

CASE STUDY

LA-RICS's FirstNet Network Planning and Deployment



About FirstNet™

On February 22, 2012, Congress signed into law The Middle Class Tax Relief and Job Creation Act, which created the First Responder Network Authority (FirstNet). Its mission, "to build, deploy and operate the first high-speed, nationwide wireless broadband network dedicated to public safety," aims to provide a single interoperable platform for emergency and daily public safety communications across the country.

To facilitate this goal, FirstNet was allocated broadband spectrum in the 700 MHz band, while The National Public Safety Telecommunications Council and the FCC endorsed the 3GPP Long Term Evolution (LTE) standard as the technology of choice for this network.

FirstNet's strategy is to develop communication network models that leverage existing telecommunications infrastructure and assets across the nation, to cost-effectively design, develop, test, analyze and optimize the performance of this new advanced wireless network. To this end, FirstNet is involved with several government agencies and organizations that provide "direction, governance, advice, leadership and technical support" to accelerate the successful achievement of its mission.

LA-RICS

The Los Angeles Regional Interoperable Communications System (**LA-RICS**) is a Joint Powers Authority formed and operated by the County of Los Angeles and 23 municipalities. It owns, operates, and maintains a new communications systems network that "vastly improves radio and broadband communication for police, firefighters, paramedics and other emergency responders in Los Angeles County." LA-RICS members include the City and County of Los Angeles, 63 independent cities, two school districts, and UCLA. It is a network of 74 fixed and mobile transmission towers that allows fast video and data communications amongst first responders, emergency services personnel, and hospitals in Los Angeles County.

LA-RICS has replaced aging communication systems with two state-of-the-art networks dedicated for use only by emergency responders, and independent from commercial broadband services. According to their website, "The Public Safety Broadband Network (PSBN) provides police, fire and emergency response agencies with secure and rapid data transmission for video, pictures, two-way voice communications, and other software applications which improve situational awareness. The LA-RICS LTE system complements its new Land Mobile Radio (LMR) infrastructure to provide a dynamic network solely for public safety, significantly improving interoperable communication between agencies during large-scale emergencies."

The LA-RICS coverage area includes airports, seaports, schools, hospitals, utility companies, and other critical facilities and infrastructure. The network is currently the largest public safety broadband network in the United States, with the ambition to become United States' western hub for public safety.

In order to achieve their lofty goal of a reliable public safety communications network, LA RICS investigated, analyzed, and selected advanced software, equipment, and services designed to optimize the inter-operation of multiple technologies within their existing vehicle and infrastructure sites. The task was complex, as it required the involvement of some of the leading RF equipment manufacturers and service test equipment providers, each offering various solutions and technologies to solve mounting obstacles. Significant challenges included topography complications among the required areas of coverage, and RF signal interference between existing LMR and multi-carrier LTE network channels.

CHALLENGES

At the outset, LA-RICS selected RF radio and router communications equipment from among the United States' industry leading manufacturers for the backbone of their 4G LTE and LMR networks. During the selection process, equipment manufacturers included supporting communications accessories as part of their overall equipment proposals, which included crucial components to the overall efficiency of the communications network, such as antennas and transmission line cabling products. Unfortunately, no additional validation or selection criteria were provided for the selection of these products at the time.

Subsequent evaluations by the LA-RICS technical team of engineers and technicians revealed various areas of concern, not only at the overall network planning level, but also about the quality and efficacy of some of the accessory products provided by equipment manufacturers, notably their antenna and cabling systems.

In addition to the high standards needed for individual antenna design and performance, LA-RICS was concerned with potential interference issues stemming from the use of multiple radio systems within a vehicle, each supported by different antenna systems. Despite the superior quality of communications equipment provided by OEM vendors, LA-RICS required additional technical support and expertise to address practical interoperability issues at the aggregate level (e.g., LTE and LMR network optimization).

To further complicate matters, LA-RICS soon identified potential accuracy and reliability problems with the Global Positioning Systems (GPS) tracking function, caused by poorly immunized GPS modules in the LTE

multi-band antennas provided with the communications equipment vendors. GPS performance was also susceptible to interference from various LMR antennas installed on each vehicle. None of the radio, router, or original antenna manufacturers offered guidance or direction on how to address these mission critical problems.

PCTEL VALUE ADDED SOLUTIONS

PCTEL holds a leading market share as a supplier of private-labeled, mission critical antenna products to public safety LMR OEMs worldwide. PCTEL is also a preferred supplier of broadband wireless and Internet

The PCTEL Proposal

During the initial interactions, LA-RICS and PCTEL discussed crucial antenna specific issues including:

- RF design efficiency and performance
- Product construction methods, durability, and reliability
- Mechanical installation restrictions and complexities
- Aesthetic considerations
- Budgetary restrictions

of Things (IoT) antenna solutions to the leading Wi-Fi and cellular router manufacturers around the globe. Market leadership, coupled with technological expertise in the convergence of LMR, broadband wireless, and GPS high rejection technologies distinguished PCTEL as uniquely suited to provide real antenna

solutions to LA-RICS's challenging FirstNet network deployments. Faced with serious concerns, and based on excellent past experience with the company, the agency invited PCTEL to present their technological perspective and expertise for the project.

After a thorough review of the LA-RICS system goals and challenges, PCTEL presented a comprehensive proposal that comprised cost-effective, "radio-agnostic" antenna solutions, coupled with expert RF system planning and installation support. The PCTEL offering would provide maximum RF system performance, enduring reliability, and future expansion flexibility, as required by LA-RICS.

