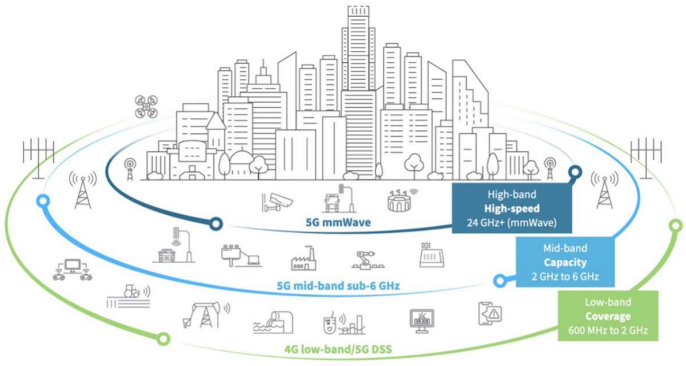
MILLIMETER WAVE VS. C-BAND IN PUBLIC SAFETY APPLICATIONS

Public safety agencies need the most reliable, robust, and resilient communications technologies possible for rapid response in the communities they serve. Today, thanks to 5G networks, first responders can stream video, share body camera footage, and keep in constant communication with their teams and dispatchers. 5G is increasingly becoming the backbone of public safety networks.

In this white paper, we'll discuss the differences between 5G frequency bands, as well as their benefits and applications. We'll share how to put in place a secure, resilient and robust solution that fits your budget.

Understanding 5G Frequencies and the Benefits of Each

5G — the fifth generation of cellular technology defined by the 3GPP standards organization — uses specific frequencies to provide faster data rates over an area. Three specific frequency bands known as high-band, mid-band and low-band make up the complete range of the 5G spectrum. For public safety applications, each frequency band has benefits and challenges. Each mobile carrier incorporates 5G differently. In the U.S., C-band is becoming the frequency of choice across the U.S.



High-band or Millimeter Wave (mmWave) 5G: High Speed but Short Range

In 2016, the Federal Communications Commission (FCC) opened large amounts of bandwidth in the high-band spectrum for 5G.[1] High-band 5G frequencies range from 24 GHz to 100 GHz, making it very fast (multi-gigabit per second speeds). But these high frequencies have trouble going through buildings and walls, making it useful only for short distances. As a result, mmWave works best in densely populated, confined areas such as sports stadiums.

Limited applications mean hardware and carrier support is somewhat limited and costly. If the industry can resolve mmWave signal range and building penetration issues, this band could enable new applications. Imagine, for example, if first responders could use virtual and augmented reality for situational awareness to better visualize the complete scenario.

Mid-band 5G (C-Band): Medium Range, Good Speed

The 5G mid-band operates between 2 and 6 GHz and provides a longer range than the mmWave band with good speeds in the Gigabit-per-second range. In fact, this is the most used 5G band because it offers the most value for the investment. In 2022, major carriers began expanding their C-band coverage[2] across the U.S. Although implementation differs among carriers, many incorporate C-band as part of their public safety network offerings.

Low-band 5G: Long Range, Slower Speed

The 5G low-band operates below 2 GHz. It does not have fast data transmission speeds and is very crowded with 4G LTE traffic. However, it is still commercially important because it supports legacy systems for basic data transmission applications.

Architecting a Public Safety 5G Solution

Over the past several years, 5G has not always lived up to the hype surrounding it. The promise of mmWave is still exciting, even with its current limitations. C-band, however, is very well established. In fact, in this section we'll share insights into key considerations for architecting a 5G solution that not only enhances first responder communications but also makes life easier for your IT team.

Here Comes the C-band

T-Mobile currently has the largest C-band coverage[3] of any carrier. Although Verizon initially invested in mmWave, it greatly expanded its C-band coverage in 2022. If fact, it now supports C-band 5G in 46 U.S. cities. AT&T is aggressively building its C-band coverage to serve up to 130 million people[4].

