Emergency Responder Radio Coverage

Scope: This policy establishes the guidelines/requirements for Emergency Responder Radio Coverage testing in new construction.

Description

Section 510 of the 2018 IFC mandates that all new buildings have approved radio coverage for emergency responder communication systems and IFC 510.1 Exception 2 provides that the fire official can determine when that coverage is not needed. Adams County Fire Rescue will waive the testing requirement and the system installation in all buildings less than 2,000 square feet and any Type V construction building less than 25,000 square feet. This policy does not waive the requirement for testing and installation of systems in existing buildings when it is determined that there are coverage issues during normal response activities.

Interpretation

System Design:

Radio amplification system design must be coordinated between the property owner, vendor, Adams County Fire Protection District (ACFPD) and Adams County Communications (ADCOM).

The frequency range which must be supported shall be current public safety frequencies of base Rx 806-824 and base Tx 851-869 MHz and easily reconfigured with filter changes to base Rx 806-815 and base Tx 851-860 MHz after the FCC-mandated “re-banding”. It shall be the responsibility of ACFPD and ADCOM to ensure adequate radio signal strength in these frequency ranges to and from the building. That signal must be brought into the building and sent back out in accordance with the following:

Performance requirements - inbound into the building:

1. IFC Section 510.4.1.1 Minimum signal strength into the building
   a. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the fire code official. The inbound signal level shall be sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 or an equivalent Signal-to-Interference-Plus-Noise Radio (SINR) applicable to the technology for either analog or digital signals.

2. A minimum average in-building field strength of 5uV (-95 dBm) throughout 95% of the area of each floor of the building when transmitted from ADCOM.
3. As used in this directive, 95% coverage or reliability means the radio will transmit 100% of the time at the field strength and levels defined in this directive within 95% if the specified area.

4. The following critical areas must be 100% covered: fire command centers, stairways, elevator lobbies, protected-in-place areas, areas of refuge, equipment rooms, high-hazard areas, basements, and underground parking areas.

5. If the outside field strength at the buildings receive antenna is less than -95 dBm, the minimum required in-building field strength shall equal the field strength being delivered to the receive antenna.

Performance requirements - outbound from the building:

1. IFC Section 510.4.1.2 Minimum signal strength out of the building.
   a. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the fire code official. The outbound signal level shall be sufficient to provide not less than a DAQ of 3.0 or an equivalent SINR applicable to the technology for either analog or digital signals.

2. A minimum average signal strength of 5uV (-95dBm) shall be received at ADCOM.

Radio amplification system equipment shall be located in an approved area with adequate environmental controls required by the product manufacturer. The equipment shall be housed in a NEMA-4 sealed cabinet which must protect it from smoke, water, and fire damage, within a two-hour fire protected room.

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 external power input. All equipment shall be properly grounded.

The system shall be supervised by the building’s fire alarm system, where provided, for power supply and operation status.

FCC Authorization:

If amplification is used in the systems, all FCC authorizations for public safety radio amplification must be obtained prior to the use of the system. A copy of these authorizations shall be provided to ACFPD.

Permit and Submittal Requirements:

A permit shall be obtained from ACFPD prior to the installation of all radio amplification systems that support emergency communications. The following information must be submitted:

1. Letter of understanding – A letter of understanding that explains the system’s capabilities and limitations.

2. Working plans – electronic copy of working plans shall be submitted for approval before any equipment is installed or remodeled. Deviation from approved plans shall require approval of the fire code official. Working 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 lists below that pertain to the design of the system.

3. Radio frequency field strength information:
4. Building plans:
   - Name and address of contractor.
   - Name of owner and occupant.
   - Location, including street address.
   - Point of compass
   - 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.
   - Location of partitions.
   - Location of fire walls.
   - Occupancy class and use of each area or room.
   - A graphic representation of the scale used on all plans.

