CEL-FI
by NEXTIVITY

CEL-FI | Smart Cellular Coverage

In-Building Enterprise Cellular Solutions

CEL-FI QUATRA | Smart Cellular Coverage

CEL-FI by NEXTIVITY

Performance Leadership | Ease of Install | Leaders in Value | Fast Set Up | Carrier Grade Approved

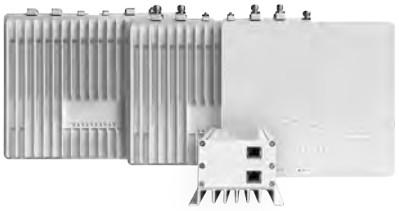
Build Your Own Coverage with Cel-Fi's Award-Winning Solutions

In today's digital world, the need for strong cellular connectivity in office settings is more important than ever before. Over the years, cellular devices have evolved to become powerful mobile workstation essentials, allowing people to stay connected and work from anywhere with reliable cellular coverage. However, dependable reception at the office is not a given.

From a structure's dense walls and building materials to its location and proximity to cellular towers, there are many factors that impact signal strength. To solve for areas with poor reception, building owners are searching for cost-effective cellular systems that deliver reliable coverage across their facilities and ensure employees can take full advantage of their digital tools.

Cel-Fi's award-winning solutions for enterprise buildings combine industry-leading signal gain with flexibility to support any structure. Available in single, dual, or multi-carrier options, Cel-Fi products are the most powerful solutions on the market. In addition to offering uniform, high quality cellular signal throughout a building, Cel-Fi systems are scalable, cost effective, and designed to be installed in days (compared to months typical of other solutions). Plus, Cel-Fi's carrier-grade solutions are network safe and provide a no noise guarantee.

Unlike older analog boosters and passive DAS technology, Cel-Fi QUATRA and GO systems deliver a cellular signal that is up to 1000x stronger. With best-in-class performance and the scalability to fit enterprise environments of all shapes and sizes, QUATRA and GO allow building owners and installers to create the ideal cellular systems and take their facilities to the next level.



- **Highest Coverage Gain:** Up to 100 dB Max Gain for 3G/4G/5G Voice and Data
- **All Digital:** Cat5e PoE/RFoE Solution
- **Scalable:** Up to 125,000 ft² Coverage per Network Unit
- **Multi Mode:** Off-Air or SuperCell Mode with Fiber Expansion
- **Network Safe:** Carrier-Approved with No Noise Guarantee
- **Cel-Fi WAVE Platform:** Set Up, Remote Monitoring, and Management

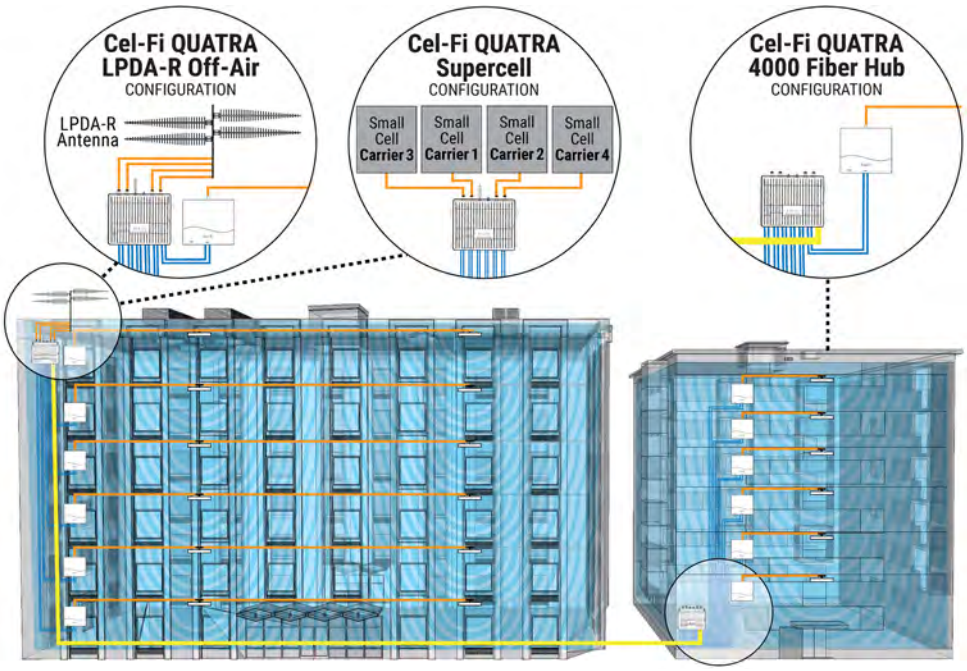
For more information, visit **Cel-Fi.com**

Find Out Why Operators, Integrators, and Building Owners Have Switched to Cel-Fi

Smart Cellular Coverage for Any Enterprise Building

Spotty cellular coverage, poor voice quality, dropped calls, and dead zones continue to plague employees and visitors in enterprise buildings. To solve that problem, Cel-Fi solutions are affordable and provide uniform, high quality cellular signal throughout any building. These industry-leading systems are also carrier approved and guaranteed network safe.

