



**COLORADO SPRINGS FIRE DEPARTMENT**  
**Division of the Fire Marshal**  
**Supplemental Ruling / Clarification**

<b>Number:</b>	2010-4		
<b>Subject:</b>	In-Building Radio Amplification Systems		
<b>Reference:</b>	2003 IFC Section 907.2.12.3		
<b>Effective Date:</b>	08/03/10	<b>Issued By:</b>	Kris Cooper, Deputy Fire Marshal
<b>Approval Date:</b>	08/03/2010	<b>Approved By:</b>	Brett Lacey, Fire Marshal 
<b>Revision Date:</b>		<b>Revised By:</b>	

**PURPOSE:** To clarify when and how in-building radio amplification systems are to be installed.

**SCOPE:** This ruling applies to any in-building radio amplification systems, voluntary or otherwise, that are installed in any structure in the City of Colorado Springs.

**DESCRIPTION OF ISSUE:** Section 907.2.12.3 as amended allows the Colorado Springs Fire Department to authorize a public safety radio amplification system to be installed within certain buildings and structures within the City of Colorado Springs. This is an option in lieu of the code required internal two-way fire department communications system. While this amendment allows for the installation, it gives no specific detail on how these systems should function when installed.

**DECISION:** This document establishes a uniform practice on the installation of public safety radio amplification systems to insure a reasonable degree of reliability for emergency services communication from within certain building and structures within the City of Colorado Springs, including to and from the emergency communications center.

**Enhanced Amplification Systems:**

Where buildings and structures provide equipment or systems to enhance signal strength, such buildings and structures shall be equipped with any of the

following to achieve the required adequate radio coverage: radiating cable systems, internal antenna systems with a frequency range as established by the City of Colorado Springs Radio Shop, with amplification systems as needed, voting receiver system, or any other approved system.

If any part of the installed system or systems contains an electrically powered component, the system shall be capable of operation on an independent battery and/or generator system for a period of at least four hours without external power input or maintenance. The battery system shall automatically charge in the presence of an external power input.

**System Design:**

Radio amplification system design must be coordinated between the property owner, vendor, Colorado Springs Fire Department, City of Colorado Springs Radio Shop and the emergency services communications center. The City of Colorado Springs Radio Shop will identify the frequency range or ranges that must be supported.

**Performance Requirements - Inbound into the Building:**

1. A minimum average in-building field strength of -95 dBm (3.99uV or 53dBu) throughout 95% of the area of each floor of the building when transmitted from the appropriate emergency service dispatch centers which are providing fire and emergency medical protection services to the building.
2. As used in this regulation, 95% coverage or reliability means the radio will transmit 100% of the time at the field strength and levels as defined in this regulation within 95% of the building's area.
3. The following areas must be 100% covered: Fire Command Center, elevators, stairwells, protect-in-place areas, lobby refuge areas, equipment rooms, high hazard areas, basements, and underground parking areas.
4. If the field strength OUTSIDE the building where the receiving antenna system for the in-building system is located is less than the -95 dBm, then the minimum required in-building field strength shall equal the field strength being delivered to the receive antenna of the building.

**Performance Requirements - Outbound from the Building:**

An average signal strength of 53dBu as received at the appropriate emergency service radio site which will provide fire and emergency medical protection services to the building. Settings may need to be adjusted to ensure the in-building amplification system does not overpower the emergency service radio sites.

**FCC Authorization:**

If amplification is used in the system, all FCC authorizations must be obtained prior to the use of the system. A copy of these authorizations shall be provided to the Colorado Springs Fire Department at the time of final inspection.

**Colorado Springs Fire Department Permit and Submittal Requirements:**

Colorado Springs Fire Department requires a permit before the installation of all radio amplification systems that support emergency communications. The following information must be included in the submittal:

**1. Letter of Understanding**

A letter of understanding that explains the capabilities and limitations of the system being installed. The Letter of Understanding must also include written agreement that regardless of the systems design approved at time of plan review, failure of the system to meet the minimum performance requirements will be cause for modification of or additional amplification equipment to be installed. The Letter of Understanding must be signed by the contractor and co-signed by the building owner or owners authorized representative.

**2. Installation and Design Plans**

Two sets of Installation and Design Plans shall be submitted for review to the Colorado Springs Fire Department before any equipment is installed or modified. The fire department, as well as the City radio shop will review the plans. If approved, one set will be marked as such and become the approved installation plans of record for the project. The second copy will be retained as official archived records. Deviation from the approved plans shall require permission of the Colorado Springs Fire Department and may require updated or as-built plans to be submitted. Installation and Design Plans shall be drawn to an indicated scale, on sheets of uniform size, with a plan of each floor, and shall show those items from the following list that pertain to the design of the system.

**A. Radio Frequency Field Strength Information:**

1. Location, elevation, date, and time of field strength test.
2. Test conducted by or information supplied by.
3. Other sources of radio frequency field strength information.
4. Map showing location of all government transmitter locations in relation to the building.
5. Location, height, and distance of all government transmitter locations in relation to the building.

6. List of frequencies and bandwidth calculations to be included in the system.
7. Copy of FCC license for frequencies used.
8. Radio frequency field strength test results for each transmitter location.

**B. Building Plans:**

1. Name and address of contractor.
2. Name of owner and occupant.
3. Location, including street address.
4. Point of compass.
5. Full height cross section, or schematic diagram, including structural member information if required for clarity and including ceiling construction and method of protection for nonmetallic piping.
6. Location of partitions/barriers.
7. Location of fire walls.
8. Occupancy class and use of each area or room.
9. A graphic representation of the scale used on all plans.

