COLORADO SPRINGS FIRE DEPARTMENT

Emergency Responder Communication Enhancement Systems

General requirements for design, submittal, and testing ERCES.

FIRE CONSTRUCTION SERVICES
6/30/2023

Division of the Fire Marshal | 375 Printers Parkway | TEL 719-385-5978 • FAX 719-385-7334
Construction Services | 2880 International Cir, Suite 200-7 | TEL 719-385-5982 Ext. 2

TABLE OF CONTENTS

PURPOSE

This guidance document has been developed to provide the highest level of service to the customers of the Colorado Springs Fire Department. 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.

DEFINITIONS

AHJ	Authority Having Jurisdiction
BDA	Bi-directional Amplification
CSFD	Colorado Springs Fire Department
DAQ	Delivered Audio Quality
ERCES	Emergency Responder Communication Enhancement System
FCC	Federal Communications Commission
GROL	General Radiotelephone Operators License
IFC	International Fire Code
NFPA	National Fire Protection Association
PPRCN	Pikes Peak Regional Communications Network
SCIF	Sensitive Compartmented Information Facility

GUIDELINES

I. INTRODUCTION

A. APPLICABLE CODES AND STANDARDS.

1. 2021 International Fire Code and local amendments.
2. 2022 NFPA 72 Alarm Signaling Code.
3. 2022 NFPA 1225 Standard for Emergency Services Communications.
4. Colorado Springs City ordinances.

B. ADMINISTRATIVE REQUIREMENTS.

1. **Personnel Qualifications**. The designer shall hold an FCC GROL license. Installation personnel shall be qualified or supervised by a qualified person(s) in the installation, inspection, and testing of ERCES. Documentation of the designers FCC license shall be provided with the submittal documents.

Documentation of the qualifications of installation personnel shall be provided upon request of a fire inspections.

2. **Code/Standard Editions.** ERCES shall meet the criteria of the adopted IFC as amended, and all applicable requirements of the most recent edition of NFPA standards. NFPA standards are enforced on January 1st of the year following the effective date printed in the standard.
3. **Permits/Inspections.** Required plan submittal with approvals and permits must be secured through CSFD prior to the start of any work. Permitted work must be inspected by CSFD and a representative of PPRCN.
4. **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 CSFD for an alternative means and methods (AMM) approach is required. The AMM must be approved before installation of the system begins.
5. **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.
6. **As-builts.** All deviations from approved plan shall be documented and submitted to CSFD 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.

II. GENERAL INFORMATION AND REQUIREMENTS

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.*

Colorado Springs does not have a blanket requirement that all new buildings be provided with an ERCES. Instead, a performance-based approach is utilized, allowing buildings that are of potential concern to be partially constructed before a qualified communications contractor tests signal strength(s).

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.

If a building is in question by the builder, or developer, it is recommend testing be completed 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, but not necessarily the whole building.

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. TYPES OF SYSTEMS. There are two main types of ERCES, and both are approved for use in Colorado Springs. Please note a converged system, that includes cellular signal boosting is not permitted.

1. Radiating cable systems (leaky cable).
2. Distributed antennae systems (DAS).

C. TECHNICAL REQUIREMENTS.

1. A minimum inbound signal strength of -95 dBm throughout the coverage area shall be provided.
2. A minimum outbound signal level shall be sufficient to provide not less than a DAQ of 3.0 or equivalent.
3. A building is considered to have acceptable emergency responder radio coverage when the signal strength measurements in 95% of all areas on each floor of the building meets the above signal strength requirements, as verified through testing.
4. Critical areas shall be provided with 99% floor area radio coverage and include but are not limited to:
    - Fire command center
    - Fire pump rooms
    - Exit stairs
    - Exit passageways
    - Elevators and elevator lobbies
    - Areas where standpipe cabinets are located
    - Locations of sprinkler sectional valves
    - Areas of refuge and/or protect-in-place
    - Basements
    - Underground parking garages
5. PPRCN will provide the following technical information. You will need to contact them directly for details. Please call 719-385-7301.
    - Frequencies required
    - Radio site location
    - Effective radiated power of radio sites
    - Maximum propagation delay in microseconds
    - Applications being used

D. DESIGN. ERCES design must be coordinated between the property owner, vendor, CSFD, and the PPRCN manager.

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.
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.

