Property Owners, Developers, Operators

In-Building Public Safety Communications Toolkit

"The last thing I expected was a $$$$ last minute change order!"
— Anonymous Property Owner

COMMDEX

SAFER BUILDINGS COALITION™
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What's inside: Why should I read this?

In-Building Public Safety Communications requirements are among the newest and most critical compliance elements in fire and building codes. This document gives you clear information about:

- What is the threat that these requirements address?
- What are the risks associated with non-compliance?
- The technology required to achieve compliance, and how it shares many common elements with building. communications, building automation, and "Proptech."
- The importance and advantages of developing a Wireless Infrastructure Master Plan.
- Myths, Truths, and Best Practices.
- Essential Recommendations.

A team of volunteers from the Safer Buildings Coalition created this toolkit to:

1) Make a statement that we, the SBC members, want to join the community of professionals working together to make successful and safe properties.

2) Help the property stakeholder ecosystem meet federal, state, and local in-building public safety communications regulations and requirements without wasting dollars or time.

3) Build a bridge together to a digitally integrated in-building communications future.

Special thanks to those who contributed to this guide, including:

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Lisa Jardine
Ron Schachter

Historically, developers and property owners

only needed to supply electricity, plumbing, and heating to workplaces, leaving tenants to design their offices to their own technical specifications.

Today, commercial builders need to meet rapidly evolving connectivity demands for advanced occupant and visitor applications and use cases.

Public safety and cellular communications are two of the most critical requirements. Building owners also need to account for innovative technologies that have not yet been invented and be future-ready for elements we cannot yet envision. It all starts with a well-executed, comprehensive plan.

80%

of wireless data traffic originates or terminates within a building.

Source: CommScope and Coleman Parkes

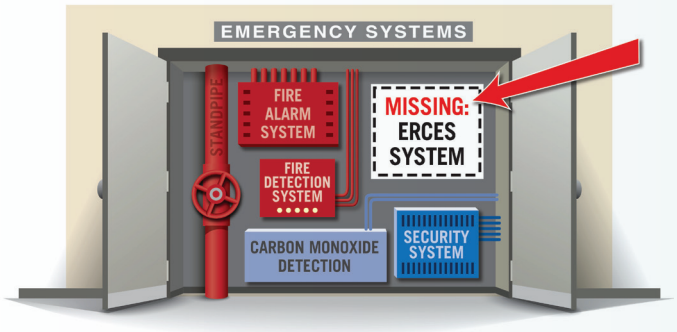
3 Pillars of In-Building Public Safety Communications

Don't let this happen to you...

Your new building received sign-off on all inspections from construction to plumbing, elevators to electrical. The walls and ceilings are closed and painted, the carpets installed, and your tenants have moved in. But there's one critical system you've failed to account for; code-mandated public safety communications. Without it, your Certificate of Occupancy, building open date, and final budget are in jeopardy.

In this unfortunate scenario, the building owner will need to raise additional funds, now inflated, due to the additional effort to install a system in finished spaces. If supply chain issues are a concern, the cost to expedite material might be necessary to move the project forward, increasing the price even more. The Authority Having Jurisdiction (AHJ) over the in-building public safety system may have considerable testing and filing requirements. The property owner's anticipated ribbon-cutting ceremony may now be months away.

If the building owner had the information they needed before the project began, the situation described above would be entirely avoidable.



The Missing System

This guide is designed to broaden your knowledge of an Emergency Responder Communication Enhancement System (ERCES).

The Solution: Emergency Responder Communication Enhancement Systems (ERCES)

The most important thing to know about in-building public safety systems is that first responders use them to communicate with one another inside and outside a building in an emergency. In fire and building codes, such a system is called an Emergency Responder Communication Enhancement System (ERCES). ERCES provides clear communication so that first responders can efficiently and effectively do their jobs. In larger and denser buildings, public safety communication devices wouldn't work without an ERCES that distributes the signal throughout the building, especially where signals typically get lost, like stairwells, elevators, and below grade.

