Fire Prevention Association of Nevada

Guide for Emergency Responder Communications Enhancement Systems Permitting, Testing, & Recertification

SNFC / FPAN International Fire Code Committee
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1.0 PURPOSE:

This guideline establishes responsibilities and requirements for submittals, document reviews, testing, reports, and permits for the installation and maintenance of Emergency Responder Communications Enhancement Systems.

It is not the intent of this guide to supplant the installation, maintenance, inspection, and testing of building fire protection and life safety systems otherwise required by other applicable codes, standards, and ordinances. Compliance with this guideline does not relieve the Owner from compliance with the maintenance, inspection, and testing required by other applicable codes, standards, and ordinances.

2.0 SCOPE:

This guideline applies to all buildings requiring an Emergency Responder Communications Enhancement System. The primary intent of this guideline is to outline the requirements for the design, installation, commissioning, recertification, or determination of need for an Emergency Responder Communications Enhancement System.

3.0 DEFINITIONS & ABBREVIATIONS:

AHJ: Authority Having Jurisdiction

BDA: Bi-directional Amplifier

DAQ: Delivered Audio Quality

ERCES: Emergency Responder Communications Enhancement System (formerly ERRCS – Emergency Responder Radio Coverage System)

FCC: Federal Communications Commission

GROL: General Radio Operators License

LVMPD: Las Vegas Metropolitan Police Department provides 700/800 MHz radio communications in support of public safety agencies operating in Southern Nevada.

SNACC: Southern Nevada Area Communications Council provides 800 MHz radio communications in support of public safety agencies operating in Southern Nevada.

4.0 REFERENCES:

The codes and standards listed below are presented only as a compilation of references that may be used to assess emergency responder communications enhancement systems and coverage within a building.

- Building Administrative Code, adopted at the time of design.
- International Building Code with Southern Nevada Amendments
- National Fire Alarm & Signaling Code with Southern Nevada Amendments
- National Electrical Code with Southern Nevada Amendments
- International Fire Code with Southern Nevada Amendments
- NFPA 1225 Standard for Emergency Services Communications

5.0 REQUIREMENTS:

When is an ERCES required:

New buildings:

An approved in-building emergency responder communications enhancement system for emergency responders shall be provided in all new buildings per IFC with the following exceptions:

1. Where approved by the building official and the fire code official, a wired communications system in accordance with IFC 907.2.13.2 shall be permitted to be installed or maintained instead of an approved communications coverage system.
2. Where it is determined by the fire code official that the communications coverage system is not needed.
3. In facilities where emergency responder communications coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the fire code official shall have the authority to accept an automatically activated emergency responder communications coverage system.
4. One-story buildings not exceeding 12,000 square feet with no below-ground area(s)**.** Unless determined by the fire code official that a communications coverage system is required.

Existing buildings:

Existing buildings other than Group R-3 that do not have approved in-building, two-way emergency responder communication 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 I.
2. Within a timeframe established by the adopting authority.

Exception: Where it is determined by the fire code official that the in-building, two-way emergency responder communication coverage system is not needed

Where the above-referenced exceptions are not met, the following procedure may assist in determining if a new or existing structure requires an ERCES system:

1. A site survey is required to demonstrate sufficient signal strength
    a. Who should perform the site survey
        i. The required site survey should be performed by a State-licensed contractor holding an FCC GROL license with the appropriate testing equipment.
        ii. The contractor performing the survey shall contact SNACC & LVMPD for the testing frequencies to be used and shall test all required frequencies.
    b. When is it appropriate to conduct the site survey
        i. The site survey to verify required signal strength should be performed once construction activities have sufficiently progressed to provide a reasonably accurate representation of coverage upon completion of construction.
        ii. In many cases, multiple surveys will be necessary. A preliminary survey should be performed early enough in the construction process to accommodate for the design, permitting, installation and inspection process without delaying the project schedule. Additional surveys may be required as construction progresses to confirm that preliminary survey results are still valid.
        iii. Walls, doors, windows, and other structural elements should be in place. Elements that greatly impact the ability of signal to penetrate the building such as concrete, steel, and low-e glass are of particular importance.
        iv. A final survey once all construction activities are completed should be performed to document acceptable signal strength.
    c. What to do with survey results
        i. If preliminary survey results indicate insufficient signal strength you should begin the process of planning for an ERCES installation. The design and installation contractor should contact SNACC & LVMPD to obtain a Frequency Rebroadcasting Agreement as described in section 6.0.
        ii. If preliminary survey results indicate sufficient signal strength be cautious of additional construction activities that will negatively impact signal strength. An additional survey will likely be necessary to validate results upon completion of construction activities. Failure of subsequent testing will result in the need for the installation of an ERCES.