III. SUBMITTAL INFORMATION.

Proper documentation is required to assure the plan submittal package contains the necessary information to conduct complete plan review.

A. CONSTRUCTION DOCUMENTS. Construction documents shall be of 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 the City of Colorado Springs.

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.

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.

B. MINIMUM SUBMITTAL REQUIREMENTS.

1. **Electronic Submittal.** Plans shall be submitted to CSFD electronically through the EPlans Customer Portal. There is an instruction manual available on the landing page to assist you with the setup of new accounts, and submittal of plans. Plans shall be drawn to 1/8" or ¼" scale.
2. **Plan Review Number.** Submittals associated with a construction project shall be provided with the CSFD Plan Review Number. This number is an eight-digit numeric code located on the back of the construction plans. Projects not associated with a building permit shall be indicated as such on the submittal so that it can be assigned a plan review number.
3. **Design Professional.** The FCC 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.

4. **Cut Sheets/Specifications.** One (1) set of the manufacturer's product information (cut sheets) shall be provided. This is to include the 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.

   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.

5. **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:

   a. Standby and Alarm current draws for each device/appliance connected to the ERCES. The current draw of each device.

   b. The model number of each device/appliance.

   c. Description of each device/appliance.

   d. Standby Time (i.e., 12 hours, 24 hours, 60 hours, etc.).

   e. Alarm Time (i.e., 5 minutes, 15 minutes, etc.).

   f. Total current draw of the system.

   g. Battery size and whether wired in series or parallel.

6. **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.

C. INSTALLATION AND DESIGN PLANS. Plans shall be submitted to CSFD Construction Services for review and approval. Construction Services will coordinate getting the plans to the PPRCN for their review and approval during their weekly stakeholder meeting. Plans are reviewed in the order in which they are received. Reference Appendix A for a more complete list of required elements to be provided the plans. PPRCN will first review the plans during their weekly stakeholder meeting. Reference Appendix A for a more complete list of required elements to be provided the plans.

D. MONITORING. 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. Monitoring for integrity per Chapter 10 of NFPA 72, including between the fire alarm system and ERCES.

2. Signal source malfunction.

3. Active RF-emitting device failure.

4. Low-battery capacity indication when 70% of the 12-hour operating capacity has been depleted.
5. Active system component failure.
6. Low of normal AC power.
7. Failure of battery charger.

E. INTERLOCKS. Buildings or spaces intentionally designed to block radio frequencies (Tempest buildings) shall be provided with methods to override radio jammers, white noise generators and similar electronic radio frequency blocking technologies. An emergency power on option could be provided that automatically powers up the ERCES upon the activation of a fire alarm system and a manual switch option to do the same. These are looked at and approved on a case-by-case basis. Please call Construction Services to discuss these options further.

IV. ACCEPTANCE TESTING

A representative from the Pikes Peak Regional Communications Network will conduct an on-site visit to verify donor antenna locations and give the OK for the final inspections and testing to proceed.

When the system has been installed, pretested and is ready for final inspections, the permit holder must contact the CSFD to schedule the final acceptance test. The system shall be tested in accordance with the requirements of NFPA 1225.

Test shall be made using frequencies close to the frequencies used by the emergency services and shall be witnessed by the CSFD and/or the PPRCN representatives.

If testing is done on actual frequencies, then this testing must be coordinated with and approved by the witnessing agencies and the emergency services communications center.