Buildings serve many of society's most primal needs, including shelter and safety. Building owners are responsible for providing a safe and secure environment to their tenants and first responders in an emergency. First responders depend on handheld radios, smartphones, and other wireless devices to do their job. The radios they use to communicate rely on radio frequency (RF) signals. When wireless radio frequency signals pass through any material, they lose strength, and when the RF signal levels are too weak, communication becomes unreliable or ceases to exist.

Modern building design and construction techniques, especially those required to satisfy LEED-certified building designs, make it difficult or impossible for the local public safety jurisdiction to provide reliable communication coverage for first responders operating inside many buildings. Throughout most of the country, ERCES help ensure the safety of building occupants and first responders by extending the range of the public safety communications systems throughout the building.

The FCC refers to the special amplifying equipment used in ERCES as Signal Boosters. A network of indoor antennas strategically located throughout the building provides reliable public safety communications coverage. Collectively, these systems are known as Distributed Antenna Systems or DAS. In addition to the DAS solution, some jurisdictions have adopted repeater-based solutions such as ARCS in NYC.

While public safety communications typically use private frequency bands licensed to jurisdictions by the FCC, ERCES could also include the nationwide public safety broadband network supported by the FirstNet Authority and other broadband commercial carrier networks if they are in use by public safety agencies in a jurisdiction. These systems can utilize directly connected or over-the air solutions when required by a jurisdiction.

DAS systems must be designed, installed, maintained, and monitored by qualified personnel to ensure they meet the coverage reliability requirements of the NFPA and the IFC enforced in the local jurisdictions. The Federal Communications Commission (FCC)'s rules govern ERCES to ensure these systems do not cause unintended harmful interference to existing public safety radio systems or other users of the RF spectrum licensed by the FCC. These are covered under FCC Signal Booster Rules in section 90.219.

Systems Integrator Qualifications Checklist:

- [ ] Brings a combination of program management, technical, and regulatory expertise.
- [ ] Has provided ERCES for at least five years.
- [ ] Has NICET certification.
- [ ] General Radio Operator License (GROL).
- [ ] Predictive RF Design Software Certification, such as from iBwave or others.
- [ ] Training and Certification from Test Equipment and Manufacturers.

There are two main types of DAS systems...

Passive DAS

A signal source feeds a passive antenna network to redistribute the signal. The signal source is often a Bi-Directional Amplifier (BDA) that amplifies an Over the Air signal. A passive DAS has limited coverage and capacity scope and usually takes its RF signal source from a donor cell or public safety radio tower.

The public often experiences similar needs with their commercial wireless systems. Increasingly, in-building and in-tunnel communications are critical concerns for public safety agencies and wireless providers as reliable coverage in those environments is particularly challenging. If the public cannot reach 911 due to poor cellular coverage, public safety cannot respond to the emergency. Therefore, cellular communications should be addressed with system enhancements to ensure the safety of the tenants, employees, and general public. Occupants of the building must be able to text and call 911 and receive mass notifications from within the building, regardless of where they may be located. It is the building owner's responsibility to ensure these critical communications can happen when a crisis arises.

Active DAS

An active DAS system uses fiber optic cable to distribute signals between the signal source and "remote nodes" placed around the building. The signal source can be a BDA or Base Station, depending on the size of the building. An Active DAS provides more extensive coverage and capacity and is more scalable. Many larger buildings such as stadiums, university campuses, hospitals, and office buildings are Active DAS systems.

Did You Know?

You need written permission from the FCC to rebroadcast license frequencies. Failure to do so can cost you $$$.

4 Public Safety Facts

1. The building owner IS responsible for providing public safety communication coverage where the code enforces it.
2. First responders use cell phones and data devices too.
3. WiFi is NOT sufficient by itself.
4. Risk management and legal liability are real. A DAS is less costly than a lawsuit.

