



# Riverside County Fire Department

## Office of the Fire Marshal

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# Technical Policy

<b>Title:</b> Emergency Responder Radio Coverage Systems		
<b>Technical Policy:</b> # TP 19-002	<b>Effective Date:</b> 08/15/2019	<b>Revised Date:</b> 09/28/2021
<b>Code References:</b> 2019 California Fire Code, Sections 104.1, 104.7.2, 510, 907.2.12.2 and 2016 NFPA 1221		

## Purpose

The Riverside County Fire Department (RCFD) Office of the Fire Marshal (OFM) has prepared this policy to provide guidance to building officials, contractors, architects, business owners, consultants and the general public on local interpretations and practices that are considered to be in compliance with the 2019 California Fire Code (CFC). In accordance with CFC Section 510.4.2.2, the purpose is to provide specific technical information and requirements for emergency responder radio coverage systems in new buildings served by Riverside County Public Safety Agencies. The intent is to clarify aspects of the code that are vague or non-specific by addressing selected issues under normal conditions. The requirements of this policy shall not be construed as altering any existing code, law or regulation which may require fire protection features not covered or alluded to in these requirements, nor shall they waive any requirements of any code, law or regulation. The reader is cautioned that the guidance detailed in this policy may or may not apply to their specific situation, and that the OFM retains final authority to determine compliance.

## Scope (CFC 510.1)

All new buildings shall have approved radio coverage systems for emergency responders within the building in accordance with this Technical Policy based upon the existing coverage levels of the public safety communication systems at the exterior of the building.

### **Exceptions:**

1. Buildings and structures that are three (3) stories or less, do not exceed 50,000 square feet in area on any single story, and do not have any complete or partial below grade building levels. Should there be complete or partial below grade levels, then this Technical Policy applies to those levels only.
2. Wood-constructed residential buildings and structures four (4) stories or less that do not have any complete or partial below grade building levels and that are not built integral to an above ground parking structure. Should there be complete or partial below grade levels, then this Technical Policy applies to those levels only.
3. Areas within elevator cabs and elevator shafts.
4. Where approved by the Building Official and the Fire Marshal, a wired communication system in accordance with CFC Section 907.2.12.2 shall be permitted to be installed or maintained instead of an approved radio coverage system.
5. Where it is determined by the Fire Marshal that the radio coverage system is not needed. Application for use of this exception requires a radio study assessing existing radio signal strengths at the project location and expected resulting radio signal strengths within all areas of the building based on proposed construction and use. Resulting minimum radio signal strength shall comply with the minimum radio signal strength required in this

Technical Policy. The radio study shall be completed and signed by an FCC Licensed Technician and shall be submitted to and approved by the Fire Marshal prior to building permit issuance. Testing shall be conducted during construction at a time approved by the Fire Marshal to confirm acceptable minimum radio signal strength as defined in this Technical Policy. At a minimum, all drywall, doors, windows, exterior siding, and any roof mounted solar panels shall be installed prior to testing. Proposed test procedure and acceptance criteria shall be based on the acceptance test procedure defined in this Technical Policy, shall be submitted two weeks in advance of proposed testing and shall be approved by the Fire Marshal prior to test. Test shall be conducted by an FCC Licensed Technician and witnessed by RCFD. Successful test shall be documented by the FCC Licensed Technician and a test report submitted to and approved by the Fire Marshal prior to Certificate of Occupancy. Failure to demonstrate compliance with acceptance criteria during the test will require submittal and installation of an approved emergency responder radio coverage system within the building in accordance with this Technical Policy prior to issuance of any Certificate of Occupancy or as otherwise approved by the Fire Marshal.

6. In facilities where emergency responder radio coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the Fire Marshal shall have the authority to accept an automatically activated emergency responder radio coverage system.

This Technical Policy shall not require improvement of the existing public safety communication systems.

### **Definitions**

FCC Licensed Technician: An individual who is qualified with a Federal Communications Commission (FCC) General Radiotelephone Operator License (GROL/PG), or equivalent, to review design plans and perform tests in affected structures to measure compliance with the specifications set forth in this Technical Policy.

Riverside County Public Safety Agencies: Fire and Law Enforcement agencies with jurisdiction at the project location.

### **Requirements**

#### **Construction Permit (CFC 510.3)**

A construction permit for the installation of or modification to emergency responder radio coverage systems and related equipment is required prior to installation. Construction documents and equipment data sheets shall be submitted to the Building Department with jurisdiction and OFM for review and approval. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.

#### **Minimum Qualifications of Personnel (CFC 510.5.2)**

The minimum qualifications of the system designer and lead installation personnel shall include both of the following:

1. A valid FCC-issued general radio operators license.
2. 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.

These qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the Fire Marshal is provided.

### **Technical Requirements (CFC 510.4 – 510.4.2.8)**

Systems, components and equipment required to provide the emergency responder radio coverage system shall comply with the following:

**Emergency Responder Communication Enhancement System Signal Strength.** The building shall be considered to have acceptable emergency responder communications enhancement system coverage when signal strength measurements in 95 percent of all areas on each floor of the building meet the following signal strength requirements:

**Minimum Signal Strength into the Building.** The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the Riverside County Public Safety Agency. 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 Ratio (SINR) applicable to the technology for either analog or digital signals.

**Minimum Signal Strength out of the Building.** The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the Riverside County Public Safety Agency. 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.

**System Performance.** Signal strength shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as specified by the Riverside County Public Safety Agency.

