



## San Diego County Fire Protection District

### Guideline for Emergency Responder Radio Coverage

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#### **PURPOSE**

The purpose of this document is to provide guidelines for compliance with the requirements in Section 510 of the California Fire Code (CFC), Section 918 of the California Building Code (CBC) and NFPA 1221 for emergency responder radio coverage systems (ERRCS).

#### **SCOPE**

This Guideline provides specific requirements for the installation of emergency responder radio coverage.

#### **Where Required**

##### **New Buildings:**

All new buildings and structures are required to comply with this guideline except for the following:

1. Group R-3 occupancies (single-family homes, duplexes, and townhomes) as defined by the CBC.
2. Open parking garages with no subterranean portions. CBC 406.5
3. Buildings or structures with a floor area not exceeding 50,000 sq. ft. and do not have subterranean levels.  
\*\* Buildings or structures with a floor area greater than 25,000 sq. ft. and less than 50,000 sq. ft. shall be tested at final inspection / Occupancy for acceptable signal strength. Buildings not meeting the required minimum signal strength will be required to install an ERRCS system prior to final / Occupancy.
4. Buildings or structures that are primarily constructed of wood and do not have subterranean storage or parking.

##### **Existing Buildings:**

Existing buildings must comply with this guideline's requirements if a previously required two-way wired fire department communication system is removed.

#### **SUBMITTAL REQUIREMENTS**

##### **1. General Requirements**

- A. Submit three (3) sets of legible, scaled plans with one (1) set of current and complete technical data sheets/manufacturer's specifications to SDCFPD.
- B. Plans shall be submitted for approval to the SDCFPD before any equipment is installed or remodeled.
- C. Plans shall be drawn in accordance with section 510 of the California Fire Code, section 918 of the California Building Code, and NFPA 1221.

##### **2. Architectural Drawings**

The following note must be added to the architectural drawings for buildings required to meet the requirements for emergency responder radio coverage as listed above:

- A. This project is required to meet the requirements in CFC Section 510 and NFPA 1221 for Emergency Responder Radio Coverage.



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#### 3. Fire Alarm Plans

If two-way communication is not provided for a building because an ERRCS is proposed, then provide notes on fire alarm plans stating that emergency responder radio coverage is provided in lieu of two-way communication.

#### 4. Electrical Plans

The electrical plans must include an approved secondary source of power required for the emergency responder radio coverage system as specified below.

#### 5. Design of Radio Coverage System

##### A. System Design

Buildings requiring an ERRCS system must be equipped with one of the following:

1. A radiating cable system, or
2. An internal multiple antenna system with Federal Communications Commission (FCC)- certified bi-directional amplifier(s), or
3. Systems otherwise approved by the Wireless Services Division to achieve the required radio coverage.
4. 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.
5. Radio enhancement to provide support for two portable radios operating simultaneously on different talk paths or channels.

##### B. Signal Strength

Acceptable ERRCS coverage requires signal strength measurements in 95% of all areas on each floor of the building, meeting the following:

1. Minimum Signal Strength into the Building. The minimum inbound signal strength shall provide usable voice communications throughout the coverage area. Inbound signal level shall 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 into the building of -95 dBm shall be receivable within the building.
2. Minimum Signal Strength Out of the Building. The minimum outbound signal strength shall provide usable voice communications throughout the coverage area. Outbound signal level shall provide not less than a DAQ of 3.0 or an equivalent SINR applicable to the technology for either analog or digital signals.
  - Minimum Signal Strength out of the building of -95 dBm shall be received by the agency's radio system when transmitted from within the building.
3. System Performance. Signal strength shall meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area.
4. Critical areas, including fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by SDCFPD shall be provided with 99% floor area radio coverage.

##### C. Amplification Systems and Components

Buildings required to have an ERRCS system must be equipped with systems and components to enhance the public safety radio signals and achieve the required level of radio coverage in Section 5 Part B. Before



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installation, all RF-emitting devices shall have the Federal Communications Commission (FCC) certification and be suitable for public safety use.

#### **D. Primary Power**

A dedicated branch circuit shall supply the primary power source. The location of the branch circuit disconnecting means shall be permanently identified at all equipment supplied by the dedicated branch circuit. The system circuit disconnecting means shall be permanently identified as "EMERGENCY COMMUNICATIONS" and have a red marking. Where a circuit breaker is the disconnecting means, an approved breaker locking device shall be installed.

#### **E. Standby Power**

An approved secondary source of power must be provided for radio coverage systems requiring electrical components per CFC 604. The secondary power supply shall be capable of operating the radio coverage system at 100% for at least 12 hours. The secondary power supply shall be either a battery system, ups or an emergency generator. All batteries must be contained within a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet.

#### **F. Signal Booster Requirements**

If used, signal boosters shall meet the following requirements:

1. All signal booster components must be contained within 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 4R or higher-rated cabinet.
3. Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use before installation.
4. Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20 dB greater than the system gain under all operating conditions.
5. Bi-Directional Amplifiers (BDAs) used in ERRCSs 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.

#### **G. System Monitoring**

A listed fire alarm control unit must monitor the ERRCS. If no fire alarm system is provided in the building, the system shall sound an audible signal at a constantly attended on-site location approved by the SDCFPD, such as a 24-hour security desk. A dedicated monitoring panel shall be provided within the Fire Command Center to annunciate the status of all RF emitting devices and system component locations. 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% reduction of operating capacity.
6. Failure of critical system components.
7. The communications link between the fire alarm system and the ERRCS.



