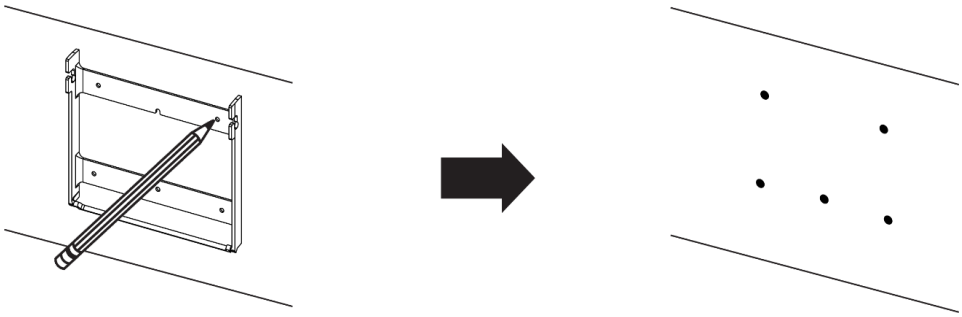
1. Determine mounting location.

   ➲ **Note:** Whenever mounting any CEL-FI gear on a wall or ceiling make sure the area is free of any dangerous electrical wires, other safety hazards, or any other objects that could be damaged or affect the quality or stability of the mounted unit.

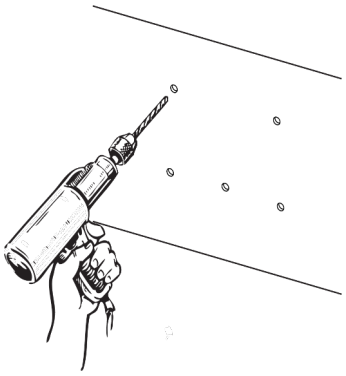
2. Position the QUATRA 4000 CU wall mount on the wall in the desired mounting location.



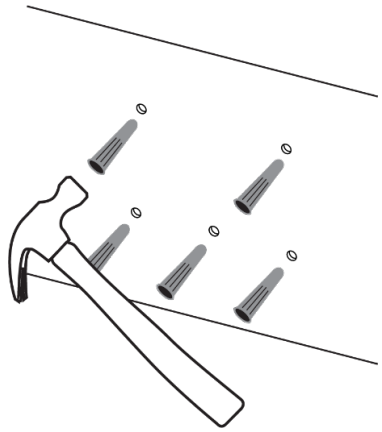
3. Holding the mounting bracket in place, mark hole locations with a pencil.



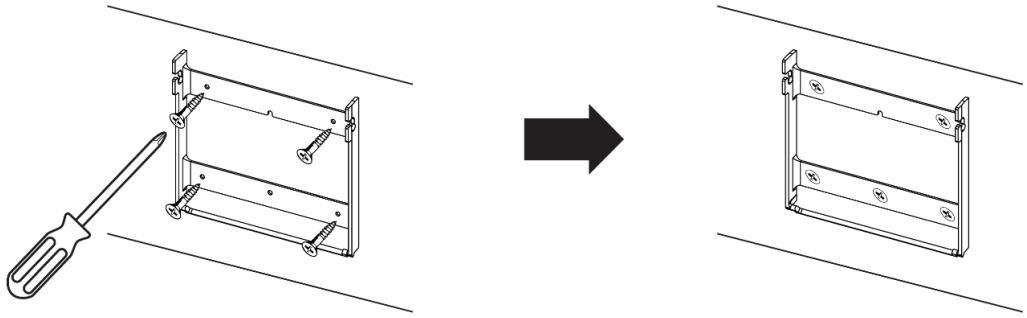
4. Drill the holes.



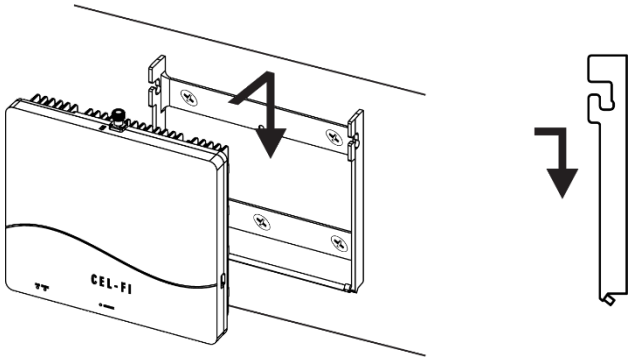
5. Hammer in the anchors.



