



PUBLIC SAFETY DAS SYSTEMS

Code Requirements for Building Life Safety

INTRODUCTION

Reliable emergency responder communications are vital for protecting lives during crisis situations in buildings. Public safety personnel depend on two-way radio systems to communicate and coordinate response efforts. However, traditional radio systems often struggle to provide sufficient signal coverage inside buildings due to structural characteristics blocking or attenuating radio frequency (RF) signals. This can lead to dangerous communication lapses that compromise emergency response.

To address this critical life safety need, model fire and building codes now mandate that buildings have a signal booster system, commonly referred to as an emergency responder communication enhancement system (ERCES) or public safety distributed antenna system (DAS). These systems amplify the radio frequencies used by fire, police, and other public safety agencies to ensure reliable coverage throughout a building.

THE CRITICALITY OF IN-BUILDING EMERGENCY COMMUNICATIONS

During an emergency situation such as a fire, shooting, or other crisis, every second counts. First responders must be able to communicate seamlessly to quickly assess threats, deploy resources, coordinate evacuations if needed, and resolve the incident safely.

Lack of reliable in-building radio coverage can have catastrophic consequences. Communication blackouts or garbled transmissions can disrupt situation awareness, slow response times, hamper firefighting and rescue operations, and put both responders and building occupants at greater risk.

By contrast, a properly designed, installed, and maintained public safety DAS provides first responders with clear, uninterrupted radio signals no matter where they are in the building. This allows coordinated, informed decision-making and response, which can mean the difference between life and death.



CODE REQUIREMENTS FOR DAS/ERCES SYSTEMS IN BUILDINGS

Several model fire and building codes require ERCES or public safety DAS to be installed in buildings to provide adequate emergency responder radio coverage:

International Building Code (IBC):

- IBC (2021) Section 403.4.5 requires that in-building, two-way emergency responder communication coverage shall be provided.

International Fire Code (IFC):

- IFC (2024) Section 510.1 requires buildings over 12,000 square feet to have approved radio coverage for emergency responders within the building based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction. While 2021 is the latest version of the code, some jurisdictions may still be referencing older versions of the IFC code (2015, 2018, 2021)

NFPA 1 Fire Code:

- NFPA 1 (2021) Section 11.10.1 states: "In all new and existing buildings, minimum radio signal strength for emergency services department communications shall be maintained at a level determined by the AHJ. Where required by the AHJ, two-way radio communication enhancement systems shall comply with NFPA 1221."

NFPA 1225

- As part of the Emergency Response and Responder Safety Document Consolidation Plan (consolidation plan) as approved and amended by the NFPA Standards Council, NFPA 1225 is a combination of Standards NFPA 1061 and NFPA 1221. Even though NFPA 1221 has been consolidated into the new NFPA 1225 standard, some jurisdictions still reference NFPA 1221 standard versions 2016 and 2019.

Local Ordinances

- Many cities and counties have additional ordinances requiring ERCES / BDA systems. These ordinances are defined by the Authority Having Jurisdiction (AHJ). Specifications set by the AHJ are required and must be met.

So, the IFC, IBC, and NFPA codes all contain requirements that new and existing buildings must have adequate radio coverage for emergency responder communications, achieved through the installation of DAS or signal booster systems when needed. Customers investing in DAS systems must choose a qualified integrator with extensive knowledge of these codes to avoid legal issues, fines, and potential safety hazards. Furthermore, a knowledgeable integrator can advise on any necessary permits or inspections required by local authorities, saving customers time and potential headaches. By partnering with an experienced integrator, customers can have peace of mind knowing that their DAS system will meet all legal requirements and provide reliable, uninterrupted service.



KEY REQUIREMENTS GUIDING THE PUBLIC SAFETY DAS INSTALLATIONS

Recognizing the vital importance of in-building emergency communications, model fire and building codes such as the International Fire Code (IFC) and NFPA 1 have adopted strict requirements for ERCES/public safety DAS:

Personnel Certifications:

- IFC (2024) Section 510.5.3 and NFPA 1225 (2022) Annex A.3.3.115 require designers to have a valid FCC general radio operator license and Certification of in-building system training issued by an approved organization or approved school or a certificate issued by the manufacturer of the equipment being installed.
- NFPA 1225 (2022) Annex A.3.3.115 suggests that the RF system designer be certified in the new program developed by the National Institute for Certification in Engineering Technologies (NICET) for In-building Public Safety Communications.
- IFC (2024) Section 510.5.2 requires installers to be certified by the equipment manufacturer.
- NFPA 1225 (2022) Section 18.2.1 requires designer and installer qualifications to be submitted with the design for approval by AHJ and frequency license holders.

Design Requirements

- NFPA 1225 (2022) Section 18.2.1 requires the system design to be approved by the AHJ and frequency license holder(s).
- IFC (2024) Section 510.1 and NFPA 1225 (2022) Section 18.8 require the ERCES systems to provide coverage in critical areas (99% floor area) and general areas (95% floor area) for emergency responder communications on all floors.
- NFPA 1 (2022) Section 11.10.7 requires the inbound signal strength to be a minimum of -95 dBm throughout the coverage area and sufficient to provide not less than a delivered audio quality (DAQ) of 3.0 or an equivalent signal-to-interference-plus-noise ratio (SINR) applicable to the technology for either analog or digital signals.
- NFPA 1225 (2022) Section 18.9.3 requires that the maximum uplink RF noise (noise crown) created by any signal booster booster-based ERCES shall not raise the noise floor at the public safety communications site closest to the ERCES or any receiving site within the public safety communications network that the ERCES is intended to operate with.