Cel-Fi QUATRA 4000 Installation



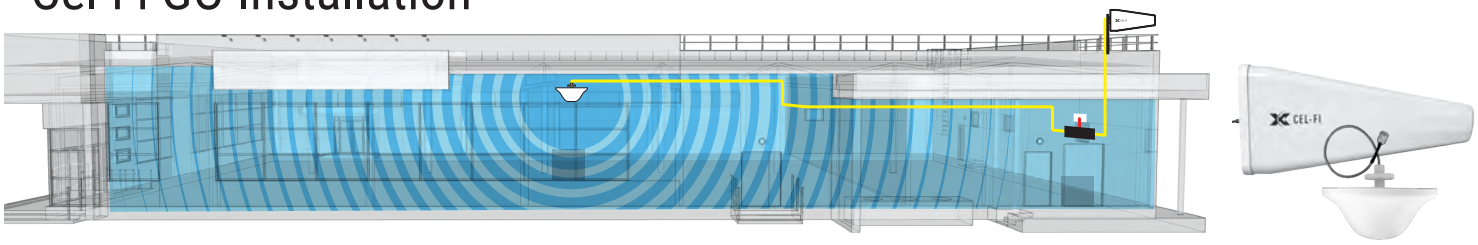
Cel-Fi QUATRA

With several configuration options, Cel-Fi QUATRA allows installers and building owners to create the perfect solution. In addition to off-air and supercell modes, QUATRA 4000 is compatible with the Cel-Fi QUATRA 4000 Fiber Hub, which significantly expands the system's reach without any signal loss.

Cel-Fi GO

Offering reliable cellular coverage up to 15,000 ft² (1,500 m²) per system, the Cel-Fi GO Smart Signal Boosters is ideal for a wide range of enterprise buildings. Needing as few as two antennas — one donor and one server — installers can set up the system and achieve unmatched signal gain within minutes.

Cel-Fi GO Installation



Discover the Perfect Cel-Fi QUATRA Solution for Your Building

OFF-AIR CONFIGURATION

Cel-Fi QUATRA systems are capable of retransmitting donor signals from outdoor directional antennas to indoor locations. Unlike typical BDA amplifiers, each operator channel is individually processed and power controlled to achieve full coverage power. This eliminates channel-to-channel coverage power variations due to differences in power of donor signals.

SUPERCELL CONFIGURATION

A Supercell is comprised of a Cel-Fi QUATRA system connected to a small cell. Multiple QUATRA systems can be connected to a single small cell, or multiple small cells, to form a Supercell. A Supercell with QUATRA is more efficient than multiple small cells, and the CUs of a QUATRA system connected to a Supercell do not interfere with one another.

FIBER EXTENSION

Expanding the capabilities of Cel-Fi QUATRA systems, the Cel-Fi QUATRA Fiber Range Extender (QFRE) increases the distance between the Network Unit and Coverage Unit up to 2.0 km (1.24 miles). QUATRA 4000 systems are also compatible with the Cel-Fi QUATRA 4000 Fiber Hub, which offers the same distance flexibility as the QFRE and allows a single NU to support up to 12 CUs. These solutions are ideal for high-rise structures, long distances, or multi-building facilities.

HARDWARE:

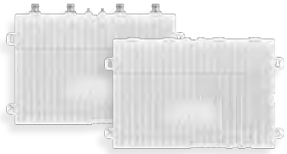
Cel-Fi QUATRA 4000/4000i
Multi-Carrier

Network Unit Coverage Unit

Cel-Fi QUATRA 4000 Fiber Hub
Multi-Carrier

Network Unit

Cel-Fi QUATRA 4000e
Multi-Carrier



Network Unit Coverage Unit

Cel-Fi QUATRA 2000
Dual Carrier

Network Unit Coverage Unit

Cel-Fi QUATRA 1000
Single Carrier

Network Unit Coverage Unit

Model Family	Carrier Support Capability	Scalable Coverage per Network Unit *(up to sq. ft.)*	Coverage Unit per Network Unit	Max Gain *(up to dB)*	Donor Source Options		Coverage Antenna Options *(passive elements available)*	All-Digital RFoE & PoE	Bands Supported
					Off-Air Mode	Supercell Mode			
Q4000i Part 90	Multi	125,000	6	100	Yes	Yes	Included Blade / External	Yes	2/4/5/12/13/25 /26/30/41/71
Q4000 Part 20	Multi	125,000	6	100	Yes	Yes	Included Blade / External	Yes	2/4/5/12/13/25
Q4000e	Multi	125,000	6	100	Yes	Yes	Included Blade / External	Yes	1/3/7/8/20/40
Q2000	Dual	50,000	4	100	Yes	No	Internal / External	Yes	2/4/5/12/13/25
Q1000	Single	50,000	4	100	Yes	Yes	Internal / External	Yes	2/4/5/12 2/4/5/13 1/3/8/20 1/7/8/20 1/3/7/8 3/5/7/28

ASSESSORIES:

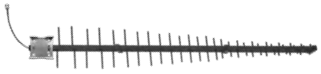
Cel-Fi QUATRA 4000 Range Extender

Cel-Fi QUATRA Fiber Range Extender

ANTENNAS:

Cel-Fi Blade Antenna
(Included)

Cel-Fi LPDA-R High-Gain Directional Antenna



Cel-Fi Low-Profile Antenna

ebook_enterprise-rcr-podcast_22-0302

For more information, visit **Cel-Fi.com**

Cel-Fi QUATRA Brings Cellular Signals for All Carriers Inside UT Health San Antonio Medical Arts & Research Center

SUMMARY

CHALLENGE

- Leading academic health center had zero cellular coverage in an eight-floor, 256,000 sq. ft. hospital located on its campus
- Previously installed solution didn't provide coverage from all carriers as required
- Disruption in cellular signal frustrated staff and doctors

SOLUTION

- Cel-Fi QUATRA

RESULTS

- Reliable cellular coverage for all four major carriers
- Easy, quick install
- Happy staff and doctors

THE CHALLENGE

University of Texas Health San Antonio (UT Health San Antonio) serves patients in San Antonio and South Texas. Its health care professionals work in more than 100 affiliated hospitals, clinics, and health care facilities across San Antonio, Laredo, and the Rio Grande Valley. More than 3,000 students, researchers, and post-doctoral students from around the world come to UT Health San Antonio to study, research, and discover new breakthroughs.