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#### H. Frequency Range

The ERRCS shall be capable of modification or expansion in the event frequency changes are required by the FCC, or additional frequencies are made available by the FCC.

Within San Diego County there are several simulcasts of our frequency bands. These are based on the geographic location of the building site.

Provide the:

1. Full name of the requestor
2. Name of the company
3. Phone number and email of contact
4. Address and GPS coordinates of the building you are designing a DAS/BDA system for indoor coverage.

Wireless Services Division will provide the correct frequency ranges.

Submit the above information to: [rcsengineering@sdsheriff.gov](mailto:rcsengineering@sdsheriff.gov)

<https://www.rcs800mhz.org/>

#### I. 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.

#### J. Protection of ERRCS

General Fire Protection

1. The backbone, antenna distribution, radiating, or any fiber-optic cable shall be rated as plenum cables.
2. The backbone cables shall be connected to the antenna distribution, radiating, or copper cables using hybrid coupler devices of a value determined by the overall design.
3. Backbone cables shall be routed through an enclosure that matches the buildings fire rating.
4. The connection between the backbone cable and the antenna cables shall be made within an enclosure that matches the building's fire rating, and passage of the antenna distribution cable in and out of the enclosure shall be fire-stopped.

- Where an ERRCS is used in lieu of a two-way wired fire department communication system (e.g., high-rise structures, zoned evacuation), then it shall have pathway survivability by meeting at least one of the following:

Protected by an automatic sprinkler system per NFPA 13 with any interconnecting conductors, cables, or other physical pathways installed in metal raceways.

1. 2-hour fire-rated circuit integrity (CI) or fire-resistive cable.
2. 2-hour fire-rated cable system (electrical circuit protective system).
3. 2-hour fire-rated enclosure or protected area.

Where installed in buildings, conductors and fiber-optic cables shall be installed in accordance with the CEC in any one of the following wiring methods:

1. Electrical metallic tubing



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2. Intermediate metal conduit
3. Rigid metal conduit
  
4. Surface metal raceways
5. Reinforced thermosetting resin conduit (RTRC)

#### **H. Installation**

##### **1. Approval Prior to Installation**

No amplification system capable of operating on frequencies used by the Regional 700 and 800 MHz Radio Systems may be installed without prior coordination and approval of the radio system licensee, Wireless Services Division. Any such system shall comply with any standards adopted by this agency.

##### **2. Mounting of the donor antenna**

The donor Antennas shall be permanently affixed on the building.

##### **3. Qualifications of Personnel**

The system designer and lead installation personnel must meet the following qualifications:

- A. A valid FCC-issued general radio operator's license; and
- B. Certification of in-building system training issued by a nationally recognized organization, schools such as Associated Public Safety Communications Officials International (APCO), National Association of Business and Education Radio (NABER), Wireless Infrastructure Association (WIA) or the International Association for Radio, Telecommunications and Electromagnetics (iNARTE) or a certificate issued by the manufacturer of the equipment being installed; or an ERRCS certification by the National Institute for Certification in Engineering Technologies (NICET).

##### **4. Acceptance Test**

Upon completion of the installation, the system is required to be tested after construction is complete to ensure that the two-way coverage on each floor of the building is not less than 95% (99% in critical areas). The test procedure shall be as follows:

- A. Each floor of the building must be divided into a grid of 20 approximately equal test areas.
- B. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency of jurisdiction, talking through the agency's radio communications system in both receive and transmit modes.
- C. Failure of more than one test area shall result in failure of the test.
- D. If two (2) of the test areas fail the test, the floor shall be permitted to be divided into 40 equal test areas. Failure of not more than two (2) nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system must be altered to meet the 95% coverage requirement.
- E. A test location approximately in the center of each test area must be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location is considered a failure of that test area. Additional test locations are not permitted.



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- F. 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.
- G. As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to ensure the subject signal booster is not generating spurious oscillations. This test shall be conducted at the time of installation.
- H. To prevent TDI/Interference to the RCS on-street simulcast coverage, DAS/DBA system acceptance tests shall also include signal strength measurements and audio tests performed along the outer perimeters of the buildings and parking structure(s), to verify that emissions limits and RF power levels are confined to indoor areas.
- I. 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 from the indoor antenna. The second portable radio shall be positioned at a distance representing 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 Section 5 Part B.
- J. The system installed must be registered with the FCC. Proof of registration must be provided to the SDCFPD.

#### **5. Nonpublic Safety System**

Where other nonpublic safety amplification systems installed in buildings reduce the performance or cause interference with the ERRCS, the nonpublic safety amplification system shall be corrected or removed.

#### **6. Final Report**

Before issuance of a certificate of occupancy, a final Acceptance Report shall be submitted to the Structural Inspector containing a floor plan and the signal strengths at each location tested, and other relevant information stamped and signed by the FCC-certified technician or Engineer with a statement specifying that the building complies with all the requirements of CFC Section 510.

#### **I. Maintenance**

##### **1. Testing**

Testing is required both annually and whenever structural modifications are made that will impact the system. See CFC Section 510.6.1 for requirements for testing.

##### **2. Additional Frequencies**

The building owner is responsible for modifying or expanding the ERRCS at their expense if the FCC requires changes or if additional frequencies are made available by the FCC.