Fire Prevention and Community Risk Reduction Division

A Guidebook for Contractor's for permit application

Submittals, reviews, and inspections.

Emergency Responder Communication Enhancement Systems

This is not an all-inclusive list of requirements; this shall serve as a general guide. All projects must be in accordance with the Poudre Fire Authority adopted fire code and all adopted amendments per City of Ft Collins, Town of Timnath, Larimer County and Weld County.

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PURPOSE

This guidance document has been developed to provide the highest level of service to the customers of the Poudre Fire Authority (PFA). The major goal of plan reviews is to ensure the design of Emergency Responder Communication Enhancement Systems (ERCES) meet the minimum requirements of the adopted codes, standards, and ordinances. To meet this goal, the submitted plans and supporting documentation must contain the information needed to conduct a thorough review.

SCOPE

This document outlines the requirements set forth in the adopted International Fire Code, local amendments, and department policies as they relate to the installation of ERCES. This document is not intended to provide an all-inclusive listing of submittal and inspection requirements, as it would be virtually impossible to cover all situations.

TERMINOLOGY/DEFINITIONS

AHJ	Authority Having Jurisdiction
BDA	Bi-directional Amplification
DAQ	Delivered Audio Quality
DAS	Distributed Antenna System
dBm	Decibels referenced to 1 milliwatt
EPO	Emergency Power Off
ERCES	Emergency Responder Communication Enhancement System
FCC	Federal Communications Commission
FLH	Frequency License Holder
GROL	General Radiotelephone Operators License
IFC	International Fire Code
NFPA	National Fire Protection Association
NICET	National Institute for Certification in Engineering Technologies
PFA	Poudre Fire Authority
RF	Radio Frequency
SINR	Signal-to-Interference-plus-Noise Ratio
SCIF	Sensitive Compartmented Information Facility

APPLICABLE CODES AND STANDARDS

FCC Part 90.219
2023 National Electrical Code
2024 International Fire Code and local amendments.
2022 NFPA 72 Alarm Signaling Code.022 NFPA 1225 Standard for Emergency Services Communications
2023 NFPA 780 Standard for the Installation of Lightning Protection Systems.
2019 UL 2524 ANSI/CAN/UL Standard for In-building 2-Way Emergency Responder Communication Enhancement Systems.
Safer Building Coalition's *Complete ERCES Handbook*, first edition, by Alan Perdue, Mike Brownson, and John S. Foley, originally published 2023. *(*Hereafter *SBC Handbook)*

RESPONSIBILITY

Individuals and entities who own or manage structures that require ERCES pursuant to Section 510 of 2024 IFC shall be responsible for compliance with this regulation.

Poudre Fire Authority (AHJ) shall issue permits for the installation of ERRCS and Larimer County or State of Colorado (FCC License Holder) shall verify compliance with this regulation. The FCC License Holder or its designee will issue a Retransmission Authorization to Operate a Signal Booster pursuant to FCC Rules & Regulations, and the permit shall be renewed annually or the ERCES shut down.

GUIDELINES

I. APPLICABILITY

A. When required: All new buildings shall have approved communication coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems.

PFA does not have a blanket requirement that all new buildings be provided with an ERCES. Instead, a performance-based approach is utilized, based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building all new construction shall be tested, surveyed, and evaluated for proper coverage.

Most new buildings may not require an ERCES based on their size, construction materials and usage. Very large buildings, basements, low-E glass use, density of buildings and line of sight seem to be the biggest hindrance to signal strength.

Once the external skin of the structure is in place. The results of the testing will determine if an ERCES is required for that building. Any areas found to be deficient would be required to be provided with an enhancement system.

If a new or existing building is proposing to have a SCIF (Sensitive compartmented information facility) as part of building, it is strongly recommended to reach out to this office prior to submittal of plans for the SCIFs installation as installation can cause the building, or floor to require the system.