[1] Understanding 5G Spectrum Frequency Bands

[2] How C-Band is Jumpstarting AT&T and Verizon's 5G Experience

[3] 5G Bands Cheat Sheet

[4] AT&T quietly updates 5G coverage info amid mapping madness

When Fixed Wireless Access Makes More Sense Than Fiber

Fixed Wireless Access (FWA) is a method of providing high-speed broadband access using radio frequencies instead of fiber cabling. Because FWA includes 5G, it is fast, secure, and reliable enough to support public safety requirements. It is quickly gaining ground across North America as an alternative to fiber because of its relatively low cost and quick deployment. According to a report from GSMA Intelligence, by 2025, 64 percent[5] of all mobile connections will be 5G connections. Although C-band is getting a lot of interest, T-Mobile is looking at using mmWave for its fixed-wireless service in some high-demand applications[6].

Once you consider the time and costs associated with laying new fiber connections compared to adding FWA, you start to appreciate the benefits of fixed wireless access. According to Dgtl Infra, it costs up to $80,000[7] per mile and can take up to 10 months to install fiber cable. With a mid-band cellular connection, you can have a network up and running in minutes at a fraction of the cost. Especially in rural areas, FWA makes much more economical sense.

Reliable Connections for Public Safety

Whether your public safety application requires mobile connectivity or stationary connectivity for locations such as fire stations and precincts, your solution needs to include a failover strategy for reliability. As first responders perform mission-critical tasks, they should never rely on a single connection. Those located in areas with no fiber should work closely with partners like Digi to deploy solutions with dual SIM cards, supporting multiple carriers. That way, if one carrier goes offline, the other carrier can provide access and without disruption. Digi Transportation (TX) cellular router solutions offer multi-carrier support as well as other built-in features for persistent link connections to ensure reliability.

Digi Solutions for Emergency Response Connectivity

Whether you need an end-to-end solution or some networking gear to get your mobile command center up and running quickly, Digi cellular TX solutions are purpose-built for public safety vehicles and other mission-critical use cases. These solutions are designed for secure, redundant communications on all public safety cellular plans. And they can be readily managed from a precinct or command center with Digi Remote Manager®, Digi's cloud-based platform for command and control of deployed devices.

Equip Your Public Safety Communications with a Digi Connectivity Solution

Digi offers complete solutions to support the full range of public safety applications — from first responder vehicles to mobile command units, dispatch centers, and traffic management solutions — to ensure emergency teams can respond rapidly, and maintain communications even in the event of a large-scale public emergency.

- **Digi SAFE™** — A complete end-to-end connectivity solution designed specifically for emergency responder vehicles, including mission-critical connectivity and our remote management platform.

- **Digi Remote Manager®** — Digi's cloud-based remote management platform provides real-time remote visibility across the entire network. It uses a simple interface to help you manage, configure, deploy and troubleshoot your deployed Digi routers — wherever they are in the field.
    - **A "single pane of glass"** — Manage an entire network through a single screen
    - **Zero-touch deployment** — Configure hundreds or even thousands of devices remotely
    - **Real-time alerts** — Receive updates on device health for proactive network management
    - **Secure out-of-band access** — Access third-party routers, hubs and switches through a secure VPN and console