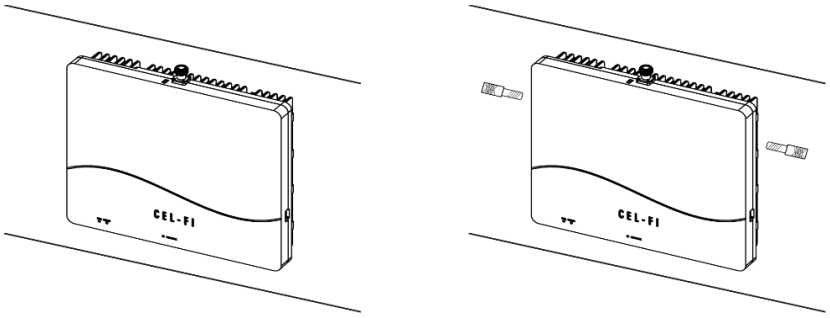
6. Attach the bracket to the wall with the included screws.



7. Once the bracket is firmly attached to the wall, the CU can be attached to the bracket.
8. With the bracket in place, attach the CU.



9. Tighten (finger) each Locking Screw into place to ensure the CU is securely attached. The CU may also be mounted to many surfaces with appropriate Unistrut hardware.



7.4 NU-to-CU Connectivity and Distance Considerations

Each Coverage Unit (CU) connects to the Network Unit (NU) using two Ethernet cables (Cat5e or better).

Using a QUATRA Range Extender (QRE-4K)

If NU-to-CU cable distances exceed:

- 100 meters (or 150 meters when using 22/23 AWG CAT6/7 cable), a QUATRA 4000 Range Extender (QRE-4K) may be installed mid-span to extend the total distance up to 300 meters.

Notes:

- Only the QUATRA 4000 Range Extender (QRE-4K) is supported.
- QRE units from QUATRA 1000 or QUATRA 2000 systems are not compatible.

Connecting Server Antenna(s)

The CU has an N-type connector on the top of the unit for attaching an antenna. An Omni-directional antenna is included with each CU, or a coaxial cable can be connected with a series of passive antennas attached.

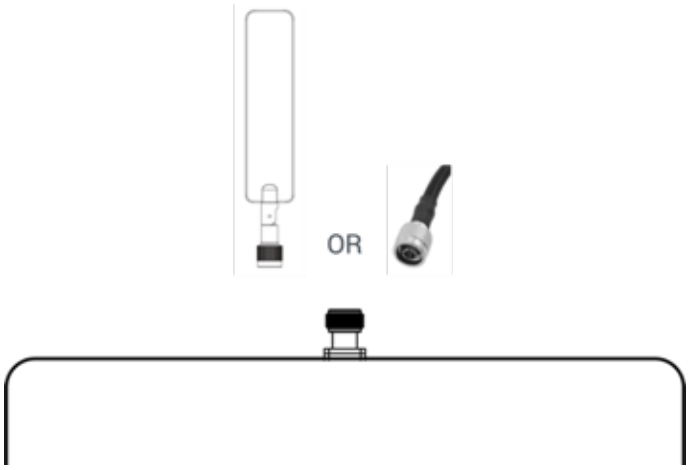


Figure 26: Connecting Server Antenna or Cable

Connecting NU and CU

Each CU connects to the NU using two Ethernet cables (Cat5e or better).

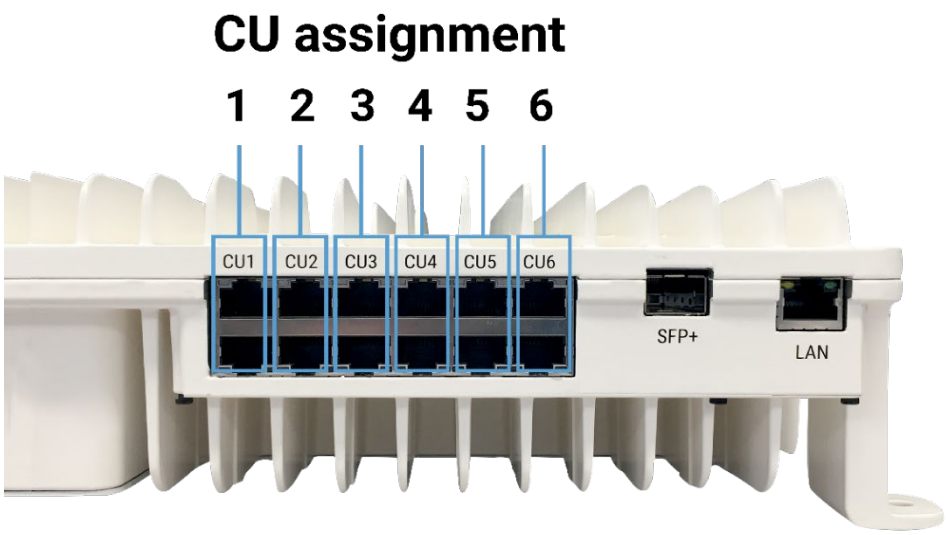


Figure 27: CU port assignment on the NU.

Using a QRE

If cable distances greater than 100 meters from NU to CU are required (150m if using 22/23 AWG CAT6/7 cable), a QUATRA RANGE EXTENDER (QRE-4K) may be used in the middle of the cable run to achieve lengths up to 300m.

