Eagle River Fire Protection District

Bidirectional and Unidirectional Antenna Requirements for In-Building Fire Department Radio Coverage

Emergency communications have been proven to be the lifeline for firefighters, police officers and EMS personnel inside of large structures. Research and investigations into Line of Duty Deaths (LODDs) and injuries to Fire, Police and EMS personnel show that the loss of reliable communications inside of such buildings is a contributing factor in death and injuries to emergency personnel.

Reliable in-building communications is a paramount requirement for the safety of emergency personnel as well as that of the public and is a major factor in the successful outcome of emergency operations inside large buildings.

This policy is to enhance Eagle River Fire Protection District's (ERFPD) emergency communications in buildings that could be subject to communications breakdown due to size, building materials, design, geography and other impediments to radio communications.

ERFPD has developed these specifications in conjunction with the requirements of the International Fire Code (IFC 2021), Town of Avon Building Code, and the Eagle County Building Code.

New buildings or structures or portions of existing buildings or structures undergoing renovations or rehabilitation (25% or more) that constitutes new construction shall be equipped with in building radio systems as an integral component of the life safety equipment of the building or structure. Any building built in phases must have the in- building system installed as if the construction were 100% complete.
The system installed must comply with all applicable sections of FCC rules.

Exceptions:
Buildings that have sufficient levels of radio coverage to satisfy the requirements of this specification may **request a waiver with the following constraints**:

- A radio survey, as described in this specification, must be completed, submitted, and signed by a qualified radio technician. All interior partitions shall be fully constructed prior to conducting the survey. The survey must utilize a minimum of two sites to ensure its validity when more than one suitable donor site is available.

- A permit must be submitted with proper signatures.
- If approved, the waiver will only be valid for a 5-year period at which time a new radio survey must be submitted.
- At any time, it is determined that radio coverage does not meet this specification, the waiver will be withdrawn, and the property owner is then required to provide radio coverage as required by this specification.
- The building owner is responsible for the costs of the radio coverage survey.
- One-and Two-Family dwellings as defined in the International Building Code.

Adequate radio coverage shall include a minimum signal level of DAQ 4 (Delivered Audio Quality 4 [speech easily understood; occasional noise/distortion]). This standard shall be assessed utilizing hand-held radio units used by the ERFPD. **Only Class A (narrowband, channelized) systems will be acceptable.**

The in-building radio system shall provide signal strength as follows:

- A minimum of –95 dBm available in 95% of the floor area of each floor of the building and 100% communications in any stairwells and at fire alarm control panels.
- Required in-building radio systems shall be FCC certified Bi-Directional Class A
- Assembly and installation of the Bi-Directional Amplification System shall be in accordance with the National Electrical Code (NFPA 70) as applicable. The radio system may utilize a radiating cable system or internal multiple antenna system.
- Transmission lines used in this system shall be type CATVR for all applications except for those run-in ducts, plenums or environmental air spaces, they shall be CATVP. Equivalents are allowed as in article 820 of the National Electrical Code (NFPA 70) is acceptable.
- Cables other than radiating coaxial cables shall be run in Electrical Metallic Tubing (EMT) or as otherwise approved by the fire chief or the chief's designee.

Public Safety Frequencies

- Eagle County uses a statewide Digital P25 radio system. The contractor will be required to use the follow locations:
    - Lower Dowd: 853.325 (Avon/Edwards) Eagle County, State of Colorado are licensees
    - Beaver Creek: 853.875 (multiple areas) Eagle County, State of Colorado and Holy Cross Energy are licensees
    - Beacon Hill: 859.2875 (Edwards) Holy Cross Energy is licensee
    - Lower B.C. (only used for B.C. Village area): 859.9875 Eagle County is licensee

Power Supplies

- Monitoring the integrity of power supplies shall be in accordance with NFPA 72, National Fire Alarm Code, 2017 edition.
- At least 2 independent and reliable power supplies shall be provided.
- The primary power source shall be supplied from a dedicated twenty (20) ampere branch

circuit and comply with NFPA 72, National Fire Alarm Code, 2017 edition.

- The in-building radio system shall be capable of operating a battery dedicated to the system with at least 12 hours of 100% system operation capacity.
- The battery system shall automatically charge in the presence of external power input. The battery system shall be contained in 1 NEMA 4 or 4X type enclosure.

System Monitoring

- The In-Building Radio system shall include automatic supervisory and trouble signals for malfunctions of the signal booster(s) and power supplies that are annunciated by the fire alarm system. Trouble signals must be immediately reported to the radio service provider.
- The integrity of the circuit monitoring the signal booster(s) and power supply/supplies shall comply with NFPA 72, International Fire Alarm Code, 2017 edition.
- System and Signal booster supervisory signals shall include Antenna Malfunction and Signal booster failure.
- Power supply supervisory signals shall include loss of normal AC power, Failure of battery charger, and Low battery capacity (alarming at 70% of battery capacity)
- The system shall be capable of operating on an independent battery, UPS and/or generator system for a period of at least 12 hours without external power input. The battery system shall automatically charge in the presence of external power input.
- Amplifiers shall be installed in secured areas in watertight NEMA 4 steel cabinets. The cabinets will be painted red and the words “Eagle River Fire Department Radios” shall be marked on the cabinet as well as the BDA permit number, the maintenance vendor and vendor phone number.
- The BDA/UDA and any other active amplifiers must be in an area with a 2-hour fire rating or in an enclosure with a 2 hour fire rating.
- All external antennas shall be provided with appropriate lightning protection in accordance with the National Electrical Code.