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

A. PERIODIC TESTING. The property owner shall have the required periodic tests and inspections conducted by a qualified third party of all components of the system in accordance with NFPA 1225. Additionally, systems employing an EPO option shall undergo a weekly test of the function of the EPO and interface between the fire alarm system monitoring and ERCES.

B. FIELD TESTING. CSFD and/or PPRCN, after providing reasonable notice to the property owner, shall have the right to enter the property to conduct field testing to be certain the required level of radio coverage is present. Discrepancies from field testing and previously recorded test results shall immediately be brought to the attention of the property owner to implement the appropriate corrective action.

APPENDICES

A. Plan Requirements Checklist

B. PPRCN Bi-directional Amplifier Requirements

Appendix A Plan Requirements per NFPA 1225 for Working Drawings.

Cover Sheet/Title Block shall contain the following:

- ❑ Name of owner and occupant
- ❑ Location including full street address, including suite numbers
- ❑ Name, address, phone, email address of installing contractor and designer
- ❑ Design professional declared on the plans
- ❑ CSFD Plan Review number or other designator
- ❑ Written narrative providing intent and system description (scope of work)
- ❑ A list of the codes and standards, including the edition dates, that were used to design the ERCES
- ❑ Type of ERCES – leaky coax or DAS – converged systems are not permitted.
- ❑ Date of issue and any revision dates

Building Information:

- ❑ Site Plan – new buildings only, no smaller 1:50 scale
- ❑ Point of Compass on every page.
- ❑ Floor plan indicating use of all rooms and level identification
- ❑ Building elevations
- ❑ Identify if building is Tempest rated or identify areas where radio communications are blocked.

System Information:

- ❑ DAQ signal source level measurements
- ❑ Device Legend to include: Make, type, model, and size of all cable, amplifies, antennas, batteries, etc. (spec sheets).
- ❑ Cable Legend to include: cable type and size, identify if enclosed in conduit, open, plenum, and power limited or non-power limited. Include type and quantity of conductors and conduit (if used) for each circuit
- ❑ Donor RF link path profiles, link budgets, azimuths, and distances
- ❑ Donor antenna mounting details and donor antenna cable installation details
- ❑ Grounding and surge suppression
- ❑ Backbone and distribution antenna cable diagrams
- ❑ Device locations on floor plans
- ❑ Pathway survivability design as applicable
- ❑ Primary and backup power distribution design and wiring
- ❑ Monitoring system design including fire alarm control unit interfaces and annunciators
- ❑ Donor/DAS antenna isolation calculations

- ❑ Pre-installation signal coverage maps on floor plans
- ❑ Designer qualifications
- ❑ Installer qualifications
- ❑ Test grids on floor plans
- ❑ Manufacturers' specifications.
- ❑ Battery calculations
- ❑ Sequence of operations – matrix format
- ❑ Graphic scale on each sheet
- ❑ Location of Annunciator
- ❑ When equipment is to be installed as an addition to an existing system, enough of the old system shall be indicated to make all conditions clear
- ❑ The working plans submittal shall include the manufacturer's installation instructions for any specially listed equipment, including descriptions, applications, and limitations for any cable, amplifiers, antennas, batteries, etc.

Appendix B PPRCN Policy for Bi-Directional Amplifier Requirements

Pikes Peak Regional Communications Network

Policy # 01-2015	Adopted:	Approved by:

OFFICIAL POLICY: BI-DIRECTIONAL AMPLIFIER REQUIREMENTS

DATE: July 1, 2015

This policy is meant to provide general guidance on Pikes Peak Regional Communications Network (PPRCN) requirements where emergency responder public safety communication systems (BDA's) are installed. Application of this policy is subject to locally adopted codes and the discretion of the Fire Code Official.

PURPOSE: To establish PPRCN policy relative to operating bi-directional amplifiers (BDA's) operational on the PPRCN Digital Trunked Radio System required to enhance Public Safety radio signals within a building.