➲ **Note:** Only the QUATRA 4000 RANGE EXTENDER (QRE-4K) may be used. The QUATRA 1000 and QUATRA 2000 QRE is not compatible with the QUATRA 4000.

8 | System Configuration & WAVE Portal

8.1 The WAVE Portal

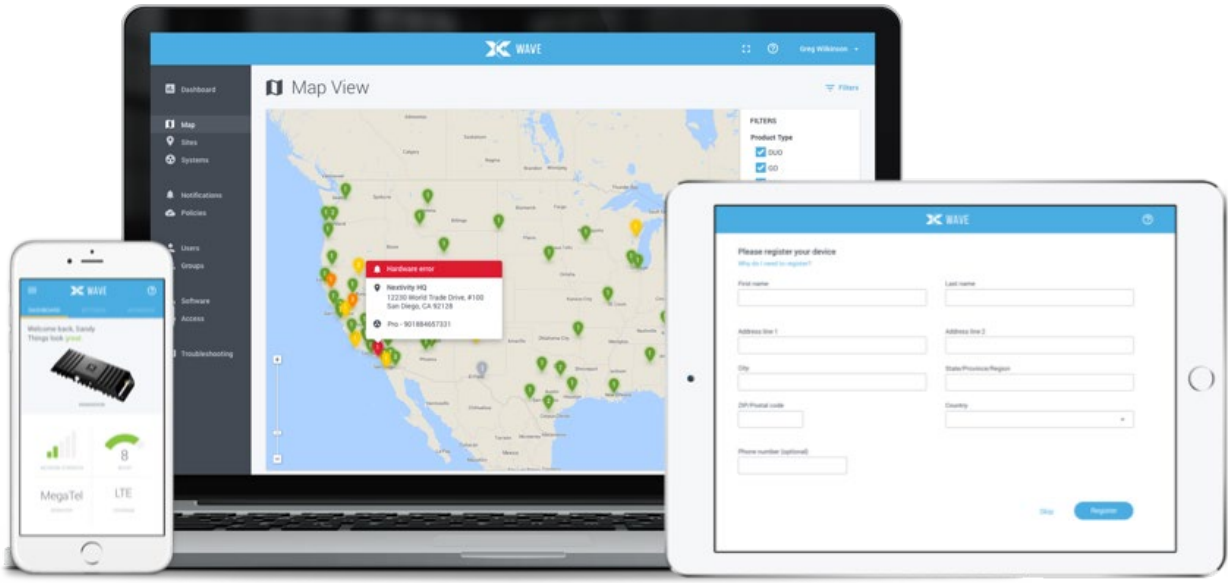


Figure 28: CEL-FI WAVE Platform

Introduction

CEL-FI WAVE is Nextivity's SOC2 Type 1 compliant cloud-based software platform from which CEL-FI apps and connected capabilities are hosted and driven. Current-generation CEL-FI products feature embedded connectivity that allows them to connect to the WAVE cloud. The WAVE portal and apps are used to facilitate software updates, registration, commissioning, installation, optimization, and troubleshooting. The CEL-FI WAVE platform continues to expand in features and function.

In order to use the WAVE portal and related capabilities, **you must be registered with the system**.

- Request access to the WAVE Portal
- Login to the WAVE Portal

Setup LAN Firewall Connection to the WAVE Portal

Verify that a live LAN Ethernet cable is connected to the Network Unit LAN port (not the LAN OUT port which is used to daisy-chain to another Network Unit LAN port). Check the LAN firewall settings to the cloud.

- Learn More about LAN Firewall Settings

User Profiles

User profiles are created in the Wave Portal. User Profile is where individual account information is stored, as well as any Group assignments.

The Main Alarms

The WAVE Portal provides visibility into system alarms and status. Detailed alarm definitions and corrective actions are provided in Section 11, Troubleshooting.

9 | Diagnostics, Testing & Optimization

9.1 Diagnostics and Testing

WAVE PRO and COMPASS

Introduction

CEL-FI COMPASS is a hand-held battery-operated device specifically designed to simplify the installation of all QUATRA variants, without the need for an Internet connection to the WAVE Portal in the cloud.

Notes:

- The WAVE Portal is a very powerful and time-saving system. Nextivity highly recommends that you still connect your QUATRA systems to the Internet for WAVE Portal remote management, alarms, and diagnostics.
- COMPASS has **its own User Manual**. Included here are only those items that relate specifically to the QUATRA 4000.

Figure 29: QR Code for WAVE PRO

9.2 Installer Diagnostic and Optimization Tools (WAVE Pro & COMPASS)

Overview

When it's not possible to open a LAN connection between a CEL-FI QUATRA Network Unit (the NU) and the CEL-FI WAVE Portal, these features will help installers set up CEL-FI systems quickly and efficiently. While complete provisioning and optimization using the WAVE Portal is preferred, we understand that it's not always possible.