Dedicated Monitoring Panel

- A dedicated monitoring panel shall be provided within the emergency command center to announce the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:
    - Normal AC power
    - Signal booster trouble
    - Loss of normal AC power
    - Failure of battery charger
    - Low battery capacity
- A sign will be located at the dedicated monitoring panel with the name and telephone

number of the radio service provider indicating that they shall be notified of any alarm.

- ERFPD must be notified of any failures that extend past two (2) hours.

Radio Survey

- The building owner shall have the in-building radio system tested to ensure that two-way radio coverage on each floor of the building meets or exceeds the required 95%.
- Each floor of the building shall be divided into a grid of approximately twenty (20) equal areas. A maximum of one (1) area will be allowed to fail the test per floor. A spot located approximately in the center of a grid area will be selected for the test. Once the spot has been selected, prospecting for a better spot within the grid area will not be permitted. Field strength testing instruments are to be recently calibrated (1 year) and of the frequency selective type incorporating a flexible antenna like the ones used on the hand-held transceivers.
- RF plots indicating the initial assessment of radio coverage and the enhanced coverage shall be submitted at the time of acceptance testing.
- All compliance testing is to be done with 50 ohm loads in place of the donor antenna to avoid interference with the ERFPD/ECSO/APD radio system. The ERFPD Bureau of Prevention (970-688-2158) is to be notified prior to any testing.
- Unattended operation of the in-building radio system is not permitted until the completion of acceptance testing.

Annual Tests

- When an in-building radio system is installed, the building owner shall be responsible for testing all active components of the system, including but not limited to amplifier, power supplies and back up batteries a minimum of once every 12 months from the date of the installation.
- Amplifiers shall be tested to ensure that the gain is the same as it was upon initial installation and acceptance.
- Backup batteries and power supplies shall be tested under load for a period of one (1) hour to verify that they will operate during an actual power outage.
- Active components shall be checked to determine that they are operating within the manufacturer's specifications for their intended purpose.

Five Year Test

- In addition to the annual test, the building owner shall perform a radio coverage survey test a minimum of once every five (5) years to ensure that the in-building radio system continues to meet the requirements of this ordinance.

Documentation

- Documentation of all testing, all testing, maintenance and repairs shall be kept on site and a copy forwarded to the ERFPD. Electronic submissions of these reports are preferred.
- The building owner will also have maintenance contract with a competent technical support organization who can respond 24/7/365 with a response time of no more than 6 hours. The

cost of this contract is the responsibility of the property owner.

- All testing shall be conducted, documented and signed by a person with a current FCC license.
- General Radiophone Operator License as defined in Title 47 of the Federal Code of Regulations or its equivalent.
- The costs of the annual and five (5) year tests are the responsibility of the building owner.

Fire Department Inspections

- The building owner shall provide reasonable access to the ERFPD, ECSO and/or APD personnel to conduct field testing of the radio systems to determine if the required radio coverage is adequate.

Eagle River Fire Protection District
Public Safety/Emergency Responders Radio System Submittal Requirements

If any of the following components are not included, the entire submittal will not be accepted**.**

BDA (Bi-Directional Amplifier) – Full Submittal

- Signed Permit Application.
- Check for the correct amount made out to ERFPD.
- Copy of the approved Building Permit – issued by Town of Avon, Eagle County, Minturn or Red Cliff.
- Current copy of contractor's license for the Town of Avon (if applicable).
- Minimum of 1 set of plans – ¼" scale.
- System installed must comply with applicable sections of FCC rules (Part 15).
- 1 set of cut sheets.
- One site plan (new construction/significant remodel).
- Reflected ceiling plans and interior elevations (new construction/significant remodel).
- Copy of the signed contract may be requested to verify job valuation

BDA Plan Requirements

- Contractor is responsible for the 800MHz BDA system design and compliance with FCC and IFC Section 510 requirements.
- BDA system shall be interconnected with the building Fire Alarm system and monitored for proper function of the signal booster and batteries. Monitoring signal shall be supervisory and display on the Fire Alarm Control Panel (FACP) as follows: "Emergency Responder Radio System trouble".
- BDA system shall be fully refundable.
- BDA system shall be supported by the manufacturer for seven years after installation.
- BDA system shall be equipped with Uninterruptible Power Supply (UPS) system.
- BDA system shall be equipped with an auto-dialer.
- Indoor antennas shall be 700/800 MHz compliant.
- Use of indoor tri-band antennas for BDA/DAS and cell phone coverage is acceptable.
- BDA system design shall utilize 1/10 couplers rather than splitters.
- Drawings shall detail the model numbers for all the proposed equipment (i.e. BDA system, Indoor antennas, Donor antenna, UPS, etc.).

PO Box 2942, 1050 Edwards Village Blvd, Edwards CO 81632
Phone: 970-748-4739 Fax: 970-949-7965
Website: www.eagleriverfire.org
Email: prevention@eagleriverfire.org
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