**System Design.** The emergency responder radio coverage system shall be designed in accordance with NFPA 1221 and the following:

**Amplification Systems and Components.** Buildings and structures that cannot support the required level of radio coverage shall be equipped with systems and components to enhance the public safety radio signals and achieve the required level of radio coverage. Public safety communications enhancement systems utilizing radio-frequency-emitting devices and cabling shall be approved by the Fire Marshal. Prior to installation, all RF-emitting devices shall have the certification of the radio licensing authority and be suitable for public safety use.

**Technical Criteria.** The Riverside County Public Safety Agencies radio systems operate within the VHF highband (150-170 MHz) and 700/800 MHz band. Specific frequencies, location of radio sites, effective radiated power of radio sites, maximum propagation delay, applications being used, etc. shall be determined based upon the geographical location of the project site.

**Standby Power.** Emergency responder radio coverage systems shall be provided with dedicated standby batteries or provided with 2-hour standby batteries and connected to the facility generator power system in accordance with CFC Section 1203. The standby power supply shall be capable of operating the emergency responder radio coverage system at 100-percent system capacity for a duration of not less than 12 hours.

**Signal Booster Requirements.** If used, signal boosters shall meet the following requirements:

1. All signal booster components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet.

2. Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher-rated cabinet.
3. Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use prior to installation.
4. Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20dB greater than the system gain under all operating conditions.
5. Bi-Directional Amplifiers (BDAs) used in emergency responder radio coverage systems shall have oscillation prevention circuitry.
6. The installation of amplification systems or systems that operate on or provide the means to cause interference on any emergency responder radio coverage networks shall be coordinated and approved by the Fire Marshal.

**System Monitoring.** The emergency responder radio enhancement system shall be monitored by a listed fire alarm control unit, or where approved by the Fire Marshal, shall sound an audible signal at a constantly attended on-site location. Automatic supervisory signals shall include the following:

1. Loss of normal AC power supply.
2. System battery charger(s) failure.
3. Malfunction of the donor antenna(s).
4. Failure of active RF-emitting device(s).
5. Low-battery capacity at 70-percent reduction of operating capacity.
6. Failure of critical system components.
7. The communications link between the fire alarm system and the emergency responder radio enhancement system.

**Additional Frequencies and Change of Frequencies.** The emergency responder radio coverage system shall be capable of modification or expansion in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority.

**Design Documents.** The Fire Marshal shall have the authority to require “as-built” design documents and specifications for emergency responder communications coverage systems. The documents shall be in a format acceptable to the Fire Marshal.

**Radio Communication Antenna Density.** Systems shall be engineered to minimize the near-far effect. Radio enhancement system designs shall include sufficient antenna density to address reduced gain conditions.

**Exceptions:**

1. Class A narrow band signal booster devices with independent AGC/ALC circuits per channel.
2. Systems where all portable devices within the same band use active power control features.

**Installation Requirements (CFC 510.5 – 510.5.4)**

The installation of the public safety radio coverage system shall be in accordance with NFPA 1221 and the following:

**Approval Prior to Installation.** Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC or other radio licensing authority shall not be installed without prior coordination and approval of the Fire Marshal.

**Acceptance Test Procedure.** Where an emergency responder radio coverage system is required, and upon completion of installation, the building owner shall have the radio system

tested by an FCC Licensed Technician and witnessed by RCFD to verify that two-way coverage on each floor of the building is not less than 95 percent. The test procedure shall be conducted as follows:

1. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
2. The test shall be conducted using calibrated portable radios of the latest brand and model used by Riverside County Public Safety Agencies talking through the agency's radio communications system or equipment approved by the Fire Marshal. All testing shall be completed with portable radios at the "on hip" position utilizing a lapel speaker microphone.
3. Failure of more than one test area shall result in failure of the test.
4. 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.
5. 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 Riverside County Public Safety 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.
6. 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.
7. 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.
8. Systems incorporating Class B signal-booster devices or Class B broadband fiber remote devices 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.
9. At the conclusion of the acceptance testing, a report, documenting the procedure and results, shall be submitted to and approved by the Fire Marshal prior to issuance of the Certificate of Occupancy.

**FCC Compliance.** The emergency responder radio coverage system installation and components shall also comply with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219.

#### **Maintenance (CFC 510.6 – 510.6.4)**

The emergency responder radio coverage system shall be maintained operational at all times in accordance with the following:

**Testing and Proof of Compliance.** The owner of the building or owner's authorized agent shall have the emergency responder radio coverage system inspected and tested annually or

where structural changes occur including additions or remodels that could materially change the original field performance tests. Testing shall consist of the following:

1. In-building coverage test as described in the Acceptance Test Procedure section of this Technical Policy.
2. 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.
3. 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.
4. Other active components shall be checked to verify operation within the manufacturer's specifications.
5. At the conclusion of the testing, a report, which shall verify compliance with the Acceptance Test Procedure section of this Technical Policy, shall be submitted to the Fire Marshal.

**Additional Frequencies.** The building owner shall modify or expand the emergency responder radio coverage system at his or her expense in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority. Prior approval of a public safety radio coverage system on previous frequencies does not exempt this section.

**Nonpublic safety system.** Where other nonpublic safety amplification systems installed in buildings reduce the performance or cause interference with the emergency responder communications coverage system, the nonpublic safety amplification system shall be corrected or removed.

**Field Testing.** Riverside County Public Safety Agency personnel shall have the right to enter onto the property at any reasonable time to conduct field testing to verify the required level of radio coverage.