➲ **Note:** Many features in the WAVE Portal are not available when using this tool. These include Commissioning, Operator Configuration, feature settings such as “disable software updates” and access to key performance data used in remote management.

Updating QUATRA Software

From time to time, the QUATRA 4000 firmware will be updated for feature improvements and bug fixes.

Updating QUATRA 4000 firmware can be accomplished in either of two ways:

1. **Using WAVE PRO**
   - Launch the WAVE PRO app.
   - Connect the LAN port on the QUATRA’s NU to an active Ethernet LAN.
   - Initiate the update from the Systems page Options menu.
     - The unit will update its firmware automatically, communicating with Nextivity’s cloud.
2. **Using COMPASS**
   - Update the COMPASS’ software by connecting it to an active Internet connection.
   - Connect the COMPASS to the QUATRA NU and follow the instructions on the WAVE PRO app.

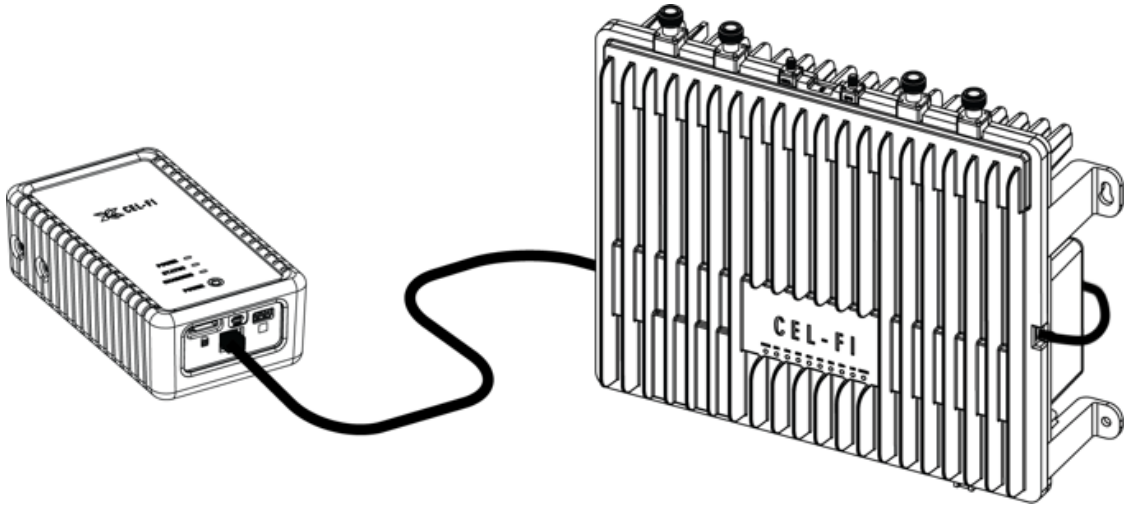


Figure 30: COMPASS connected to CEL-FI QUATRA 4000

Band Settings

1. All CEL-FI QUATRA variants will select bands and channels to relay automatically.
2. Optionally, bands may be enabled/disabled using the Bands Settings feature using COMPASS and the WAVE Pro app.
   - From the main menu, tap on “**Bands Settings**”

- Select the band preference and then tap "**Update**"

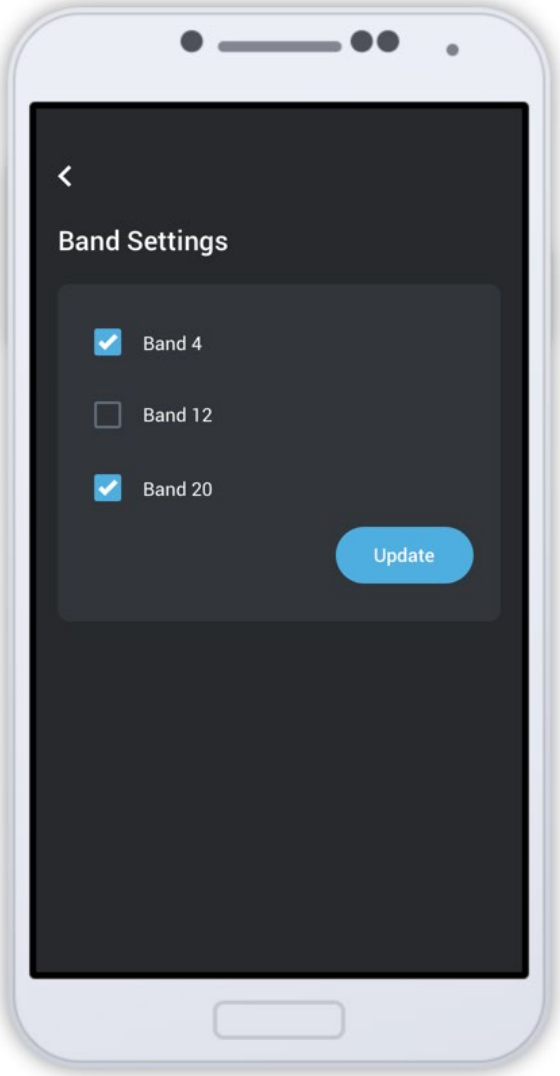


Figure 31: QUATRA Software – Band Settings

CEL-FI QUATRA Optimization Features

Antenna Positioning

The QUATRA 4000 system can accept up to four individual donor signals. One per carrier. Each donor can be established to the system either via small cell or off-air. When using an off-air signal, a directional antenna is recommended to provide the best signal quality. (Nextivity offers a number of directional antennas that can be used. See Nextivity's Products page for details.)