[5] North America Moves Steadily Towards Wider 5G, FWA and IoT Adoption

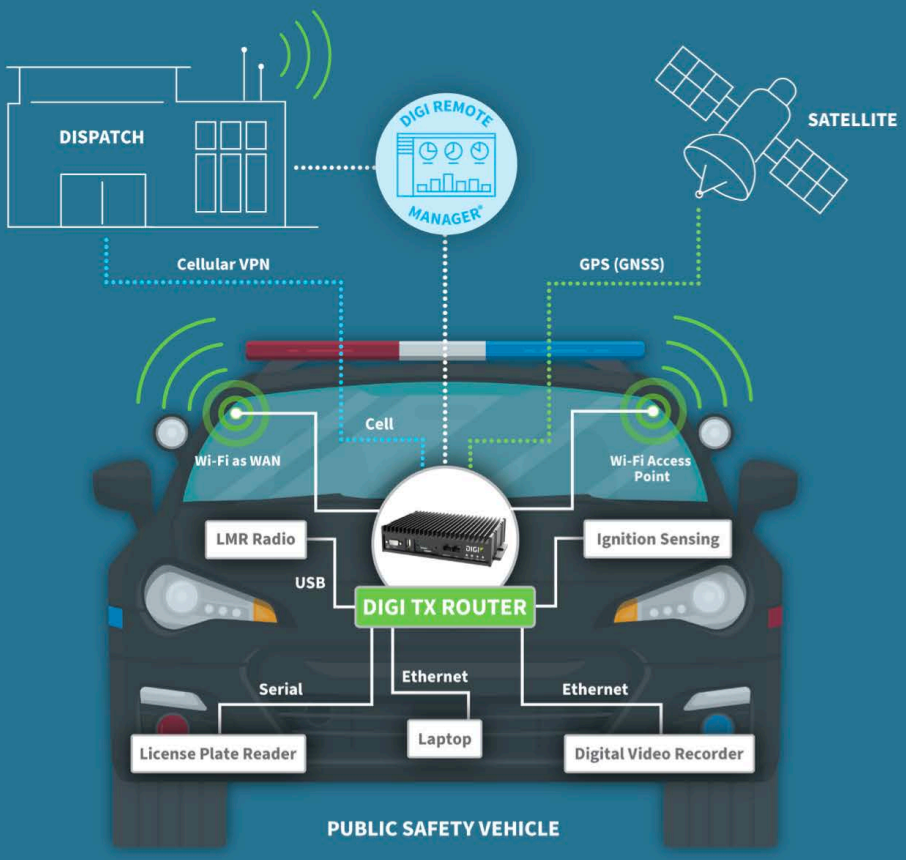
[6] T-Mobile Execs Open a Door to mmWave FWA

[7] Fiber Optic Network Construction: Process and Build Costs

- **Digi TX 5G/LTE Routers** — We designed these rugged transportation routers for extreme conditions, with dual SIMs for persistent connectivity
- **Digi TX40 5G Cellular Router** — Coming soon! Digi TX40 is a 5G wireless communications hub that connects all devices in a vehicle through a fast and reliable vehicle area network
- **Digi EX50 5G Cellular Router** — Cost-effective enterprise routers for use cases such as environmentally controlled mobile command units, with an extended temperature rating to ensure operation even in variable conditions, or if a heating/cooling system fails
- **Digi Professional Services** — Professional services to help you select, configure and put in place equipment appropriate for your carrier and purpose, as well as application development, training and other services to support rapid, successful deployments

Use Case: First Responder Vehicles

Software and Hardware That Work Together



Digi Remote Manager

At the heart of Digi SAFE™ is Digi Remote Manager®, the command center of your intelligent public safety network. Digi Remote Manager enables IT teams to monitor, manage and update devices in the field remotely. It facilitates the rapid deployment of cellular routers, and enables security and firmware updates.