B. Existing buildings: Existing buildings other than Group R-3 that do not have approved in-building emergency response communications enhancement for emergency responders in the building based on existing coverage levels of the public safety communication systems, shall be equipped with such coverage according to one of the following:

1. Where an existing wired communication system cannot be repaired or is being replaced, or where not approved in accordance with Section 510.1, Exception 1.
2. All buildings exceeding 10,000 square feet and any Type V construction exceeding 15,000 square feet.

II. ADMININSTRATIVE REQUIREMENTS

A. Minimum Contractor Qualifications. In-Building Public Safety Communications (IB-PSC) Certification from the National Institute for Certification in Engineering Technologies' (NICET). Design Performance certification required for the design layout, stamped and at least a level II for installation. The designer shall hold an FCC GROL license. Documentation of the designers FCC license shall be provided with the submittal documents.

B. Code/Standard Editions. ERCES shall meet the criteria of the adopted IFC as amended, and all applicable requirements per the IFC adopted Referenced Standards.

C. **Permits/Inspections.** Required plan submittal with approvals and permits must be secured through PFA prior to the start of any work. Permitted work must be inspected by PFA and a representative of FLH.

Pre-wiring the ERCES prior to application for a permit is allowed. Please understand that this is done at your own risk. The installer assumes all risk for any changes required due to engineering of the system, plan review, changes in construction, etc. A request via email for pre-wiring must be received and approved prior to.

D. **Alternative Methods.** If special building conditions and/or restrictions exist that may prohibit any of the requirements set forth in this guidance document or the adopted codes and standards from being met, approval from PFA for an alternative means and methods (AMM) approach is required. The AMM must be approved before installation of the system begins.

E. **Revisions.** All revisions after approval shall be clouded and identified with a sequential number or lettering system. Revisions are date sensitive, thus each revised sheet must bear the date of the revision.

F. **As-builts**. All deviations from approved plan shall be documented and submitted to PFA for archiving. Reviews will not be conducted on as-built plans, unless specifically required by the fire inspector, as the field changes are often verified as compliant by the fire inspector. All as-built plans shall be conspicuously marked as such.

III. GENERAL INFORMATION AND REQUIREMENTS

A. **Types of Systems.** There are two main types of ERCES, and both are approved for use in PFA's jurisdiction. Please note a converged system, that includes cellular signal boosting is not permitted.
   1. Radiating cable systems (leaky cable).
   2. Distributed antennae systems (DAS).

B. **Technical Requirements.** System Design
   1. Federal compliance - ERCES installation, components, and operation, shall comply with all applicable Federal regulations, including but not limited to, the Federal Communications Rules specified in Title 47 of the Code of Federal Regulations, including 47 CFR §90.219. Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC shall not be installed without prior coordination and express written consent of the FLH.
   2. UL 2524 Listing - All bidirectional amplifiers, fiber optic DAS, and backup power systems, shall be certified to UL 2524 by a Nationally Recognized Testing Laboratory (NRTL) recognized by OSHA pursuant to Title 29 CFR §1901.7 et seq. to conduct UL 2524 testing.
   3. The building shall be considered to have an acceptable in-building emergency responder communications enhancement system where signal strength measurements in 95 percent of all areas and 99 percent of areas designated as *critical areas* by the *fire code official* on each floor of the building meet the signal strength requirement.
      - Critical Areas – Fire command center, fire pump rooms, area of refuge, basements, underground parking garages, exit stairs, exit passageways, elevator lobbies, fire protection equipment room and control valve locations.