The Antenna Pointing feature allows you to easily optimize the direction your external antenna should be pointed. The algorithm takes into account the system gain and radio environment (including signal strength, signal quality, and pilot pollution).

This feature is designed to work with the CEL-FI Mount, which is an indoor/outdoor mount with a proprietary 8-position dial base. This dial enables the antenna to be rotated in 45-degree increments.

1. Make sure the CEL-FI COMPASS is connected to the donor antenna using the (included) RP-SMA to N adaptor cable.
2. The SIM card in COMPASS must be removed when using this feature.
3. Click on “Antenna Positioning” in the WAVE PRO app.
4. Rotate your antenna to a position on the dial mount and tap the corresponding number button. You will need to test 2 or more positions to see results.
5. For each carrier channel, the app displays position information on donor signal quality.
6. Current test results may be exported using the Options menu.

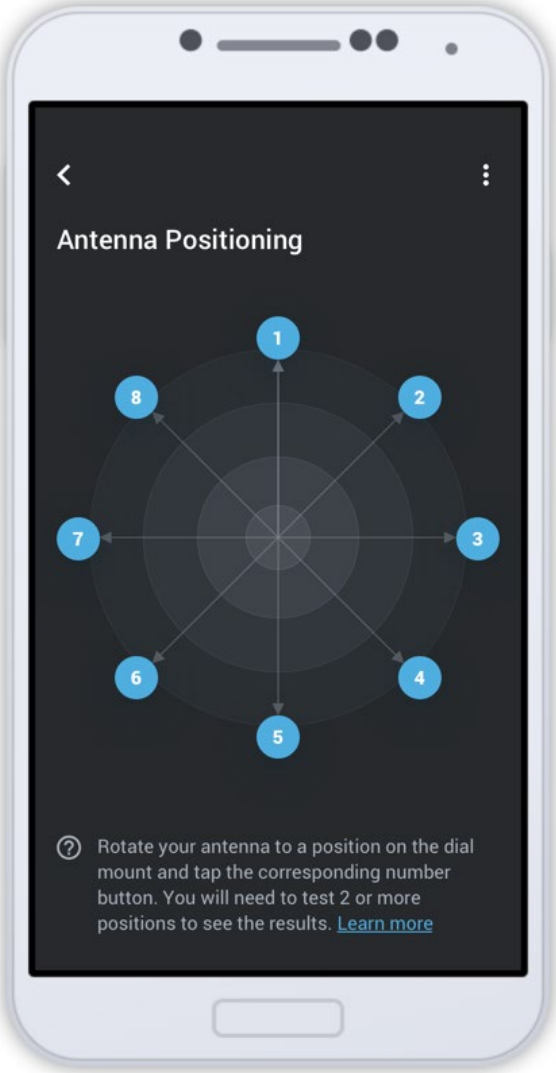


Figure 32: QUATRA Software – Antenna Positioning

Signal Report

A Full Signal Report scans all bands and channels for each carrier and returns a list of the channels it finds with RF metrics.

1. The SIM card in COMPASS must be removed when using this feature.
2. Go to the optimization section in the WAVE PRO app and click on “**Full Signal Report**”.
3. Press the "**Start Test**" button to begin measuring.
4. Current scan results may be exported using the **Options** menu.

Exporting the Signal Report

You can export the Signal Report by selecting the "**More**" icon and "**Email Report**". Type in your email address and results will be sent as a text attachment.