Located on the UT Health San Antonio campus, the UT Health Medical Arts & Research Center (MARC) is a hub of activity with approximately 200 physicians and 30 different practices calling the 256,000 square foot building home. According to Mark Alexander, Senior Infrastructure Director at UT Health San Antonio, it was important to provide cellular coverage to anyone who entered the MARC, including staff and doctors who use their cellphones to conduct medical and personal business. "There was practically zero cellular coverage from any carrier within the entire eight floors of the building," says Alexander.

Austin, TX-based GTS Technology Solutions, an IT solution architect and managed services provider, worked with partner HCI, a wireless communications integrator of voice video and AI data solutions, to propose and implement a solution that would solve the coverage challenges in the MARC and deliver reliable cellular signals for all carriers throughout the building.

GTS
TECHNOLOGY SOLUTIONS

- Established in 1984
- Based in Austin, TX
- Services include IT solutions, managed services, and datacenters
- Customers include government, education, and public safety

CEL-FI CERTIFIED **RESELLER**

THE SOLUTION

HCI designed a solution that would bring strong cellular signals from all major carriers into the MARC. The solution features Cel-Fi QUATRA, an active DAS hybrid that delivers uniform in-building cellular coverage.

"I'll always first recommend Cel-Fi QUATRA for my clients that want a customized in-building cellular solution that's going to be reliable. In order to have a reliable system, it must be designed properly for the coverage required and Cel-Fi QUATRA has different options to fit all types of buildings with less worries.," says Trevor Henson, Service Manager at HCI.

Cel-Fi QUATRA specifically addresses the challenges of poor voice quality, dropped calls, and dead zones in large commercial buildings. Unlike analog boosters and passive DAS systems, QUATRA delivers a cellular signal that is up to 1000x stronger, offering a much larger coverage footprint. QUATRA uses cabling with Power over Ethernet, so there is no need to install additional power outlets for the internal remote antennas.

"One of the best advantages of the Cel-Fi QUATRA units compared to competitive products is the coverage and how much better it works. I've done analytics when designing other competitive solutions to determine how far an indoor antenna would go compared to a Passive DAS requiring coax cable. QUATRA's ease of installation and the coverage spread is always going to overcome any others that are similar to its range," explains Henson.

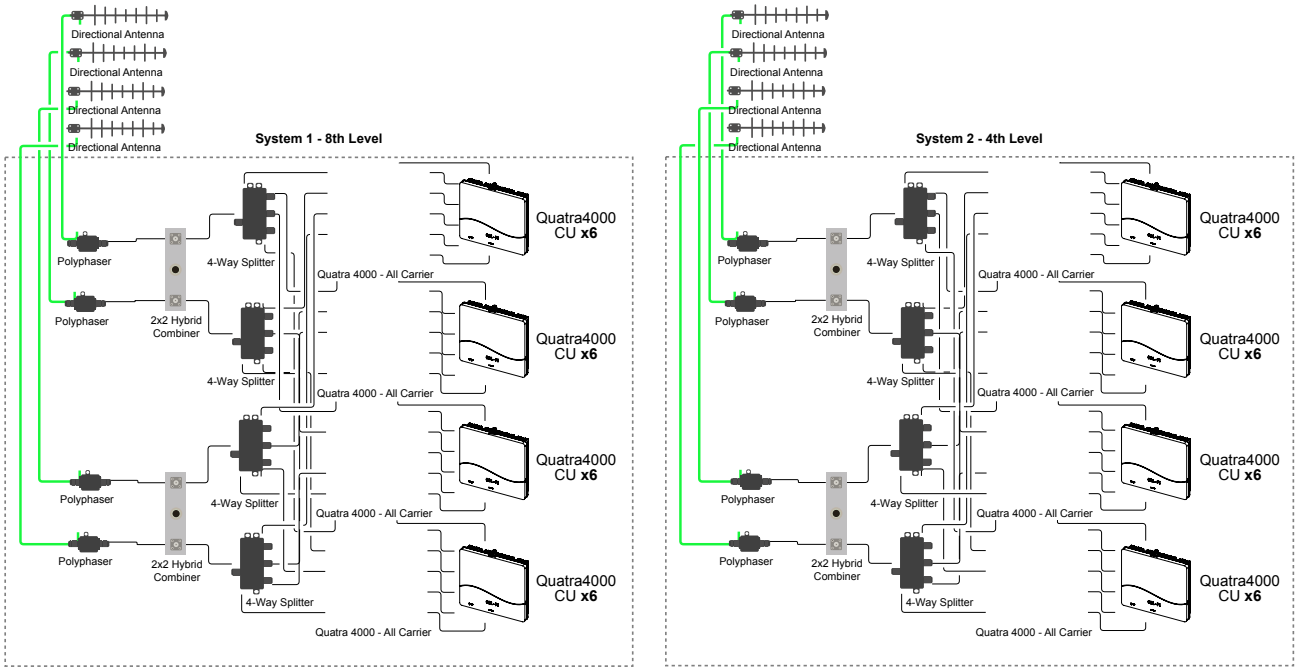
According to Henson, four Cel-Fi QUATRA 4000 Network Units (NUs) — the head end of the system — were installed on the eighth floor and another four NUs were installed on the fourth floor. Each NU supports and enhances the outdoor signal for all major carriers, and digitally re-transmits the carrier signal with zero signal loss via Cat5+ cables or better to QUATRA Coverage Units (CUs) — which are the remote internal antennas. HCI chose to use GameChanger cables as they are more durable, plenum-rated and can be run up to 600 ft. without needing a range extender. There were 6 CUs placed on each floor for a total of 48. External log-periodic dipole array (LPDA) donor antennas were installed on the roof for the off-air signal source.

A four-person team installed the Cel-Fi QUATRA system in 10 days, working each evening from 6 pm to 5 am while there were no patients in the building. With the installation taking place amid the COVID-19 pandemic, the team complied with extra safety precautions during the installation — wearing masks, protective gear, and sanitizing their hands as well as getting screened each day for temperature or symptoms.