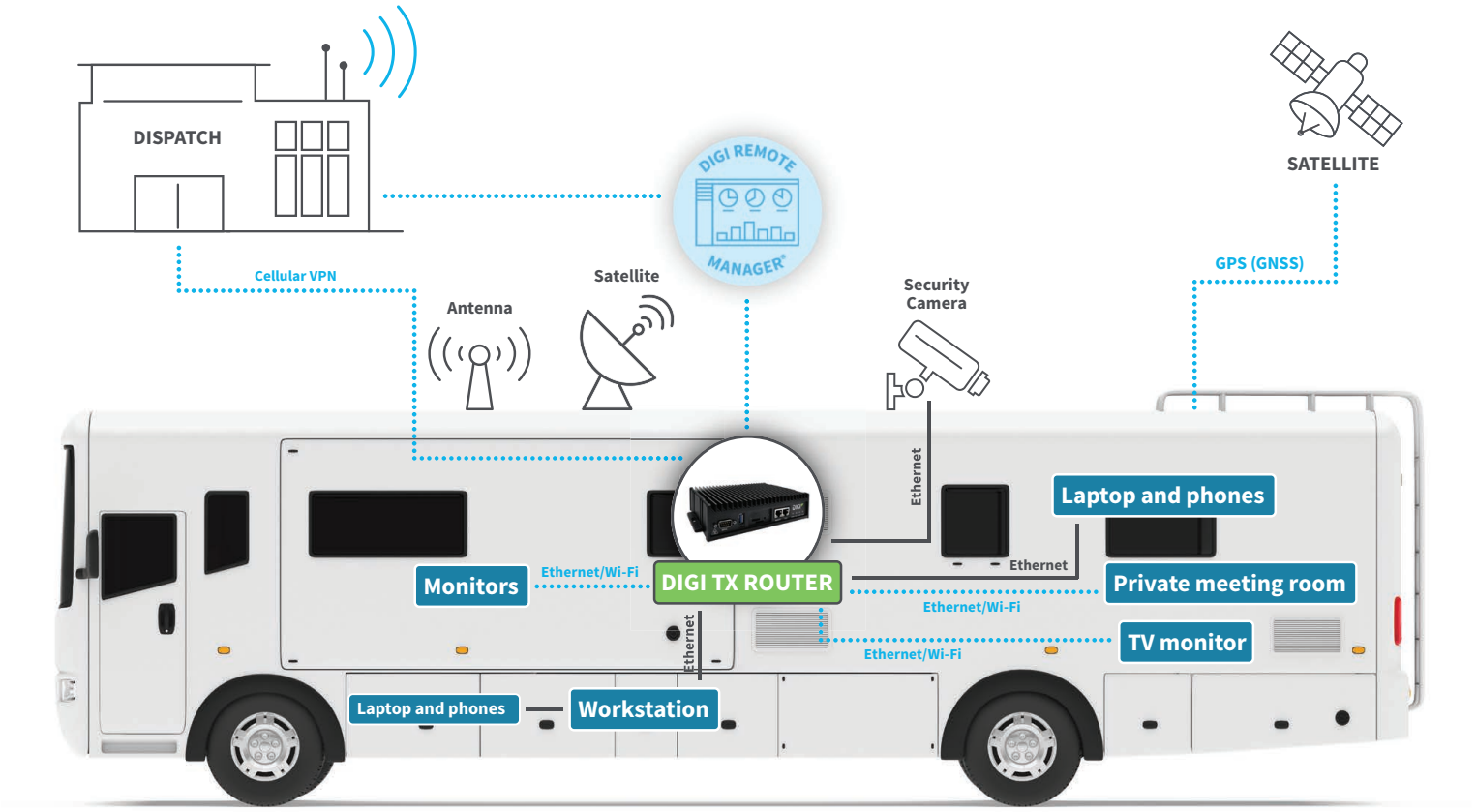
Digi TX Cellular Routers

Digi TX cellular routers are purpose-built for the challenging conditions encountered by public safety professionals in the field. They have IP64-rated hardened enclosures, are temperature rated for -34° C to +74° C, and they incorporate serial, USB, dual SIMs and more, for maximum integration flexibility.

Emergency vehicles require a range of connected devices, for everything from dispatch center communications to in-vehicle radios, radars, video equipment and smart devices such as tablets, cell phones and laptops. The challenge is that multiple systems require associated data plans as well as support from IT, which results in cost and complexity that challenges the lean budgets of public safety teams.

Dig-SAFE offers an all-in-one solution to meet these needs, with fast, secure and reliable connectivity and state-of-the-art software to ensure the security and performance of the network. Digi SAFE integrated hardware can withstand extreme conditions. The Digi-SAFE solution is easy to use and priced for widespread deployment by police and fire departments of all sizes.