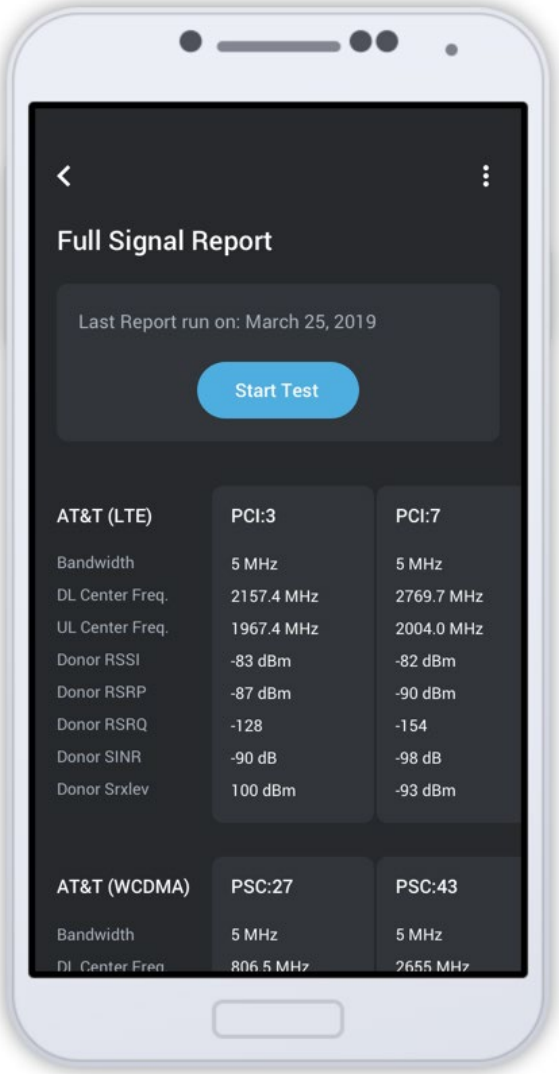


Figure 33: QUATRA Software – Full Signal Report

Speed Test

This feature tests the speed of the current Network Carrier of the SIM card inserted into the COMPASS.

1. In the WAVE PRO app, go to the “**Optimization**” section and press the "**Speed Test**" button.
2. Click on “**Start**,” and The CEL-FI COMPASS will gather data for several minutes and display the results below.

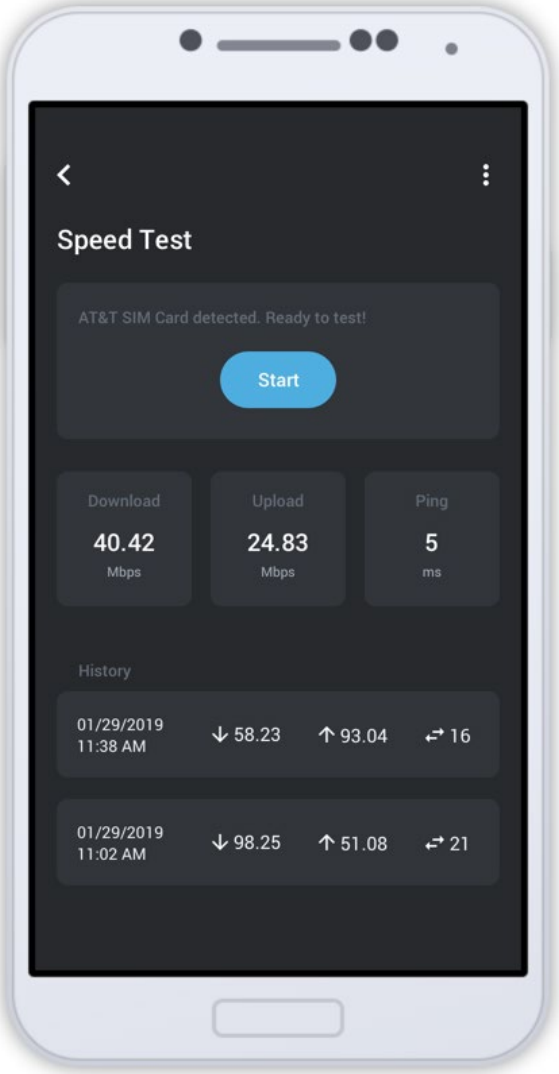


Figure 34: QUATRA Software – Speed Test

Serving Cell Report

The Serving Cell Report is a live reading of the current Network Carrier of the SIM card inserted into the CEL-FI COMPASS. The data will constantly refresh while on the page.