HCI

- Established in 1978
- Based in Houston, Texas
- Services include custom wireless communications solutions design and implementation
- Customers include education, government, oil & gas, manufacturing healthcare, and public safety

CEL-FI CERTIFIED **RESELLER**



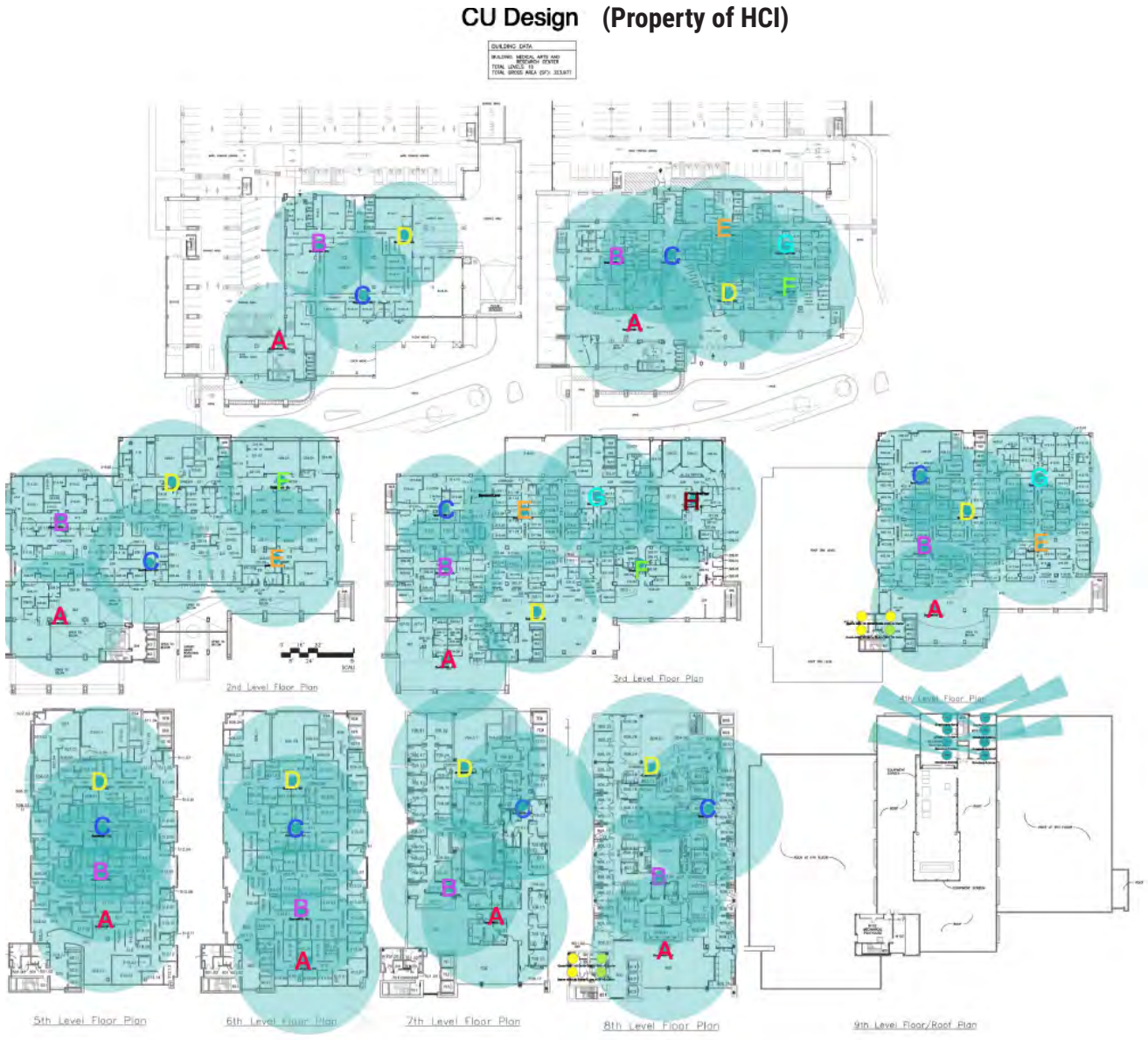
"They would give us a sticker once we passed the screening and we were good to go," says Trevor. "If we left the building for any reason, we were required to get screened again when we came back."

THE RESULTS

The telecom techs at the UT Health San Antonio MARC love the improvements in coverage, according to Henson.

"Before, the readings were between 95 to 120dB, depending on the carrier. After Cel-Fi QUATRA was installed, signals improved between mid-60s and 70s throughout the building," explains Henson.

Mark Alexander says the installation was fantastic and went very smooth. "Once this solution was installed, we alleviated all carrier issues. Our staff and doctors are extremely happy with the system. They can now go about their business and make cellular calls as needed, with no disruption in services."



Cel-Fi QUATRA Delivers Cellular Coverage for Grocery Chain Distribution Center

SUMMARY

CHALLENGE

- Regional grocery chain specializing in Latin American cuisine was experiencing poor cellular coverage at its primary distribution center and headquarters
- Cellular connectivity needed for the safety of employees and for real time inventory tracking on cellular-enabled devices
- Significant macro capacity congestion due to the nearby major freeway interchange, airport, and conference center

SOLUTION

- Cel-Fi QUATRA

RESULTS

- Strong and reliable cellular connectivity throughout the facility
- Cost-effective solution significantly less expensive than the picocells initially recommended by carrier
- Improved distribution center operations
- Increased subscribers for the carrier

THE CHALLENGE

A supermarket chain that specializes in Latin American cuisine handles the entire food ecosystem for its operations, from purchasing fresh produce and authentic ingredients in Mexico and warehousing it to distributing it to its 60 retail grocery stores in Southern California, Arizona, and Nevada. Its headquarters and central distribution center are located in Rancho Cucamonga, California in a 353,000 sq. ft. building. The warehouse is 297,000 sq. ft., while the offices are on two levels and span 60,000 ft^2.