SCOPE: Any organization of a member or PPRCN participant, that did not cause a BDA to be installed prior to adoption of this policy, will ensure the guidelines and requirements of this policy are complied with. Questions about requirements can be addressed to the PPRCN System Manager. The PPRCN Board will have final authority over decisions as long as they do not counteract rules and requirements of the FCC on the frequency licensees.

BACKGROUND: Section 510 of the International Fire Code (2012) sets mandatory minimum radio coverage requirements for buildings. Agencies within the PPRCN operating area may choose to adopt this (or similar) code to provide for Emergency Responder communications on the PPRCN system. Actual building coverage requirements are determined by the fire code adopted by the Authority Having Jurisdiction (AHJ), and its Fire Code Official. This policy addresses how a BDA is approved for use within the PPRCN operating area.

REQUIREMENTS:

- The Agency with the authority to sign off on Building and occupancy permits in reference to code requirements of Bi Directional Amplifiers (BDA) has the responsibility to provide the building owner, contractor, architect and all other interested parties with the code requiring installation of BDA(s) and up to date local radio system requirements to protect the operation of the Pikes Peak Regional Communications Network (PPRCN) and the Motorola Smart Zone 800 MHz digital trunked radio system installed operated

and maintained (IOM) to support the needs of emergency responder public safety communication in the region.

- The PPRCN System Manager will be the designated point of contact. The PPRCN System Manager will work in conjunction with the FCC licensees (City of Colorado Springs and the El Paso County Sheriff's Office) to ensure compliance with all applicable FCC rules.
- PPRCN has the responsibility to provide a comprehensive, up to date technical requirements document to the authorized authority responsible for issuing building and occupancy permits that sets the requirements for installing, operating, and maintaining a BDA system interfacing with the PPRCN digital trunked radio system. PPRCN will work with AHJ to coordinate inspections and other required activities in a manner to minimize disruptions for the building owner as possible.
- Requested BDA(s) must designate a PPRCN Systems Manager approved donor site to mitigate potential traffic problems. The BDA must be IOM so as to preclude hitting multiple donor sites. Directional antennas and frequency filters or a combination of both may be required at the expense of the building owner.
- Output levels of the IOM BDA must be a level measured not exceed -75 dBm at the donor site. This required measurement will be coordinated and witnessed by the PPRCN Systems Manager or designee at the expense of the building owner.
- Prior to installing a BDA in any building, the selected contractor will provide a copy of the engineering plans and be specifically prepared to discuss any potential loopback hazards such as loading dock doors or other areas where radio signals may escape the building other than through the BDA at the expense of the project.
- Selected contractor will create and provide the building owner/representative with installation documents that include sweeps on the BDA antenna system, building location drawings for the BDA and associated antenna feedline and antennas, screen representations of donor site receive signal level from the BDA, the signal level from the BDA in the building in the center of each room, hallway (both ends and middle) and all four sides of the exterior of the building up to 25 feet from the building, if surroundings permit, at the expense of the project.
- Recognized BDAs in operation prior to the adoption of this policy are exempt from the approval phase of this process (design review, testing, etc.). They are not exempt from FCC rules compliance, code compliance, etc. The PPRCN System Manager keeps and maintains this list.

  PPRCN recommends that all active BDA system components, such as amplifiers, power supplies and backup batteries be tested annually. Amplifiers should be tested and monitored to ensure the gain has not degraded from the installed value. Backup batteries and power supplies should be tested under load for a period of at least four hours to verify that they will properly operate during an actual power outage.

- Environmental changes, PPRCN system changes, etc. may necessitate a change in the operation of an approved BDA. Any costs associated with these needed changes are the responsibility of the building owner. Situations requiring a BDA change in operation include, but are not limited to:
    - Changes to PPRCN system, such as simulcasting or additional sites, may require new donor antenna, or system shutdown, or other change.
    - New BDAs in the vicinity may require modifications to existing BDA.
    - New construction might block existing donor site.

PPRCN BDA Flowchart – Version 0.3

November 10th, 2015