1. If the installation of an ERCES at a later date would prove difficult, it may be advisable to install raceways to facilitate installation after construction has progressed.
    a. Note that any raceways installed in advance should account for the pathway survivability that will be required based on the building construction type.

iii. Final survey results shall be provided to the AHJ for record.

System decommissioning:

If at any time an installed system is determined by the frequency holder (SNACC/LVMPD) to be unnecessary based on existing coverage or to be causing interference, the system shall be immediately decommissioned at the direction of the frequency holder.

1. Upon decommissioning the contractor shall make appropriate notifications to the AHJ and secure any required permits.

6.0 SUBMITTALS:

Contractor Certification and Licensing Requirements:

1. Possess and maintain an FCC GROL License
2. Possess and maintain 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.
3. Possess and maintain a NICET Certification for In-Building Public Safety Communications Design - Effective two years from the date of code adoption.

Approvals Required Before Submitting to the Fire Department:

1. Request frequencies to be tested from SNACC & LVMPD via email at: bdatesting@LVMPD.com and SNACC@clarkcountynv.gov.
    a. All frequencies specified by SNACC & LVMPD shall be tested.
2. If survey results indicate that an ERCES will be required, obtain a Frequency Rebroadcasting Agreement from the frequency holder:
    a. Obtain a Frequency Rebroadcasting Agreement form via an email request to bdatesting@LVMPD.com and SNACC@clarkcountynv.gov.
    b. Complete the required fields of the rebroadcasting agreement.
    c. Submit the completed rebroadcasting agreement along with site survey results (including heat maps) to the frequency holder for review, acceptance, and required signatures via email to bdatesting@LVMPD.com and SNACC@clarkcountynv.gov.
3. Once reviewed and accepted by the frequency holder you will receive a signed Frequency Rebroadcasting Agreement to be used for submittal to the Fire Department.

Plan Submittal Requirements:

1. Applicants are responsible for ensuring applications submitted are complete. Incomplete applications will result in plans being rejected or returned to the applicant during the review process.
2. Plan Readability. Easily read; legible; a readable typeface. Vivid contrast or difference in brightness between the light and dark areas of the drawing. Minimum 8-point font size for legibility of printed plan set.
3. Plans shall meet the requirements of the currently adopted codes, ordinances, and regulations of each jurisdiction
    a. International Building Code with local amendments
    b. National Fire Alarm and Signaling Code with local amendments
    c. International Fire Code with local amendments
    d. NFPA 1225 Standard for Emergency Services Communications
    e. Nevada State Fire Marshal Regulations
    f. Life Safety Report, if applicable (reference on the plan set)
4. Provide the following documents at the time you submit your application for an ERCES permit.
    a. Frequency Rebroadcasting Agreement signed by LVMPD, SNACC, and the In-Building System Owner. (Can be on the plan set)
    b. Plans with calculations (1 digital set)
    c. Site survey results for 700 & 800 MHz frequencies. Testing shall be conducted in accordance with IFC 510.5.4 (1 digital set)
    d. Product data submittal, including a cover sheet, index sheet listing products used by make and model number, manufacturer data sheets (highlighted or marked), listing information for all equipment, devices, materials, wire and cable, and maintenance instructions. (1 digital set)
5. Plans must contain the following minimum content requirements. This list is not intended to be all-inclusive of every detail required of an ERCES submittal. Rather, it is provided to give an overview of the basic plan contents needed for the review of plan sets
    a. Cover Sheet
        i. Provide general project information, including project name and street address
        ii. Provide Contractor’s name, address, phone number, license numbers, license classification, and license limit
        iii. Written narrative providing scope, intent, and system description
        iv. Signature of the licensee (contractor's Master or Qualified Employee)
        v. FCC GROL licensee name, signature, and license information
        vi. ERCES General Notes
            1. IBC Construction Type, including fire resistance rating
            2. Pathway Survivability (NFPA 1225 18.12.3)
            3. Life Safety Report Permit Number and date (if applicable)
            4. Alternate Method / Code Modification Permit Number (if applicable)