The facility is adjacent to a major freeway interchange in Los Angeles with extremely heavy traffic during the morning and evening rush hours. The cellular tower serving this area has capacity constraints due to the volume of the freeway traffic, resulting in poor signal and capacity issues inside the building as the bulk of the bandwidth is used by commuters on the freeway. An airport and major conference center are also close to the building, which further reduces available capacity and creates service problems for other subscribers in the area.

While Wi-Fi Calling was being used to address the cellular signal and capacity issues, the coverage was spotty and the calls were of a poor quality with too much latency. The company's main concern was employee safety. The warehouse runs 24/7 and has 40 bays for trucks. At any given time, there are two dozen forklifts and the same number of power jacks whipping around the warehouse at high speed.

The company was concerned that they could not depend on Wi-Fi Calling if a safety issue occurred and an employee somewhere in the facility had to call 911. Handheld wireless devices were also being used to track inventory in real time when loaded on pallets and then into the trucks. These devices experienced problems due to the poor Wi-Fi connection, so the chain wanted to transition the handheld devices over to LTE for better reliability.

A carrier suggested taking the necessary steps to improve cellular coverage in the building so the distribution center could move off Wi-Fi Calling. The carrier initially recommended picocells, but too many units were required, which made that solution too expensive. There were also interoperability challenges for handoffs between the picocells when placed inside the facilities.

THE SOLUTION

The carrier contacted Nextivity for a solution, and Cel-Fi QUATRA was installed by an authorized reseller and engineering firm specializing in enterprise cellular DAS solutions based in Irvine, California.

Cel-Fi QUATRA is an active DAS hybrid that delivers a cellular signal that is up to 1000x stronger than analog boosters and Bi-Directional (BDA) Passive DAS systems, offering a much larger coverage footprint for multi-carrier voice and data on 3G/4G/5G networks. QUATRA uses cabling with Power over Ethernet, so there is no need to install additional power outlets for the internal remote antennas.

In the offices, the integrator installed three Network Units (NUs), the headend of the system, and 10 Coverage Units (CUs), the remote internal antennas that distribute the cellular signal to end users. On the warehouse floor, two NUs and 6 CUs were installed. CAT5e cabling from the NUs to the CUs made the installation easier to accomplish by four technicians.

The major challenge in the deployment was aiming the antennas to avoid the interference from the heavy rush hour traffic on the freeway, the airport, and convention center. However, this was resolved by using the Cel-Fi COMPASS smart radio frequency handheld scanner, which is designed to measure signal strength and the quality of multiple bands.

THE RESULTS

After the installation was completed, Wi-Fi Calling was disabled in the warehouse. LTE coverage, which is far superior in quality and reliability to Wi-Fi Calling, meant that the real time inventory tracking devices performed with a stable connection to smooth out operations. Employees were also able to connect using their cell phones throughout the building, addressing any of the previously raised safety concerns.

The chain was so pleased with the installation and reliability of the cellular coverage achieved in the distribution center that they installed 100 cellular-enabled M2M devices that track the utilization of all their lift equipment, including usage trends and driver behavior, so the company can now better manage their resources and investments.

Cel-Fi QUATRA provided the cellular coverage the supermarket chain needed for employee safety and to ensure the smooth running of its operations. Before and after performance data, reports from the carrier, and customer feedback were all positive.

CEL-FI™ QUATRA

BEYOND BETTER COVERAGE

- **High-quality middleprise solution for 3G/4G/5G voice and data coverage**
- **Supports multi-carrier voice and data**
- **Carrier-approved, unconditionally network safe, and no interference guarantee**
- **Can be monitored and managed using Cel-Fi WAVE**

Public Safety Communications Sees Major Advancements for Manufacturing with Cel-Fi QUATRA RED

SUMMARY

CHALLENGE

- State-of-the-art electric vehicle manufacturing facilities under construction needed to meet fire safety code requirements
- Remote location and building materials inhibited public safety or cellular signals from entering two buildings ranging in size from 200,000 to 600,000 square feet

SOLUTION

- Cel-Fi QUATRA RED
- Cel-Fi QUATRA 4000

RESULTS

- Compliance with public safety regulations required for a Certificate of Occupancy
- Reliable cellular coverage throughout the buildings for all four major carriers

THE CHALLENGE

State-of-the-art manufacturing facilities were under construction in an area outside Tucson, Arizona that was previously farmland. One building was 200,000 square feet and a second building was 600,000 square feet. As the facilities were built with steel, they were essentially giant Faraday cages which, combined with the remote location, meant public safety and commercial cellular signals could not penetrate into the two buildings.

During the inspection of the facilities for a Certificate of Occupancy, the fire marshal noted an Emergency Responder Radio Communication System (ERRCS) was required to meet public safety regulatory requirements due to the size and construction of the buildings. It was also apparent during construction that poor cellular reception throughout the facilities would require a cellular amplification solution. As public safety regulations dictate that ERRCS systems must be separate from other cellular solutions, two independent systems needed to be installed.

Powernet, an Ohio-based provider of public safety and telecommunications equipment and services, was brought in to provide the ERRCS system the facilities required.

powernet®
Enabling you to connect.®

- Established in 1992
- Based in Cincinnati, OH
- Services include SIP Trunking, UCaaS, Internet/Wi-Fi, Managed Security & Network services, Contact Center solutions, Cell & Public safety signal boosters, and full-service MDU packages
- Customers include government, education, health care, hospitality, and public safety

CEL-FI CERTIFIED **RESELLER**

"When we started installing the ERRCS system, the walls inside were just going up. There was good reception from all carriers outdoors, but signal dropped completely as soon as we came in the building, so we let them know at some point they would also need a cellular booster," says Jose Morales, System Engineer at Powernet.