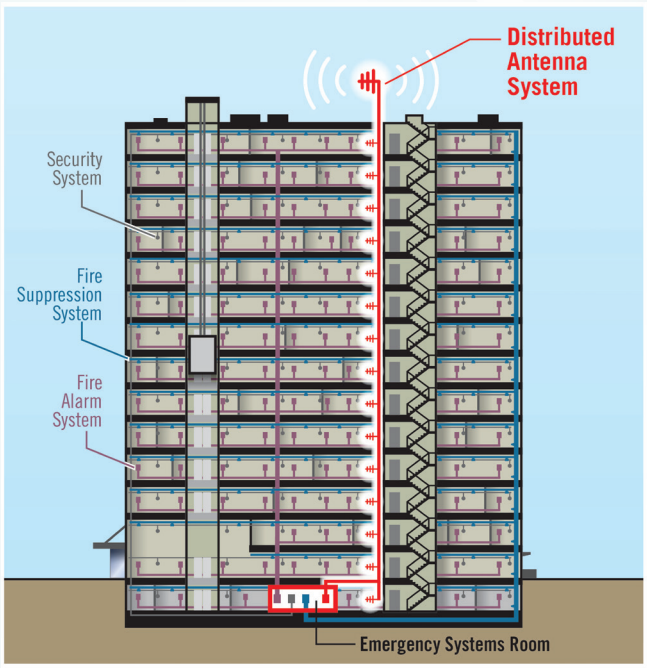
Telecommunications Infrastructure... Do you have a Wireless Infrastructure Master Plan?

Ensure your building provides voice services, ubiquitous wireless service for the first responders, cellular service, IoT, and next generation of wireless services.

Property owners are expected to provide sophisticated technologies to stay ahead in a highly competitive real estate market. It is advisable they take a holistic view of the building technologies, subsystems, and devices across a common building infrastructure. Often, general contractors (GC) have devalued network infrastructure as the systems are expensive and often not detailed in the initial specification documents. Going over budget is a critical error for a GC, and if the systems are not called out in the specification document, the GC will not include them in the bidding process.

The POEM Principle (Pull Once Enable Many) is the most comprehensive and cost-effective methodology. This cross-disciplinary approach will ensure the risers have adequate pathway, fiber, power, and space for current and future needs. Further, there are both fire-rated and non-fire-rated pathways, and these will support multiple structured cabling systems within a building, including fiber and coaxial category cable options.

The truth is wireless systems require a lot of wire. Moreover, numerous systems require varied cable types. In new construction, it is vital to designate pathways before risers close. In existing buildings, a critical examination of the infrastructure is required. The risers in older buildings will often require removal of abandoned cabling before the new infrastructure is installed.



In today's buildings...

...low voltage infrastructure plans include diverse building and communication systems that are converged or migrated to the building network. The property owner should include a wireless framework in the master plan.

Organizations such as WiredScored and TIA have created guidelines for the landlord; however, a proper building evaluation by an RCDD specializing in technology solutions and system design is vital to ensure the building cable pathways are designed for today and into the future.

GLOSSARY of Terms and Concepts

Codes and Standards

In the case of an emergency, all buildings must support wireless communications for first responders, such as the police and the fire departments. The International Fire Code (IFC) requires full indoor coverage for public safety in all new and existing buildings or those undergoing significant renovation or expansion to obtain a Certificate of Occupancy*. In addition, each municipality requires a unique configuration for public safety radio. These Public Safety DAS must meet either/or IFC and NFPA codes.

AHJ: Authority Having Jurisdiction

There are tens of thousands of AHJs across the United States. It is important to note that not every AHJ is the same in every jurisdiction. The AHJ can range from the radio shop, fire marshal, fire department, and sheriff's department to the inspector that provides the final sign-off on the system for the building to achieve occupancy permission. Some AHJs work with you independently on these systems, and some work together to create a compliant system to please all parties involved.