**C. System Equipment and Plans:**

1. Make, type, model, and size of all cable, amplifiers, antennas, batteries, etc. (spec sheets).
2. Location of all cable, amplifiers, battery panels, etc. (all equipment must be installed in locked water-proof cabinets)
3. Type and locations of hangers, sleeves, braces, and methods of securing cable and antennas, when applicable.
4. Battery and battery charging calculations.
5. System design calculations.
6. Declaration that the power supply for the equipment will be supervised for integrity through the fire alarm system that will be capable of reporting equipment failure as a supervisory signal.
7. Where the equipment is to be installed as an addition to an existing system, enough of the existing system indicated on the plans to make all conditions clear.

The working plan 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.

**D. Acceptance Test Plan:**

The Acceptance Test Plan must be included with the Installation and Design Plan and must incorporate all elements of the Acceptance Test Plan as listed below.

**E. Permit Fees**

Fees for the plan review, permit, and inspection will be assessed at the time of plan review in accordance with the Colorado Springs Fire Department Fee Schedule as adopted by City Council.

**System Testing and Acceptance:**

When the system has been installed, pretested, and is ready for final inspections, the permit holder must contact the Colorado Springs Fire Department to schedule the final acceptance test. The system shall be tested in accordance with the Acceptance Testing Plan.

**Qualifications of Testing Personnel:**

All tests shall be conducted, documented and signed by a person in possession of a current FFC license, or a current technician certification issued by the Associated Public-Safety Communications Officials International (APCO) or the Personal Communications Industry Association (PCIA). All test records shall be retained on the inspected premise and a copy submitted to the Colorado Springs Fire Department for official archiving.

**Acceptance Test Plan (ATP):**

The following method shall be used to conduct the test:

1. Tests shall be made using frequencies close to the frequencies used by the emergency services, and shall be witnessed by the Colorado Springs Fire Department and the City of Colorado Springs Radio Shop.
2. 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.
3. All testing shall be done on frequencies that are authorized by the FCC.
4. A valid FCC license shall be required if testing is done on frequencies different from the City's police, fire, or other emergency services frequencies.
5. The plan and acceptance tests must be approved by the Colorado Springs Fire Department and the City of Colorado Springs Radio Shop.

**Measurements Shall be Made Using the Following Guidelines:**

1. With a service monitor using a gain antenna on a small ground plane.

2. Measurements shall be made with the antenna held in a vertical position at three to four feet above the floor.
3. A calibrated service monitor (must have record of a factory calibration within the last 24 months) may be used to perform the test measurements.
4. If measurements in a specific location are varying, the average measurements may be used.

**Initial Tests:**

All tests shall be witnessed by a Colorado Springs Fire Department Inspector and an employee of the City of Colorado springs Radio Shop.

1. Signal Strength, both inbound and outbound as defined above, shall be measured on each and every floor level above and below grade level including stairways, basements, penthouse facilities, and enclosed parking areas of the structure.
2. The structure shall be divided into 100 square-foot grids and the measurements shall be taken at the center of each grid. In critical areas as determined by the Colorado Springs Fire Department (fire command center, elevators, stairways, elevator lobbies, equipment rooms, high hazard areas, basements, underground parking areas, etc.) the grids shall be reduced to 25 square feet. The size of the grids may also be reduced upon requirements of the fire inspector for areas where displays, equipment, stock or any other obstruction may significantly affect communications in the determined areas.
3. The test shall be conducted using a portable radio approved by Colorado Springs Fire Department, talking through the emergency services communications center.
4. A spot located approximately in the center of a grid area will be selected for the test.
5. The radio will be keyed to verify two-way communications to and from the outside of the building through dispatch. Once the spot has been selected, prospecting for a better spot within the grid will not be permitted.
6. Each grid area will be tested for transmission/reception at minimum signal strength of -95 dBm. If signal strength fails to meet the requirement, the grid shall be marked as a fail.
7. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file at the facility and with the Colorado Springs Fire Department so that the performance can be verified during each year's annual test. In the event that the measurement results become lost, the building owners will be required to re-run the acceptance test to reestablish gain values.

**Annual Test by Property Owner:**

The property owner shall have an annual test conducted by a third party of all active components of the system, including but not limited to

amplifiers, power supplies, and backup power systems. Amplifiers shall be tested to ensure the gain is the same as it was at the time of initial acceptance testing and system approval. Backup power supplies shall be tested under load for a period of one hour to verify they will properly operate during a power outage situation. If within the one hour test period, in the opinion of the testing technician, the battery exhibits signs of failure, the test shall be extended for an additional hour to confirm the status of the batteries. All other active components shall be inspected/tested to determine that they are operating within the manufacturer's specifications for the intended purpose. Any deficiencies noted at the time of inspection shall immediately be brought to the attention of the property owner to implement the appropriate corrective action.

**Field Testing:**

Colorado Springs Fire Department and/or City of Colorado Springs Radio Shop employees, 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 shall immediately be brought to the attention of the property owner to implement the appropriate corrective action.

**Existing Systems:**

Except as otherwise provided for in this ruling, no person shall modify any building or structure or portion thereof, or cause the same to be done which fails to support adequate radio coverage for emergency service providers where existing systems are installed. For purposes of this section, adequate radio coverage shall constitute a successful communications test between the building interior and the emergency communications center. In the event the City of Colorado Springs changes its radio frequencies, it will be the responsibility of the property owner to upgrade/change their system to comply with the new frequencies. This upgrade/change will be required within 60 days of receipt of written notice.