"Powernet offers turn-key services for both public safety and commercial cellular booster solutions including design, testing, installation and support. Our engineers do all the FCC registration and we make sure everything is up and running, including doing all the testing with the AHJ." says Penny Thurnau, Vice President of Channel & Strategic Alliances at Powernet.

THE SOLUTION

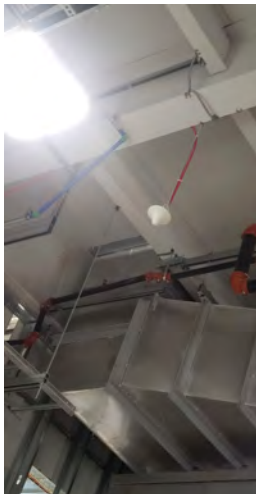
ADDRESSING PUBLIC SAFETY WITH CEL-FI QUATRA RED

To comply with the AHJ's requirements for a Certificate of Occupancy, Powernet chose to install Cel-Fi QUATRA RED Class A 700MHz/800MHz channelized Emergency ERRCS Smart Signal Booster. It is the first ERRCS that is able to boost both LMR and FirstNet signals.

"We chose solutions from the Cel-Fi QUATRA family of products as we've installed them at other facilities. They have a public safety and enterprise system that we knew would deliver strong gain with excellent coverage, be fast and easy to install, and would cost less than a traditional DAS – all important factors for the client," says Thurnau.

Where other ERRCS solutions require integrators to purchase different elements from a variety of vendors to create a complete solution, Cel-Fi QUATRA RED simplifies the deployment by offering an all-in-one solution. It includes everything from the head end (Network Unit or NU), remotes (Coverage Unit or CU), Master Battery Back-up Unit (MBBU), Remote Annunciator, Emergency Power-off Switch (EPO), coverage measuring tools and comprehensive remote management. Each component was built around the International Fire Code (IFC) and National Fire Protection Association (NFPA) standards, is NEMA 4X rated and fully compliant with UL2524, and are all optimized as an integrated solution.

The Cel-Fi QUATRA product family uses proprietary Cel-Fi smart booster technology that is approved for use by more than 200 carriers around the world. When QUATRA RED is installed, the technology intelligently delivers the same strong signal to all emergency responders inside the facility regardless of where they are located in relation to the system head-end or macro high site.



The system also simplifies the testing process, ensuring it passes the inspection done by the Authority Having Jurisdiction (AHJ). Cel-Fi QUATRA RED is the first ERRCS solution that includes built in uplink grid testing along with downlink grid testing. The Cel-Fi Compass handheld receiver tool is used to record the measurements on a 20- or 40-grid and input the data into the Cel-Fi WAVE PRO cloud-based management system that produces a formal report for the AHJ's Certificate of Occupancy or annual fire safety inspections. Using the testing tools can save considerable cost, and it speeds up the certification process by eliminating the need for the AHJ to return multiple times to redo tests.

A single Cel-Fi QUATRA RED system will cover up to 1,200,000 sq ft, and multiple systems may be combined for even larger projects. Powernet installed one Network Unit (NU) which is the head-end of the system, in each building. With the exception of the remote antennas, all head-end system components were installed in the ground floor stairwell areas, which are fire rated, in each building.

The Monitor & Battery Backup Unit (MBBU) provides constant direct current, alarming, monitoring, and battery charging capabilities. It integrates a wireless LTE modem and a wired Ethernet port for remote access to all the Cel-Fi QUATRA RED components via the Cel-Fi WAVE Portal or the WAVE PRO app.

Network Unit (NU)	Coverage Unit (CU)	Monitoring and Battery Backup Unit (MBBU)	Remote Annunciator Panel (RA)	Emergency Power-Off Switch (EPO)

The Cel-Fi QUATRA RED Remote Annunciator Panel provides automatic supervisory signals for any malfunctions of the ERRCS system. Designed to prevent inadvertent operation, the QUATRA RED Emergency Power-off Switch can instantaneously shut down the ERRCS solution from a single point to eliminate the risk of combustion caused by electricity or static.

Powernet installed a total of 4 Coverage Units (CUs) connected to service antennas in the 600,000 square foot building, and 3 CUs in the 200,000 square foot building. Paige GameChanger Ethernet cable was used to deliver lossless signals from the NUs to the CUs utilizing Power over Ethernet (PoE). The PoE architecture allowed for a quick installation and alarm configuration. Powernet installed a single donor antenna on the roof of each building to receive the Land Mobile Radio (LMR) signal from the closest high site.

"The tools included with Cel-Fi QUATRA RED made the installation quick and painless," says Morales.

GETTING A CELLULAR SIGNAL INSIDE WITH CEL-FI QUATRA 4000

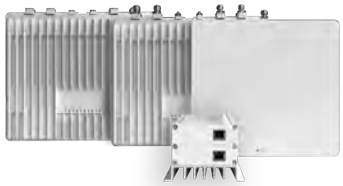
"When we were about two-thirds through with installing the public safety system, it was clear that the cellular coverage gaps needed to be fixed right away. When the walls went up, they lost virtually all of their signal indoors," says Morales. "They had a lot of glass and metal in the new construction, as well as robotics, moving parts and other physical barriers that blocked signal and prevented good RF propagation. So we began installing Cel-Fi QUATRA 4000 while completing the public safety system installation."

Cel-Fi QUATRA 4000 active DAS hybrid specifically addresses the challenges of poor voice quality, dropped calls, and dead zones in large commercial buildings. Unlike analog boosters and bi-directional amplifier (BDA) passive systems, QUATRA delivers a cellular signal that is up to 1000x stronger for all major carriers simultaneously, offering a much larger coverage footprint. It is fully digital and uses lossless Ethernet cabling, making the installation easier and faster. Power over Ethernet eliminates the need to install additional power outlets for the Coverage Units (aka Remote Units).