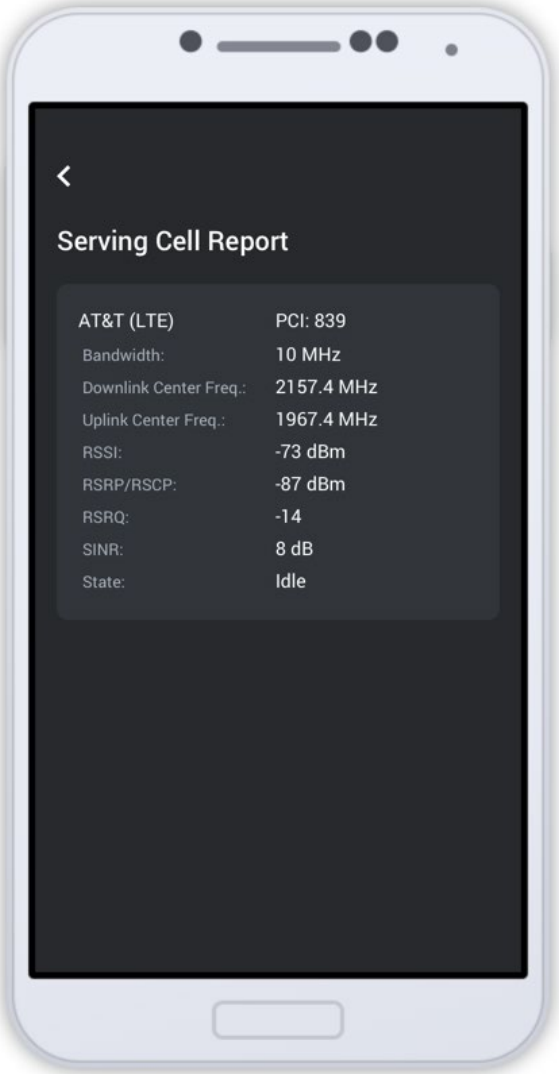


Figure 35: QUATRA Software – Serving Cell Report

10 | LEDs & Status Indicators

10.1 NU

The QUATRA 4000 NU has ten (10) LEDs on the front of the unit, used as status indicators, during setup and normal operation. The LEDs are labeled.

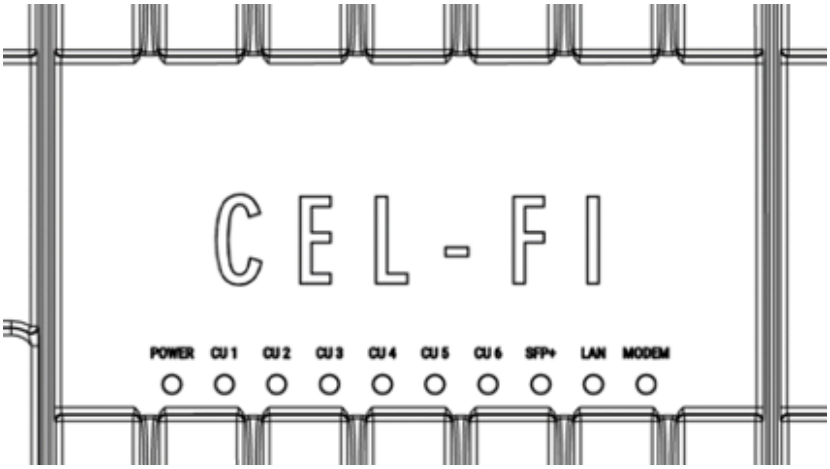


Figure 36: NU-LEDS

The LEDs on the front of the QUATRA 4000 function as follows:

LED Label	LED State	Meaning
POWER	NO LIGHT	No power
	SOLID GREEN	Powered and operating normally
	FLASHING GREEN	Scanning to acquire network signals
	SOLID RED	Hardware error
	FLASHING RED	Error
CU1, CU2, CU3, CU4, CU5, CU6	NO LIGHT	Not connected properly, no power
	SOLID GREEN	Connected, powered and operating normally
SFP+	SOLID GREEN	SFP+ module installed, and communicating properly
	FLASHING GREEN	SFP+ module installed, not communicating
LAN	SOLID GREEN	Link is up

LED Label	LED State	Meaning
	FLASHING GREEN	Link is up and active
MODEM	SOLID GREEN	Modem is installed, connected, and has an IP address
	FLASHING GREEN	Modem is attempting to connect
	FLASHING RED	Modem error

10.2 CU

Each QUATRA 4000 CU has three (3) LEDs on the front of the unit, used as status indicators, during setup and normal operation. The LEDs are labeled.

Figure 37: CU LEDs

The meaning for each LED on the CU is shown in the table below.

LED Label	LED State	Meaning
POWER	NO LIGHT	No power
	SOLID GREEN	Powered and operating normally
	FLASHING GREEN	Network scanning
	SOLID RED	Hardware error
	FLASHING RED	Error
NU LINK **CABLE LINK**	NO LIGHT	Logical Link: Down
	SOLID GREEN	Logical Link: Up

LED Label	LED State	Meaning
	NO LIGHT	Physical Link: Down
	SOLID GREEN	Physical Link: Up

11 | Troubleshooting

This section provides guidance for identifying and resolving common issues that may occur during installation, commissioning, or operation of the CEL-FI QUATRA 4000 system.