vii. System Classification (Note: Class B Bi-Directional Amplifiers are prohibited)
viii. Wire/Cable Legend indicating conductor size, type, and quantity. (All cable shall be contained in a non-combustible raceway, metal-clad, or fully enclosed cable tray system
ix. Symbol legend with equipment description (manufacture's name and model number), mounting description (surface, semi-flush, flush, and exterior), and device counts
    1. *Symbols used shall comply with NFPA 170, 2018 edition*
x. Indicate all signals to be monitored by the building Fire Alarm system per IFC 510.4.2.5
xi. Site plan, indicating building orientation

b. ERCES Plans
    i. Floor plan drawn to an indicated scale (1/16" minimum unless otherwise approved by the fire code official) on sheets of a uniform size (sufficient clarity for readability) showing the following:
        1. Point of compass (north arrow)
        2. A graphic representation of the scale used on all plans
        3. Walls, doors, windows, openings, stairs, elevators, passageways, critical areas, etc., as applicable to depict the facility
        4. Room use identification labels
        5. Location of:
            a. Antennas
            b. Bidirectional Amplifiers
            c. Battery Backup units
            d. Splitters
            e. Remote Annunciators
        6. Conduit/cable routing and size with type and quantity of conductors
        7. Electrical power panel and circuit connection (120V panel & circuit numbers for all equipment)
        8. Key plan
        9. Predictive heat maps indicating required signals strength, including a table and identification of materials assigned to the building elements with attenuation values (700 & 800 MHz)
        10. Roof plan depicting the location of antennas and required signage
        11. Riser diagram including the following
            a. General arrangement of the system, in building cross-sectional or elevation view
            b. Wall/shaft/stairwell and/or cable ratings demonstrating the required pathway survivability level
            c. Type and number of cables in each riser, including conduit and wiring sizes and types, shall be shown including the

interconnects between devices, control panels, and other elements

d. Type and number of ERRCS components devices on each floor or level including but not limited to antennas, amplifiers, battery back-up units, splitters, and annunciators

12. Aerial map depicting path between agency antenna(s) and donor antenna(s) within the donor antenna beamwidth for both 700 & 800mhz antenna(s)
13. Line of sight diagrams indicating elevations and clear path between agency antenna(s) and project site for both 700 & 800mhz antenna(s)
14. Battery capacity calculations (12hrs or 4hrs when provided with an emergency generator)
15. Design number and detail of penetration fire stop system when required
16. List control channel frequencies specified by SNACC & LVMPD
17. Equipment and device diagrams identifying all wiring terminals and connected wiring
18. Any additional information determined necessary

7.0 ACCEPTANCE TESTING:

The AHJ shall verify and receive the following:

1. Heat Map (spectrum analyzer report) to be provided by contractor before testing. Each floor shall be divided up into approximately 20 zones.
2. Verify that the installing contractor has an approved set of plans on site.
3. Require the testing company to provide a representative with a spectrum analyzer or other suitable test equipment and the analyzer report.
4. Require the testing company to provide the Frequency Rebroadcasting agreement with signed acceptance from SNACC, LVMPD for both uplink and downlink levels.
5. Have a minimum number of inspectors based on size of property and availability of inspectors, work with your DFM or supervisor.
6. Have the fire alarm company and the ERCES installation company representative present during testing of the ERCES.
7. Where applicable: The test team shall visually inspect the donor antenna and verify it's properly secured and grounded. A clearly visible sign stating: “MOVEMENT OR REPOSITIONING OF THIS ANTENNA IS PROHIBITED WITHOUT THE APPROVAL FROM THE FIRE CODE OFFICIAL”.
8. Written documentation acceptable to the AHJ of the initial system testing, including system performance measurements at all locations covered by the installed system.
9. Signed inspection and maintenance agreement executed by the property owner or authorized representative.