Each one can interpret either IFC or NFPA codes differently. The design, installation, commissioning, and testing of a DAS System must meet their interpretation to get the ERCES approved. It is strongly recommended to reach out to the AHJ early in the project to prevent delays during the approval process. Many delays result from alarming, cable pathway protection, battery backup, and insufficient RF coverage in critical areas such as stairwells, boiler rooms, and stairwells.

License Holder

The FCC is responsible for managing and licensing private radio frequencies (wireless spectrum) for commercial and non-commercial users, including state, county, and local governments. This includes public safety, commercial and non-commercial fixed and mobile wireless services, broadcast television and radio, satellite, and other services. In licensing the spectrum, the Commission promotes efficient and reliable access to the spectrum for various innovative uses and promotes public safety and emergency response.

www.fcc.gov/licensing-databases/licensing

System Integrators

System Integrators are traditionally engineering and installation companies specializing in ERCES. They typically work with the electrical contractor and provide the parts and smarts for a complete ERCES, including design, project management, and testing. When choosing a systems integrator, select one with design software-certified RF engineers who are experienced with in-building design and construction/installation standards and processes. iBwave and RANplan are the two industry-standard propagation tools that simulate how an in-building wireless system should function. Look for an integrator with experienced construction project managers with an understanding of the principles of RF propagation. They should be well versed in NFPA, IFC, and electrical building codes required for in-building systems in public safety and cellular enhancement. System Integrators may turnkey the entire project, or provide parts and smarts to a local installation contractor. System Integrators work with the local AHJs to understand and incorporate the requirements of each system to give the building owner a code-compliant system.

* Local jurisdictions may modify model code requirements.

Time is Money

The ideal time to plan and implement an ERCES is before construction has begun. Incorporating planned cable routes into the building will ensure an expeditious installation and implementation. Unfortunately, many building owners are unaware of the mandated requirements for these systems and often learn about them after the building has been designed and construction has begun. Installing an ERCES before the ceilings close is advised if that is the case. It is recommended to include the design team in the initial planning stages for high-end projects, as they will have input regarding the antenna locations and physical attributes. Often, they get involved after the preliminary design is created and filed with the AHJ. Their changes can trigger the need for a Post Approval Amendment (PAA), which can delay the approval process considerably.

Common Acronyms

AHJ: Authority Having Jurisdiction
BDA: Bi-Directional Amplifier
DAS: Distributed Antenna System
ERCES: In-Building Emergency Responder Communication Enhancement System
IFC: International Fire Code
NFPA: National Fire Protection Association
RF: Radio Frequency

Myths, Truths, and Best Practices

Myth: Codes and standards are the same in every jurisdiction.

Truth: There may be additional requirements such as published documents or bulletins from the AHJ outlining their interpretations of the international codes. In this case, we must adhere to the AHJ's interpretation of the code stated in their published documents.

Best Practice: Know your AHJ and its standards before you install a system.

Myth: Once this system is installed, I do not need to stay up to date on annual inspections as I do with the Fire Alarm system.

Truth: IFC and NFPA codes state that you are required as a property owner to maintain the system by having an annual inspection. Many factors could affect your system after installation without your knowledge and delaying maintenance could be costly to you.

Best Practice: Schedule your annual inspection at the same time as your Fire Alarm inspection. Keep up with your annual inspections to ensure compliance with code requirements and eliminate any possible negligence fines.

Myth: Anyone can implement these systems.

Truth: We can't emphasize enough how important it is to use skilled and experienced RF engineers and installers to design, install and test these systems. It is the only way to guarantee that the system you install meets the local jurisdiction's requirements and works in an emergency.

Best Practice: Compare Bill of Materials to verify that the same equipment is quoted and ask the systems integrator for their credentials, which should consist of the following: manufacturer's certification, design certification, test equipment certification, General Radio Operator License (GROL), and a history of work performed in corresponding jurisdictions. NICET (www.nicet.org) has created a brand-new certification regime for in-building public safety communications. NICET certification is highly recommended.