4. The minimum downlink signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the fire code official. The downlink signal level shall be sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 throughout the coverage area using either narrowband analog, digital or wideband LTE signals or an equivalent bit error rate (BER), or signal-to-interference-plus-noise ratio (SINR) applicable to the technology for either analog or digital signals.
5. The minimum uplink signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the fire code official. The uplink signal level shall be sufficient to provide not less than a delivered audio quality (DAQ) of 3.0 using either narrowband analog, digital or wideband LTE digital signals or an equivalent bit error rate (BER), or an equivalent SINR applicable to the technology for either analog or digital signals.
6. City of Fort Collins, Police Services will provide the following information:
    - Frequencies required
    - Radio site location
    - Effective radiated power of radio sites
    - Maximum propagation delay in microseconds
    - Applications being used

C. Design

1. ERCES shall be designed to support two portable radios simultaneously transmitting on different talk paths or channels.
2. Systems shall be upgradeable to allow for instances where the jurisdiction changes or adds system frequencies to maintain radio system coverage as it was original designed.
3. Standby power supply shall be capable of operating the ERCES for a duration of not less than 12 hours. Systems must have 2 independent and reliable power sources.
4. Monitoring by the building fire alarm system shall be provided.
5. The system must have dedicated annunciator capable of visually indicating required component status listed in NFPA 1225 in the fire command room or attended location.
6. Secure buildings / SCIFS may be allowed use of manual or automatic activation of system pending review and approval by the AHJ.
7. All repeaters, transmitters, receivers, signal-booster components, remote annunciators and operational consoles, power supply and battery charging system shall be listed to UL 2524.

D. Campus Style Installation* *[see SBC attribution for Campus section below]*

1. When an ERCES serves multiple buildings from a single BDA, or when system components are distributed across separate structures, cabling that transitions outside the building envelope introduces grounding and protection requirements beyond those of the donor antenna installation.
2. Backbone Classification. Cabling that connects ERCES components between separate buildings — whether coaxial or fiber — constitutes backbone infrastructure. The loss of an inter-building link results in complete loss of ERCES coverage in any building that does not contain its own BDA, making it a single point of failure equivalent to the loss of a riser cable within a building.
3. Inter-building ERCES cabling must therefore be subject to all code requirements for backbone monitoring and survivability as defined in the applicable fire code and NFPA

1225 including supervision for integrity and annunciation of fault conditions at the fire alarm control panel.

4. Pathway Types. Inter-building ERCES connections may utilize underground, aerial, or direct-buried pathways, each with distinct design and code requirements. The designer must identify the pathway type early in the design process.
    - Underground pathways use conduit systems (PVC, HDPE, rigid metal, or intermediate metal conduit) routed through duct banks, with access provided via manholes and handholes.
    - Aerial pathways use messenger strand or self-supporting cable between poles or building attachment points and are subject to the National Electrical Safety Code (NESC) for clearances, loading, and strength requirements.
    - Direct-buried pathways place cable or continuous conduit directly in a trench without an enclosing duct structure.
5. Design professional shall provide full evaluation to use existing Outside Plant Design (OSP) or submit for new OSP construction.
6. Provide coaxial cable shield and/or fiber with metallic sheath grounding.
7. Provide surge protection.
8. Provide bonding between buildings
9. Provide cable rating
10. Documentation should include conduit or aerial routing shown on a site plan; burial depth or attachment heights; building penetration and sealing details; the location of all manholes, handholes, poles, and access points; the location and detail of all grounding blocks, surge protectors, and bonding conductors at each building entrance point; and cable type and rating for each segment.

IV. SUMBITTAL INFORMATION

A. Construction documents. Plan submittal package shall contain the necessary information to conduct complete plan review, sufficient clarity to indicate the location, nature and extent of the work proposed and show how it conforms to the provisions of the IFC, NFPA standards, relevant laws, ordinances, rules and regulations as adopted by PFA.

When a project is associated with a building permit, ERCES plans shall reflect the scope of work as approved under the building permit. The scopes of work must match. This is especially crucial when you have multiple permits within the same building.

B. Scope of Work. A detailed narrative indicating the intent of the system, auxiliary functions or features and any non-required components, functions, or features, as well as the extent of work (on existing systems) shall be provided. Note if there is supplementary and/or non-required equipment.