10. Letter of completion documenting the settings of all frequency channels or bands. subbands, channel/band gains, and filter bandwidths, and all configurable parameters of automatic gain control (AGC) modes used during the installation and testing. One copy shall be maintained onsite with a second copy provided to the AHJ.

Initial Acceptance Verifications:

1. Go to the fire command or panel location and verify that the unit is not in alarm or in trouble status.
2. The test team will verify the model for the BDA and DAS system as per the approved plans.
3. Verify the BDA (Bi-Directional Amplifier – head end unit), DAS (Distributed Antenna System - remote) components shall be contained in a NEMA 4 and battery system components shall be contained in a NEMA 3R or higher-rated cabinet. This shall be documented on the plans.
4. The test team shall verify a dedicated panel with visual and labeled indications of the monitored signals.
5. The test team will verify that the riser has the approved survivability requirement as per the approved plans, NFPA 70, NFPA 1225 and IFC.
6. The test team will verify that the BDA (head end unit) and DAS (remotes) are in a secured area in areas with a fire resistance rating of 2-hrs. or what the construction of the building's fire rating requirements are. Verify the BDA is not below grade level (NFPA 1225). A per approved plans.
7. Walking with the radio and the spectrum analyzer (spectrum analyzer to be provided by contractor), the team shall verify the coverage meets 95 percent of the floor coverage of the building. Minimum -95dbm for the signal strength always, sending and receiving with a DAQ of 3.0 or greater.
8. All critical areas shall be confirmed for 99% floor coverage (NFPA 1225 18.8)
    a. Emergency Command Centers
    b. Fire Pump Rooms
    c. Exit Stairs
    d. Exit Passageways
    e. Elevator Lobbies
    f. Standpipe Cabinets
    g. Sprinkler Sectional Valve Locations
9. The test team shall verify and test the following signals are monitored at the dedicated panel and at the Fire Command Center if applicable. (when accepted by the AHJ a single supervisory signal is permitted to be monitored by the fire alarm system with all required signals indicated at the ERCES annunciator)
    a. Loss of normal AC power
    b. System battery charger failure
    c. Signal Source Malfunction.
    d. Failure of Active RF-Emitting devices

e. Low battery capacity (to 70 percent depletion)
f. Failure of critical system components
g. The communications link between the fire alarm system and in in-building ERC system. (Note: this is achieved via FACP supervision of the signaling line circuit, and loss of this connection will result in a trouble condition at the FACP)
h. Oscillation of active RF-emitting devices.

Zone Testing (per IFC 510.5.4):

1. Start the 4 or 12-hr. Backup test and verify that the head end unit and the remote units are all on backup power.
2. While under battery load the system shall be tested for a period of 1 hour to verify that they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for an additional 1-hour until the integrity of the battery can be determined. (After 1 hour and there are no battery issues, power can be restored, and testing can continue under power)
3. One inspector will stay within the Fire Command Center or panel location, one inspector will assume an Incident Command position external of the building, both inspectors are to repeat and confirm the radio communication for the testing team withing the building.
4. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
5. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system or equipment approved by the fire code official.
6. Failure of more than one test area shall result in failure of the test.
7. In the event that two of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of not more than two nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 95-percent coverage requirement.
8. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered to be a failure of that test area. Additional test locations shall not be permitted.
9. The gain values of all amplifiers shall be measured, and the test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.
10. As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal

booster. This test shall be conducted at the time of installation and at subsequent annual inspections.

11. Systems shall be tested using two portable radios simultaneously conducting subjective voice quality checks. One portable radio shall be positioned not greater than 10 feet (3048 mm) from the indoor antenna. The second portable radio shall be positioned at a distance that represents the farthest distance from any indoor antenna. With both portable radios simultaneously keyed up on different frequencies within the same band, subjective audio testing shall be conducted and comply with DAQ levels as specified in Sections 510.4.1.1 and 510.4.1.2.

Test team shall verify that all signals have cleared, and all power supplies have been restored prior to completing the test.

The lead team member shall provide the testing narrative in the resulting of the permit. Provide the spectrum analyzer report to the AHJ.