Use Case: Mobile Command Vehicles



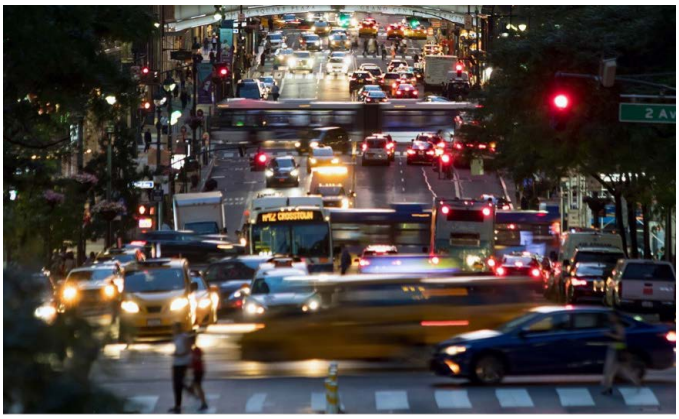
MOBILE COMMAND CENTER

Communication is the primary purpose of mobile command vehicles. These vehicles become remote command centers during emergency events. Whether it's in response to wildfires or rescue operations after a hurricane, these vehicles can quickly create secure, robust communication networks for first responders.

These vehicles may be the only viable communication network in areas hit by disaster. They must include everything necessary to communicate, including access to satellites, the Internet and phone systems. That means they host power, as well as racks full of servers and all the necessary networking equipment. They're climate-controlled lifelines for response teams, so the equipment needs to work well wherever the vehicle travels.

Digi-SAFE provides robust, high-speed, mission-critical connectivity and remote management in an all-in-one solution to support the needs of these mobile command units, wherever they need to operate.

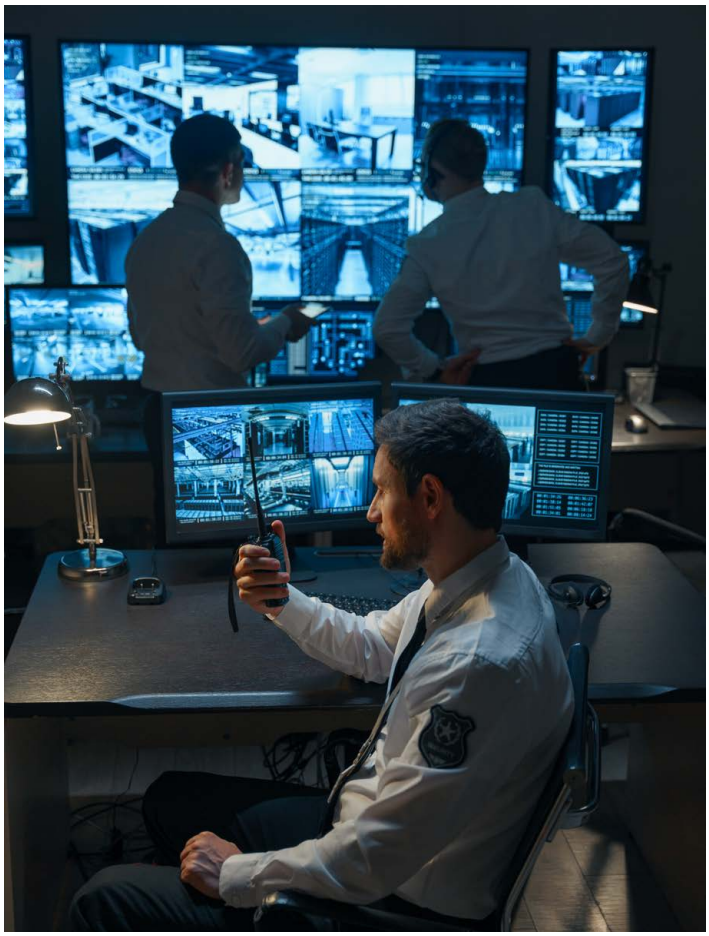
Use Case: Traffic Management and Public Safety



The New York City Department of Transportation (NYC DOT) manages one of the most complex transportation networks in the world. When it was time to replace its wireless infrastructure network, it selected FirstNet Ready™ Digi TX54 dual cellular routers and Digi Remote Manager.