PCTEL Antenna Solutions

PCTEL proposed its state-of-the-art Trooper™ platform for cellular 4G LTE coverage to connect the LA-RICS modems to the LTE system. The Trooper multi-band antenna platform houses optimally spaced 4G LTE elements for maximum signal throughput of video and data transmissions. This low-profile antenna offers multi-port 802.11ac MIMO add-in options for Wi-Fi/Bluetooth

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connectivity and support of vehicular hotspot networks. Its multi-band properties provide the optimal RF coverage of 4G LTE cellular communications required for next generation 911 and first responder operations.

For installation flexibility, the Trooper's narrow footprint easily accommodates placement restrictions on the ridged rooftops of popular police Ford Explorer Interceptor sport utility vehicles. The antenna is offered with black or white housing options to meet individual agencies' aesthetic requirements.

Trooper also satisfies public safety industry environmental specification requirements for vehicular applications.

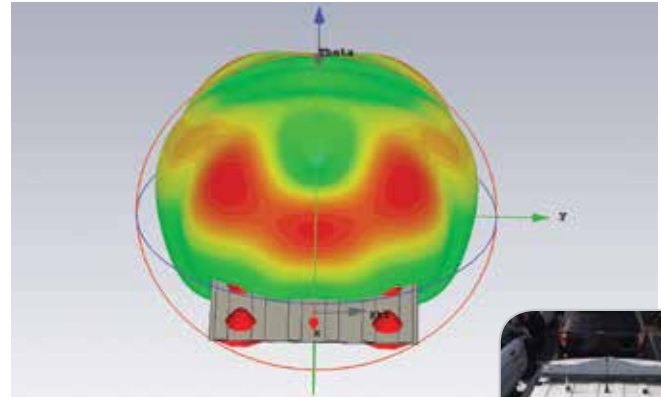
In addition, PCTEL offered ultra-wideband vehicular antennas. These platforms feature optimized radiation patterns to ensure that the RF energy is directed towards the desired area of coverage, regardless of the frequency of operation. These antennas are ready to install, requiring no additional field tuning. Performance and installation ease have made PCTEL's wideband antennas an industry staple for LMR mission critical communications.



Product images (trooper inside elements, chrome coil antennas)

High rejection GPS technology. PCTEL GPS multi-band antennas, including Trooper, feature PCTEL's proprietary high rejection technology that effectively prevents energy from nearby antennas from interfering with the performance and sensitivity of the GPS system. The result is reliable, precision tracking of vehicles and assets, even during RF intensive public safety operations.

RF Optimized Antenna Placement Layout Services. PCTEL provided RF modeling for optimized antenna placement on the rooftop of public safety vehicles. Each model suggested the best antenna placement for maximum system gain, radiation pattern symmetry, improved isolation among multiple frequencies, and overall network efficiency. The study included popular public safety Ford Explorer Interceptor sport utility vehicles.



(Simulation modeling images)



Photo courtesy of Los Angeles Sheriff's Department

Customization for Installation Efficiency and Quality Control. One of LA-RICS's principal concerns revolved around the preponderance of multiple coax cables leading to multiple antenna systems in a public safety vehicle. The leading cellular routers for 4G LTE communications could accommodate up to 8 antenna ports. In addition, new LMR radio equipment could accommodate 4 ports. LA-RICS also allocated extra antenna space for additional radio ports, for redundancy and technology "future-proofing" of its vehicles. As a result, any given public safety vehicle could have 16-20 cable connections, if equipment diversity were used. LA-RICS recognized the opportunity for costly installation errors, which could lead to system failure and removal of the vehicle from service, during emergency first responder operations.

To address LA-RICS's challenge, PCTEL provided two separate antenna colors to differentiate between the antennas supporting cellular LTE routers, and those supporting the LMR radio system. In addition, custom color coding and labeling by technology was added to facilitate installation process and expediency.



LA-RICS performed side-by-side comparisons of PCTEL's antenna products and the originally specified antennas. Their review revealed durability, construction, and RF performance shortcomings in the originally specified products that did not satisfy LA-RICS's mission critical requirements. In contrast, the RF and mechanical properties of PCTEL antennas, coupled with industry-wide brand acceptance and the company's preferred supplier designation among leading public safety OEM vendors, clearly positioned PCTEL as the superior antenna portfolio for FirstNet applications.

PCTEL successfully displaced other antenna suppliers by providing outstanding value in terms of product performance, technical support, and product customization flexibility. PCTEL's outstanding product warranty policy and competitive pricing complemented the overall value proposition.

Tournament of Roses Parade

In February 2017, a press release by the Los Angeles Regional Interoperable Communications System (LA-RICS) reported, "it helped 1,500 public safety officers from the City of Pasadena and the County of Los Angeles patrol and secure the Tournament of Roses Parade route by blending new technologies with trusted radio systems. 'We saw outstanding performance from the LA-RICS system at the Rose Parade this year, helping a broad coalition of public safety responders do their jobs more efficiently,' said John Radeleff, Interim Executive Director for the LA-RICS Authority. 'The long parade route, large crowds and high-profile event provide a unique challenge for public safety, and this network served as a key asset to help public safety fulfill its mission to keep the 750,000 attendees safe.'"

The press released added that the deployment for the 5.5-mile parade route included both fixed and mobile video cameras, which were monitored at mobile command stations and a central operations center. One hundred handheld, broadband-enabled devices were used by officers at the event, to help monitor video feeds, share pictures and text, and see location data for personnel and equipment. The advanced technology enabled a push-to-talk function which allowed responders to talk directly with each other regardless of which voice radio or data device was used.

The Los Angeles Sherriff Department confirmed that to date, thousands of PCTEL antennas have been installed in the LA-RICS fleets, operating in VHF, UHF, cellular data 3G and 4G LTE, and GPS bands encompassing 66 UHF T-band Sheriff Radio Channels.



Photo courtesy of County of Los Angeles Fire Department



Photo courtesy of Los Angeles Sheriff's Department



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