1. Electronic Submittal. Plans shall be submitted to PFA electronically through the online construction permit portal.
2. Design Professional. The NICET IB-PSC licensed designer shall be declared on the plans and cut sheets/specification through their signature and date and the appropriate certification number. Documentation of the designer's qualifications shall be included in the submittal package.
3. Secondary Power Calculations (Battery Calculations). Secondary power (battery)

calculations shall be provided for all power supplies being installed within the system. This is to include the voltage and amperage information on all batteries being installed within the main panel and any supplemental power panels being provided. Battery calculations shall include the following information:

- Standby and Alarm current draws for each device/appliance connected to the ERCES. The current draw of each device.
- The model number of each device/appliance.
- Description of each device/appliance.
- Standby Time (i.e., 12 hours, 24 hours, 60 hours, etc.).
- Alarm Time (i.e., 5 minutes, 15 minutes, etc.).
- Total current draw of the system.
- Battery size and whether wired in series or parallel.

4. Cut Sheets/Specifications. One (1) set of the manufacturer's product information (cut sheets) shall be provided. This is to include information on all devices that are part of, or being connected to, the ERCES. When cut sheets show multiple models/type of devices, the specific item being installed shall be highlighted.
5. Stamped cut sheets will be returned to the contractor and must remain on the job site with the approved plans. The cover of the cut sheets shall be signed/sealed by the design professional responsible for the submittal package.
6. When working on an existing system, you must provide details on that system such as original installation date, original requirements of the system or its intent, requirements based on occupancy and occupant load, etc.
7. Signal Booster Requirements. If used, shall meeting the following requirements
    - All signal booster components shall be contained in a NEMA Type 4 cabinet.
    - Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher-rated cabinet.
    - Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use prior to installation.
    - 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.
    - Active RF-emitting devices used for in-building emergency responder communications enhancement systems shall have built-in oscillation detection and control circuitry to reduce gain and maintain operation. When a signal booster detects oscillation, a supervisory signal shall be transmitted. In the event of uncorrectable oscillation, the system shall be permitted to shut down.
    - The installation of amplification systems or systems that operate on or provide the means to cause interference on any in-building emergency responder communications enhancement network shall be coordinated and approved by the fire code official and the frequency license holder(s).

V. INSTALLATION REQUIREMENTS

A. Mounting of the donor antenna(s). To maintain proper alignment with the system designed donor site, donor antennas shall be permanently affixed on the building or where approved, mounted on a movable sled with a clearly visible sign stating, "MOVEMENT OR REPOSITIONING OF THIS ANTENNA IS PROHIBITED WITHOUT APPROVAL FROM THE FIRE CODE OFFICIAL." The antenna installation shall be in accordance with the applicable requirements in the International Building Code for weather protection of the building envelope.

VI. SYSTEM MONITORING

A. Monitoring requirements. All ERCES shall be monitored by a building fire alarm system. The fire alarm communications method shall be located OUTSIDE any secured communications areas to prevent inhibition of signals being sent to the supervising station. The following points shall be monitored by the fire alarm system and shall report as a supervisory signal:

1. Loss of normal AC power supply.
2. System battery charger(s) failure.
3. Signal source malfunction.
4. Failure of active RF-emitting device(s).
5. Low-battery capacity at 70 percent of the 12-hour operating capacity has been depleted.
6. Failure of critical system components.
7. The communications link between the *fire alarm system* and the in-building emergency responder communications enhancement system.
8. Oscillation of active RF-emitting device(s).

VII. ACCEPTANCE TESTING

A. When the system has been installed, pretested and is ready for final inspections, the General Contractor shall submit a request online for final inspection of ALL systems. The system shall be tested in accordance with the requirements of 2024 IFC and NFPA 1225.

B. Tests shall be made using frequencies close to the frequencies used by the emergency services and shall be witnessed by the PFA.

C. If testing is done on actual frequencies, then this testing must be coordinated with and approved by the FLH.

D. All testing shall be done on frequencies that are authorized by the FCC.

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