- IFC (2024) Section 510.5.1 (2024) requires components to be installed in NEMA 4-rated enclosures.
- IFC (2024) Section 510.4.2.4, NFPA 1225 (2022) Section 18.3.3.2, 18.10 requires that where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20dB greater than the system gain under all operating conditions.
- IFC 510 (2024) Section .4.2.8 and NFPA 1125 (2022) Section 18.3.4 require sufficient antenna density to address reduced gain conditions and minimize the "near-far" effect unless all portable devices use active power control.
- IFC (2024) Section 510.4.2.4 and NFPA 1225 Section 18.4.1 (2022) require systems to be capable of all radio frequencies assigned by the AHJ. In addition, section 18.11.2 requires the capability for modification or expansion of frequency changes if required by the FCC or other licensing authority or if additional frequencies become available. (IFC 510 (2024) Section .4.2.6, NFPA 1225 (2022))
- IFC (2024) Section 510.4.2.3 and NFPA 1225 Section 18.13.2 (2022) require dedicated 12-hour standby batteries or 2-hour standby batteries connected to the facility's generator system.

Installation Requirements:

- IFC (2024) Section 510.5.1 and NFPA 1225 (2022) Section 18.3.3 require the donor antennas to be permanently affixed and should not be moved from the approved location without AHJ approval.
- IFC (2024) Section 510.4.2.6 and NFPA 1225 Section 18.6.1 (2022) require FCC certification for signal boosters/amplifiers.
- IFC (2024) Section 510.5.5 requires FCC compliance for installation, components, and mitigating interference.
- In non-sprinklered buildings, in buildings that are partially protected by a sprinkler system, or in heavy timber construction buildings, NFPA 1225 (2022) Section 18.12.3.4 requires a fire-resistance rating of the protected areas to match the rating requirement for the primary structural frame. However, NFPA 1225 (2022) Section 18.12.3.3 allows backbone cables and backbone cable components installed in buildings that are fully protected by an automatic sprinkler system in accordance with NFPA to not have a fire-resistance rating.



- NFPA 1225 (2022) Section 18.12.3.5 requires the backbone cables and distribution antenna cables that are run in a fire-resistant enclosure or protected area (1) connection between the backbone cable and the distribution antenna cables be made within an enclosure or protected area, and (2) passage of the distribution antenna cable in and out of the enclosure or protected area be fire-stopped to an equivalent rating of the enclosure or protected area.
- NFPA 1225 (2022) 18.4 requires Lightning Protection installed per Article 820 of NFPA 70.

Testing

- NFPA 1225 Section 18.9 (2022) requires signal strength and quality requirements (minimum Delivered Audio Quality (DAQ) 3.0 for downlink and uplink.
- NFPA 1225 (2022) Section 20.3.10 defines the initial acceptance testing requirements for DAQ, gridding each floor, and documentation.
- NFPA 1 (2021) Section 11.10.11.1 requires systems to be tested using two portable radios (enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications systems), simultaneously conducting subjective voice quality checks (DAQ) in each grid on each floor.
- IFC (2024) Section 510.5.4 requires an acceptance test procedure with specific requirements for verification of coverage.

System Monitoring & Testing:

- IFC (2024) Section 510.4.2.5 requires monitoring by the listed fire alarm control unit or audible signal at a constantly attended location.
- NFPA 1225 (2022) Section 18.14.1, IFC (2024) Section 510.4.2.5, items 1-8, requires that the system must interface with a fire alarm for supervisory signal monitoring per NFPA 72.
- NFPA 1225 (2022) Section 18.14.2 requires a dedicated annunciator in the fire command center to monitor system status.
- NFPA 1225 (2022) Section 17.1.2.2 requires the primary and secondary power sources supplied to all required circuits and devices of the system to be monitored for integrity.



MAINTENANCE & SERVICE REQUIREMENTS

Like any life safety system, public safety DAS requires ongoing maintenance and service to ensure reliable emergency communications when needed most.

- IFC (2024) Section 510.6.1 and NFPA 1 Section 11.10.3 (2021) require annual inspection and testing, as well as after structural modifications.
- IFC (2024) Sections 510.5.4 and 510.6.1 require annual inspection, testing, and maintenance.
- NFPA 1225 (2022) Section 18.6 requires non-public safety services to ensure that the coverage and performance of the public safety communications channels are not degraded by interference. IFC (2024) Section 510.6.3 requires correction or removal of interference from non-public safety amplification systems.

By fully complying with code requirements for installation, monitoring, maintenance and personnel certifications, building owners can have confidence their public safety DAS will deliver clear, uninterrupted emergency responder communications every time.

CONCLUSION

The ability of first responders to communicate seamlessly during crisis situations is quite literally a matter of life and death. Public safety DAS provides the critical, code-mandated solution for achieving reliable in-building radio coverage. When properly designed, installed, tested, and maintained per codes and standards, these systems ensure first responders can communicate clearly to save lives.



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