8.0 OPERATIONAL PERMITS:

Annual Renewable Permit Requirements:

1. Property owner shall obtain the required annual renewable permit from the AHJ and maintain the permit in good standing for the life of the system.
2. Property owner shall contract with a licensed and qualified contractor for inspection & 24/7 maintenance for the life of the system.

9.0 PERIODIC INSPECTION AND TESTING REQUIREMENTS:

Semi-annually:

All systems that are connected to fire alarm or dedicated function sprinkler monitoring panels that are monitored off site as defined by NFPA 72 shall be visually inspected semiannually for the following conditions in accordance with NFPA 1225 20.3.10.2:

1. Normal ac power
2. Loss of normal ac power
3. Battery charger failure
4. Low battery capacity
5. Signal source malfunction
6. Active RF-emitting device malfunction
7. Active system component malfunction
8. Loss of communication with the fire alarm control panel
9. Signs of physical damage to components that could affect proper system operation

Annually:

1. All systems shall be operationally tested annually in accordance with IFC 510.6 & NFPA 1225 20.3.10. Testing shall consist of the following:
    a. In-building coverage test as described in IFC Section 510.5.4.
    b. Signal boosters shall be tested to verify that the gain is the same as it was upon initial installation and acceptance or set to optimize the performance of the system.
    c. Backup batteries and power supplies shall be tested under load of a period of 1 hour to verify that they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.
    d. All active components shall be checked to verify operation within the manufacturer's specifications.
    e. At least one quantitative DAQ test shall be in accordance with NFPA 1225 18.9.1 and 18.9.2 on each floor. Where the floor area exceeds 128,000 ft^2 (11,900 m^2), additional quantitative tests shall be performed.
    f. Signal boosters shall be tested to verify that the gain is the same as it was during the initial installation and acceptance or set to optimize the performance of the system.
    g. Backup batteries and power supplies shall be tested under load for a period of 1 hour.
    h. Other active components shall be checked to verify operation within the manufacturer's published specifications.
    i. All required supervisory monitoring signals shall be tested.
    j. A spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster.
    k. Where a donor antenna is used, isolation in accordance with NFPA 1225 Section 18.10 shall be verified.
    l. An inspection shall be made to evaluate if the building structural changes or alternations that have been made impact the communications coverage of the system as required in NFPA 1225 Section 18.8.
2. All visual inspection and testing reports shall be documented in a format acceptable to the AHJ in writing.
3. All reports shall be retained for the life of the system in either paper or electronic form and be made available to the AHJ upon request.
4. Contractor shall upload annual test report documents to the approved electronic system.
5. Impairments, deficiencies, discontinuation or declined service shall be reported via the approved electronic system as described and within the time frames specified in IFC 110.3 as amended.

5 Years:

1. Every five years a new frequency rebroadcasting agreement with the associated approvals shall be obtained from the frequency holder. Follow the requirements outlined in section 6.0 of this document to obtain a new frequency rebroadcasting agreement.

2. At least every five years systems shall be quantitatively tested to ensure that the system still provides the required DAQ values in accordance with NFPA 1225 Section 18.9.
3. The five-year test shall also confirm that there has been no deviation of coverage more than 5 percent from the initial installation documentation.
4. Deviation of more than 5 percent shall result in additional evaluations to determine if any system modifications are required to bring the system into conformance with the coverage required in Section NFPA 1225 18.9.
5. The five-year test shall confirm that there have been no changes in the frequencies utilized for the proper operation of the system.
6. The AHJ can require additional testing if the system fails to operate during normal operations at frequencies shorter than five years or if radio system conditions change.

Remodels and Tenant Improvements:

1. The owner of the building or owner's authorized agent shall have the in-building emergency responder communications enhancement system inspected and tested where structural changes occur, including additions or remodels that could materially change the original field performance tests.
2. ERCES modifications required as a result of such changes shall adhere to the submittal and permitting requirements outlined in this document.
3. If testing is required based on construction changes or alterations to coverage:
    a. Go to fire command or panel location and verify that the unit is not in alarm or in trouble status.
    b. Follow testing procedures for a new install listed above if changes to the building have been made. Testing signals is required in areas that are affected by a building change.
    c. Spot checking other areas may also be performed at this time.