Issues frequently arise when public safety and commercial cellular amplification solutions are installed in the same facility due to interference between the signals of the systems. This problem usually needs to be resolved by placing large cavity filters between the head-end of the two systems and the remote units. These filters cost between $1,000 to $2,000 and many would be needed in facilities as large as these.

However, when Cel-Fi QUATRA RED and Cel-Fi QUATRA 4000 are installed in the same facilities to address both public safety and commercial cellular coverage, this problem is avoided. Cel-Fi products are guaranteed unconditionally network safe, with no interference on the macro or other networks.

Cel-Fi QUATRA has a Network Unit (NU) that is the head-end of the system, and Coverage Units (CUs) that are the remote RF units to connect external antennas and distribute the cellular signal throughout the buildings. Powernet installed three NUs and 15 CUs in the 600,000 square foot building, and one NU and five CUs in the 200,000 square foot building.



Two donor antennas for the cellular carriers were installed on the roof of each building. One donor antenna on each building was dedicated to Verizon, with the remaining three major carriers consolidated on the other antenna. In compliance with IFC and NFPA codes, separate donor antennas were installed for the Cel-Fi QUATRA and Cel-Fi QUATRA RED systems. The cabling was wired separately for each system as well.

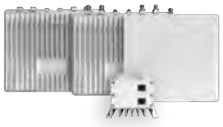
THE RESULTS

"The deployment of the systems went great," says Morales. "It took a four-person team about three weeks on and off to do the installation of both systems. Once the cabling was done, installing and commissioning QUATRA took two days as the systems are self-configuring. Optimum antenna positioning was also fast and easy using Cel-FI WAVE."

Cel-Fi QUATRA RED passed the inspection needed for the Certificate of Occupancy on the initial AHJ inspection test, which was largely why QUATRA RED was chosen for this time sensitive project.

Cel-Fi QUATRA 4000 delivered strong cellular reception throughout the facilities, providing 99% coverage where previously there was only 5% of the building with usable signal, according to Morales. When asked for feedback on the system, executives from the manufacturing facility said, "Don't turn them off!"

CEL-FI QUATRA



Enterprise System

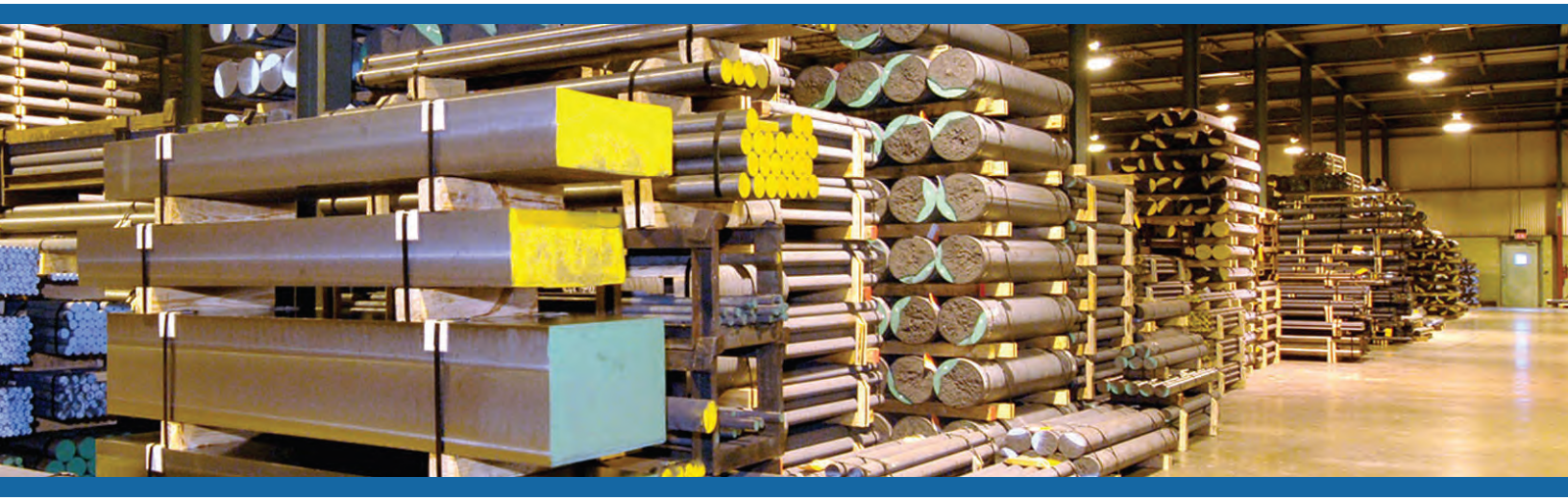
CEL-FI QUATRA RED

Public Safety System

BEYOND BETTER COVERAGE

- **Cel-Fi QUATRA RED an all-in-one, ERRCS solution for both LMR and FirstNet housed in the same facilities with industry leading in-building cellular coverage systems**
- **Cel-Fi QUATRA RED built for building owners to get a faster Certificate of Occupancy and optimum public safety signal reception**
- **Cel-Fi QUATRA RED and Cel-Fi QUATRA are built for integrators for faster, simpler installation, easier maintenance, and confidence in systems that deliver what customers want customers want**

Cel-Fi QUATRA Powers Cellular Connection for Underground Electric Vehicle Charging Stations



Headquartered in Woodstock, Illinois, Charter Dura-Bar focuses on continuous cast iron bar products that are used as alternatives to carbon and alloy steel for industrial applications such as drilling and hydraulic fracturing in oil and gas. The company is comprised of two divisions. Dura-Bar is the world's largest producer of engineered cast iron bar products—and the only continuous cast iron bar foundry in the United States. Dura-Bar Metal Services is Dura-Bar's largest distributor, serving more than 3,000 global customers from locations in Illinois, Pennsylvania, Texas, and North Carolina.