Myth: If you have a well-designed system, it will operate flawlessly.

Truth: A properly designed system is an excellent start to building a DAS; however, you need a strong installation team to install the components of the DAS correctly, including connectors, couplers, jumpers, and antennas. It should be noted that while coaxial cable looks very strong, tough, and resilient, it is fragile and can easily be damaged. Poor connector terminations, kinks to the cable, tight bends of the cable, or screws in the cable will damage it and affect the system's signal. A strong installation team will find all defects in the system, fix them, and ensure that the DAS works flawlessly. Additionally, the team that is commissioning (programming) the DAS needs to have a thorough understanding of RF principles and how to operate the RF test equipment to assure the DAS is operational and does not cause harmful interference.

Best Practices: Take a look at the acceptance test documentation provided by the integrator to ensure all tests are passed. Any issues that barely pass this acceptance test will be caught during annual inspections.

6 Impacts of Waiting Too Long to Plan for an ERCES Project:

1. Material price increases
2. Significant construction cost increases
3. Product availability
4. Additional design cost due to lack of early-stage coordination
5. Rated pathways
6. NOT ABLE TO OPEN YOUR BUILDING

6 Essential Recommendations for Building Owners

1. Find out the current code requirements in your building's jurisdiction.
2. Select a qualified System Integrator Partner.
3. Do a baseline RF assessment of your building—know where you stand.
4. Consider future development of the site. (Will new buildings be added?)
5. New Construction:
   - Consider designing and installing conduit and pathways in advance.
   - Leave room for equipment if needed.
6. Be certain to obtain written authorization from the relevant FCC License Holder(s) for every frequency included in your system.

What Really Matters

Over the past few years, property owners have realized that they have to install a public safety system in their buildings. The public safety system is often not included in the initial budget, and the system's installation may cause more damage than they think to their building. Our goal is to inform the property ecosystem of what is required in the marketplace, how to install the correct system the first time, who are trusted partners to install the system, and why an ERCES is vital for your community.

5 Questions for Property Stakeholders to Consider

1. Can first responders communicate inside your building(s)?
2. Can your employees and customers in your building(s) reach and clearly communicate with 911 on their cell phones?
3. Do you have a mass notification emergency system?
4. Do you have a disaster recovery program for your property(s)?
5. Do you have a "smart building" strategy for energy, comms, security etc.?

Next steps...

Attend an In-Building Public Safety Communications Seminar

Located throughout the United States, these seminars hosted by Safer Buildings Coalition leadership, with subject experts from our sponsor members, this interactive seminar is based on model codes regarding in-building public safety communications systems. A typical agenda includes:

- Emergency Responder Radio Communication Systems (ERCES): General Requirements Review.
- The important role of the Frequency License Holder/Radio System. Administrator.
- Designing to minimize noise and interference.
- National and Local Code Requirements for Public Safety Radio Communications.
- Recent and Planned Code Updates - NFPA, IFC, Local Amendments.
- System Testing and Best Practices.
- Info about NICET Certification for Designers and Technicians Panel.
- Discussion, Local Town Hall and Q&A.

Attendance is free for enterprise property stakeholders including building owners, developers and operators. Find and register for an In-Building Public Safety Communications Seminar near you at saferbuildings.org/events.

Become a Member of the Safer Buildings Coalition

Join our mission to make successful and safe properties where critical communications can happen when needed most. As an Enterprise/End-user, your membership is currently complimentary, meaning there is no cost for you join us. By signing up you'll received access to important industry and code related updates, exclusive member resources, and more. Members in this category currently include Stanford University, The Cosmopolitan of Las Vegas, Hines, CBRE, and others. Learn more and sign up for SBC membership at saferbuildings.org/membership.

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WWW.SAFERBUILDINGS.ORG/BUILDINGS