Dedicated Digi experts assisted during system integration and deployment phases of the project. Onsite personnel worked daily with NYC DOT network engineers and contractors for a year. A Digi implementation engineer kept the project moving by coordinating planning, testing and troubleshooting.

This award-winning project[8] incorporated an AT&T wireless network with a dual-carrier design to maximize network connectivity and uptime. In the case of an outage, it automatically switches to a secondary carrier to provide 99.99 percent communication reliability. This massive deployment took just 9 months and stayed under budget. And today, the system seamlessly routes traffic to support better traffic flow, and rapid emergency response. Additionally, the entire deployment can be managed from the traffic management center with Digi Remote Manager.



Make Your IT Team's Job Easier

No 5G solution, whether mmWave or C-band, should be deployed without an IT partner. Yes, speed, cost and coverage are important. But what about network management, configuration, deployment, troubleshooting and security updates? Many public safety IT teams have little time to take on new projects. So, if you're implementing new 5G networking equipment, why not partner with your IT team on a network management strategy?

Instead of having to touch and program every new router manually (a major time-consuming activity), a remote management platform allows your IT team to wirelessly configure any number of devices all at once with the touch of a button. That is going to save time, energy and money. It's also going to make the IT team's job a lot easier.

Work with Digi to Upgrade Your Emergency Communications

Communication is at the heart of public safety operations. Yet tight budgets mean making tough decisions around technology solutions, including IT. That's why your public safety mmWave or C-band 5G implementation requires a plan.

Let Digi help your team upgrade to next-generation connectivity seamlessly and cost-effectively. Digi supports the full range of connectivity requirements for the public safety industry with all-in-one solutions. Connect with us for secure, always-on solutions that are easy to configure, deploy and manage. Take the next step to learn how we can become your public safety technology partner.

Next Steps

- Ready to talk to a Digi expert? Contact us
- Want to hear more from Digi? Sign up for our newsletter
- Or shop now for Digi solutions: How to buy

[8] NYC Intelligent Transportation Project Wins ITS-NY Award, Advancing ITS

Why Digi?

Digi is a complete IoT solutions provider, supporting every aspect of your project, from mission-critical communications equipment to design and deployment services to get your application designed, installed, tested, and functioning securely, reliably and at peak performance.

Digi builds its products for high reliability, high performance, security, scalability, and versatility so customers can expect extended service life, quickly adapt to evolving system requirements, and adopt future technologies as they emerge. Digi embedded modules, routers, gateways, and infrastructure management solutions support the latest connected applications across verticals, from the enterprise to transportation, energy, industrial and smart cities use cases.

Our solutions enable connectivity to standards-based and proprietary equipment, devices, and sensors, and ensure reliable communications over virtually every form of wireless or wired systems. Our integrated remote management platform helps accelerate deployment and provide optimal security using highly efficient network operations for mission-critical functions such as mass configuration and firmware updates, as well as system-wide monitoring with dashboards, alarms, and performance metrics.

Company Background

- Digi has been connecting the “Internet of Things” — devices, vehicles, equipment and assets – since 1985
- Digi is publicly traded on the NASDAQ stock exchange: DGII
- Headquartered in the Twin Cities of Minnesota, Digi employs over 800 people globally, and has connected over 100 million devices worldwide

As an IoT solutions provider, Digi puts proven technology to work for our customers so they can light up networks and launch new products. Machine connectivity that’s relentlessly reliable, secure, scalable and managed — and always comes through when you need it most. That’s Digi.

Learn more on our About Digi page.

Contact a Digi expert and get started today

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