Charter Dura-Bar boasts a picturesque campus. A lake and plenty of green space surround its three main buildings, which house administrative functions, metal services, and an iron foundry. Its somewhat rural location, coupled with the large amount of steel and cinder block walls in the foundry, made it difficult for cellular signals to penetrate indoors. As the company's 10 small cells began to reach the end of their lifecycle and the carrier no longer supported the offering, Charter Dura-Bar was on the hunt for a new solution.

Ease of management was a key criterion. "Each small cell could only hold 15 numbers, so we were constantly having to make updates as employees moved around or phone numbers changed," says Wendy Zeitler, a senior telecommunications technician at Charter Dura-Bar. "We also had to prioritize based on seniority, so it was very disheartening to tell employees we weren't able to give them cellular coverage at work."

THE CHALLENGES: Manufacturing

- Within a rural area: 35,000 square foot, brick-exterior administrative building, 57,000 square foot shop area used to cut metal
- A large amount of steel and cinder block walls in the foundry
- 10 small cells began to reach the end of their lifecycle
- Constantly having to assign available phone numbers to a set number of employees due to limitations of how many each small cell could support
- Need secure machine-to-machine communications moving from the network to a cellular network.

USING CELLULAR TO POWER IOT

In addition to wanting to provide typical voice and data services over the cellular network—for example, enabling employees to communicate with one another between buildings, or for personal reasons—the metal services building, and the iron foundry feature industrial-sized vending machines that contain various tools and supplies. Employees working on the factory floor must enter a personalized code to access, for instance, protective gloves or specific parts they need to operate a piece of machinery. The company's credit card is then processed in real-time for these purchases.

Payment processing was running over Charter Dura-Bar's network. But because

the vending machines were operated by a third-party company, the security team wanted to separate this function from the company's IT network to mitigate security risks in the event of a breach.

"By moving to a cellular network," explains Trent Bruha, a service desk technician at Charter Dura-Bar, "we would gain peace of mind while enabling secure, machine-to-machine communication."

Charter Dura-Bar also wanted to improve the cellular experience for employees taking part in the company's BYOD program, and more generally to eliminate the inconvenience of having to run out to the parking lot whenever they wanted to use their phones.

CONNECTING WITH KONECTAUSA AND CEL-FI QUATRA

On the recommendation of their carrier, Charter Dura-Bar turned to KonectaUSA, a leading provider and installer of indoor cellular solutions. KonectaUSA decided to use the Cel-Fi QUATRA active DAS hybrid from Nextivity to build out Charter Dura-Bar's cellular network.

"When we tell customers that we can support applications such as credit card vending machine transactions over cellular, they love it because we don't have to touch their IT network," explains Mike Shortridge, a partner at KonectaUSA. "Cel-Fi QUATRA is a cost-effective solution that can provide reliable, multi-carrier coverage in places that have traditionally proved to be a challenge."

Shortridge began his work in the iron foundry, a 596,000 square-foot building that runs 24 hours a day in three shifts totalling 300 employees. A cafeteria, as well as administrative and engineering offices are located in the foundry. The vending machines are situated in an office next to the cafeteria because it is too hot in the foundry itself to make calls.

KonectaUSA

- Founded in 2015, with headquarters in Minneapolis, Minnesota
- Leading cellular live-inside provider installations and service provider
- Services include design, installation, and maintenance
- Customers include education, hospitality, healthcare, and FORTUNE 500 companies

A Cel-Fi QUATRA Network Unit (NU – the head-end of the active DAS hybrid) was installed to deliver Verizon and AT&T signals to four Coverage Units (CUs – the internal antennas that rebroadcast the signal inside the building). Three CUs provide coverage to the offices, including one CU that is cabled to two passive dome antennas for a cost-effective solution to feed signal to the cafeteria where the vending machines were located. The fourth CU was used to cover the large engineering area (50 x 100 square feet) with cinder block walls.

"With other products, we would definitely have needed two, maybe even three, coverage units for the engineering area," says Shortridge. "But Cel-Fi QUATRA performed really well with just the one coverage unit. It was impressive."

THREE BUILDINGS IN EIGHT DAYS

Next up was the 35,000 square foot, brick-exterior administrative building predominantly made up of offices, meeting rooms, and a cafeteria. There, KonnectaUSA installed one NU and four CUs that were placed in a typical square configuration to ensure coverage in each corner of the building. A wideband directional antenna on the roof provided the donor signal.

Once this was complete, Shortridge turned his attention to the metal services building. The 57,000 square foot shop area is used to cut metal, with 30 employees split over two shifts to do this work. It also housed a vending machine. Here, one NU and four CUs also did the trick. Now, employees working in shipping and receiving can communicate more easily with truck drivers trying to pick up or deliver materials.

In total, it took Shortridge's cabling crew only eight days to complete the installation in all three buildings.

"It was a seamless and non-disruptive installation process," says Bruha. "We were able to continue production without interruption."

REALIZING BUSINESS BENEFITS ACROSS THE BOARD

Charter Dura-Bar now has a separate, secure network to handle vending machine orders. Operationally, the company has seen a number of operational benefits. Pre installation readings went from -120 and -110 to post installation readings of -85 and -75 throughout the different buildings, and capacity is no longer an issue—every employee now enjoys coverage. This has come with some unexpected, but welcome, benefits.

"One of our employees received a text from her child's school while she was at work, and she was able to see it and deal with it immediately," says Bruha. "That simply wasn't possible before. Our employees are very much enjoying this soft benefit, and morale has definitely improved."

It has also eased the burden of IT management on the Charter Dura-Bar team, who estimate they've saved several hours a month from not having to manage the previous solution, or employees' expectations around coverage.

"Our president was behind this 120% and is beyond thrilled with Cel-Fi QUATRA," says Zeitler. "He understands the impact it has on the business and is so very appreciative."