11.1 Common Alarm Conditions and Corrective Actions

Alarm Error	Description
Network Unit Hardware Error	Power cycle the Network Unit (NU) and check for software updates. If problem persists, return NU for service.
Insufficient Donor Signal	Relocate Network Unit (NU) where a stronger signal exists, or use an external antenna for the NU. If using a small cell, verify the small cell can process calls and check the connections to the NU. Power cycle the NU.
Coverage Unit Hardware Error	Troubleshoot any Network Unit (NU) error first, and check for software updates. Make sure Coverage Unit (CU) cables do not exceed recommended cable length maximums. Note that standard Ethernet Extenders or active LAN switches and routers will not work with CU cabling. Power cycle the CU by detaching and reattaching the LAN cable. Test CU by plugging it into back of NU with short test cable.
Donor Signal Too Strong	Move Network Unit (NU), or re-aim NU external antenna. Strong signal source may be from another Operator's device (cell tower, local small cell, or booster).
Network Unit is Overheating	The Network Unit (NU) should be upright and the air vents not blocked. Move NU to a cooler area.
Coverage Unit is Overheating	Make sure the Coverage Unit (CU) air vents are not blocked, or move the CU to a cooler location.
Too Close	One of your Coverage Units (CU) is too close to your Network Unit (NU). Try moving the units farther apart (or move units so more signal blocking structures isolate them from each other).
Too Far	One of your Coverage Units (CU) is too far from your Network Unit (NU). Try moving the units closer together.
Disabled by Operator/Vendor	Your system has been disabled by the mobile network operator or vendor. Contact your vendor for further assistance.
Location Lock	Your system has been moved from its original address. Please move the system back to its original location or register your new address with your wireless provider.
Registration Required	Systems are pre-enabled and carrier registration is obligatory.
Self-Test Failed	Power cycle the unit and check for software updates. If problem persists, return the unit for service.
Small Cell Not Detected	Network Unit (NU) Mode is set to small cell. Verify that small cell is connected and operational, or set NU Mode to Internal or External Antenna if no Small Cell used.

Alarm Error	Description
Small Cell Detected	Small Cell Detected but Network Unit (NU) is not set to Small Cell. Use the WAVE Portal to set NU Mode to Small Cell.
Antenna Configuration Error	Too Many Coverage Units (CU) connected. More than one CU in use for Off-Air configuration. Use the WAVE Portal to set Mode to External Antenna, and NU should be connected to an external antenna.
Antenna Positioning Required	Antenna positioning incomplete. Use the WAVE Portal to aim the NU donor antenna.
Ethernet Link Error	The ethernet link between NU and CU is behaving unreliably or reporting an error. Ensure the ethernet cable is not damaged and its connectors are securely plugged in on both ends.
CU Shutdown from Portal	CU's 1 though 4 has been shut down from the Portal.

The table below provides the internal alarm codes and corresponding system indicators that map to the troubleshooting conditions described above.

11.2 Alarm Codes and System Indicators

Error Indication	Name	Meaning
ES1	NU HW	Network Unit hardware error
ES2	Not Receiving Signal	Insufficient donor Signal
ES3	CU HW	Coverage Unit hardware error
ES4	Input too strong	Donor signal (RSRP) too strong
ES5	NU Overheating	Network Unit is overheating
ES6	CU Overheating	Coverage Unit is overheating
ES7	Too Close	N/A*
ES8	Too Far	N/A*
ES9	Disabled by operator	N/A*
ES10	Location Lock	N/A*
ES11	New Registration Required	N/A*
ES12	Self-Test Failed	System self-test has failed
	Ethernet Link Error	An error has been detected in the link between the NU and CU
	CU Shutdown from Portal	A CU has been shut down remotely from the WAVE portal

* Not used in QUATRA 4000 systems.

12 | Specifications & Reference

12.1 CEL-FI QUATRA 4000 Service Agreement

- Every NU will be bundled with a 1-year product Service Agreement
- The Service Agreement may be renewed on an annual basis
- Upon request once the system installation is complete, Nextivity will review key system KPI's and provide feedback on the installation.
- Nextivity will monitor systems for any alarms and perform Level 1 remote troubleshooting for each alarm.

Learn more about our Service Agreement.

12.2 Specifications

For details, please refer to the CEL-FI QUATRA 4000 Data Sheet

12.3 Trademarks

CEL-FI, IntelliBoost, and Nextivity logo are trademarks of Nextivity, Inc.

12.4 Warranty & Limitation of Liability

Nextivity Inc., provides a limited warranty for its products.

For details, please refer to cel-fi.com/warranty.

In no event shall Nextivity, nor its directors, employees, agents, suppliers or End Users, be liable under contract, tort, strict liability, negligence or any other legal or equitable theory with respect to the Products or any other subject matter of this Agreement (i) for any lost profit, cost of procurement of substitute goods or services, or special, indirect, incidental, punitive, or consequential damages of any kind whatsoever or (ii) for any direct damages in excess of (in the aggregate) the fees actually received by Nextivity from End User with respect to the Products actually purchased and paid for.

12.5 Compliance

In the event of regulatory compliance issue, please contact Nextivity Inc. directly.

Contact information is available at cel-fi.com/doc

12.6 Glossary

Term	Definition
MIMO	Multiple In, Multiple Out
SISO	Single In, Single Out
SiNR	Signal to Interference plus Noise Ratio
RSRP	Reference Signal Receive Power
RSSI	Received Signal Strength Indicator
Donor Antenna	Antenna used to capture the exterior macro cellular network signal, and provide such signal to the system.
Server Antenna	Antenna used internally to provide the coverage benefit from CEL-FI QUATRA 4000.