5. System equipment and design details:
   - Make, type, model, and size of all cable, amplifiers, antennas, batteries, etc. (spec sheets)
   - Location of all cable, amplifiers, battery panels, etc.
   - Type and locations of hangers, sleeves, braces, and methods of securing cable and antennas, when applicable.
   - Battery and battery charging calculations.
   - System design calculations.
   - 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.

6. For combination systems also providing service for cell-phone, wireless data, internal radio, or similar systems.
   - A letter from the design professional verifying that shared systems will not interfere with emergency radio systems.
   - Plans shall show the connections of all other systems connected to common amplification components.

System Testing and Acceptance:

The public safety radio amplification system shall be tested upon completion and prior to final acceptance of the system. All tests shall be conducted, documented, and signed by a person in possession of a current FCC radiotelephone operator license. All test records shall be retained on the inspected premises and a copy submitted to ACFPD.

The following parameters will be used to conduct the tests:

1. Tests shall be made using frequencies close to the frequencies used by the emergency services.
2. If testing is done on the actual frequencies, then this testing must be coordinated with the appropriate emergency services.
3. All testing must be done on frequencies that are authorized by the FCC.
4. A valid FCC license will be required if testing is done on frequencies different from the police, fire or emergency medical frequencies.

Measurements shall be made using the following guidelines:

1. With a service monitor using a unity gain antenna on a small ground plane.
2. Measurements shall be made with the antenna held in a vertical position at 3 to 4 feet above the floor.
3. A calibrated service monitor or spectrum analyzer (with a factory calibration dated within 24 months) may be used to make the tests.
4. If measurements in a location are varying, then average measurements may be used.
5. A Fire Inspector will do a hands-on radio test to check the area for proper radio operation/reception.

Acceptance tests will be witnessed by a Fire Inspector using the following procedures:

1. Signal strength, both inbound and outbound as defined in this directive, shall be measured on all floors including stairwells, basements, penthouse facilities, and parking areas of the structure.
2. Each floor shall be divided into grid of approximately 20 equal areas. A maximum of two nonadjacent areas will be allowed to fail the test. In the event three areas fail, and to be statistically accurate, the floor may be divided into 40 equal areas; with a maximum of four nonadjacent areas allowed failing the test. In the critical areas specified in this directive requiring 100% coverage, the grids shall be reduced to 25-feet. The size of the grids may also be reduced upon recommendations of the Fire inspector, in areas where displays, equipment, stock or any other obstruction may significantly affect communications in those areas.
3. The test shall be conducted using ACFPD portable radio in order to communicate with ADCOM.
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 outside of the building through ADCOM. Once the spot has been selected, prospecting for a better spot within the grid area will not be permitted.
6. Each grid area will be tested for transmission/reception at the minimum signal strength of -95dBm. If signal strength fails to meet the requirement, the grid area 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 the fire department so that the measurements can be verified each year during the annual tests. In the event that the measurement results become lost, the building owner will be required to rerun the acceptance test to reestablish the gain values.

System Maintenance

Public safety amplification systems shall be maintained in an operative condition at all times and shall be replaced or repaired where defective. An annual test shall be conducted by the building owner, or designed qualified technician, or all active components of the system including, but not limited to, amplifiers, power supplies and backup batteries. 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 hour to verify that they will properly operate during an actual power outage. If within the one-hour test period, in the opinion of the testing technician, the battery exhibits symptoms of failure, the test shall be extended for additional one-hour periods until testing technicians confirm the integrity of the battery. All other active components shall be checked to determine that they are operating within the manufacturer’s specifications for the intended purpose.

Annual tests shall also be conducted by ACFPD using field radios. If the communications appear to have degraded or if the tests fail to demonstrate adequate system performance, the owner of the building or structure is required to remedy the problem and restore the system in a manner consistent with the original approval criteria.

When building additions or alterations occur, the owner of the building or structure is required to maintain the system in a manner consistent with the original approval criteria in order to obtain a final inspection for occupancy.

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Christopher Wilder                Original Issue Date
Deputy Fire Marshal