

PAFD SECTION 510 - ERRCS Codes & Addendums



Palo Alto Fire Department

Palo Alto Fire Prevention Bureau 650.329.2184

285 Hamilton Avenue, 1st Floor | Palo Alto, CA 94301

Palo Alto Emergency Responder Radio System Guidelines:

The purpose of this document is to provide guidance for the design and field acceptance testing to ensure that the radio coverage is adequate for first responders emergency operations.

Emergency responders need reliable communications wherever they work, including inside buildings. The 2019 California Building code section 917 and the 2019 California Fire Code Section 510 and 1103 requires that certain buildings be provided with radio enhancement systems designed to provide radio coverage in areas of the buildings where signal strength does not meet minimum criteria due to building construction features and/or location. These radio coverage enhancement systems are also referred to as BDA (bi-directional amplifier) and DAS (distributed antenna systems). In this Protocol, they are collectively referred to as BDA/DAS systems.

510.1 Emergency responder radio coverage in new buildings. *Approved* radio coverage for emergency responders shall be provided within all buildings meeting any one of the following conditions:

1. Where required by the *Fire Code Official* and radio coverage signal strength levels are not consistent with the minimum levels set forth in Section 510.4.1

Exceptions:

1. Where *approved* by the *Fire Code Official*, a wired communication system in accordance with Section 907.2.13.2 shall be permitted to be installed or maintained in lieu of an *approved* radio coverage system.
2. Where it is determined by the *Fire Code Official* that the radio coverage system is not needed.
3. 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 Code Official* shall have the authority to accept an automatically activated **ERRCS**.
4. Buildings and areas of buildings that have minimum radio coverage signal strength levels of the Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase 2 700 MHz Digital Trunked Radio System within the building in accordance with Section 510.4.1 without the use of an indoor radio coverage system.

The radio coverage system shall be installed and maintained in accordance with Sections 510.4 through 510.7 of this code and with the applicable provisions of NFPA 1221, Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems.

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The coverage shall be based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building.

510.1.1 Obstruction by new buildings. No obstruction of the public safety radio system shall be allowed without an *approved* mitigating plan.

510.2 Emergency responder radio coverage in existing buildings. Existing buildings shall be provided with approved radio coverage for emergency responders as required in CFC Chapter 11.

- All existing ERRS shall be upgraded to provide coverage enhancement of 700 through 800 MHZ frequencies at the owner's expense.

510.3 Permit required. A construction permit for the installation of or modification to *ERRCS* and related equipment is required as specified in Section 105.7.5. Maintenance performed in accordance with this code is not considered a modification and does not require a permit. A frequency change made to an existing system will require a new Fire Permit.

510.3.1 SVRIA system registration. Prior to issuance of a construction permit, systems must be registered with the SVRIA at <http://svria.org/resources/> and proof of registration shall be submitted to the *Fire Code Official* upon plan submittal.

Silicon Valley Regional Interoperability Authority
601 EL Camino Real
Santa Clara, CA 95050
Phone: 408.615.5571

3rd party requirements

- Prior to submittal of fire permit a 3rd party consultant is required to review plans and issue a letter of acceptance.
- Prior to final inspection the same 3rd party consultant shall provide an acceptance report showing a 20 grid per floor radio frequency test, a 95% pass rate with a -95BD minimum signal strength.
- 3rd party tester shall, be required to conduct an Uplink Test – 5-watt radio near DBA.

510.4 Technical requirements. Systems, components, and equipment required to provide *ERRCSs* shall comply with Section 510.4.1 through 510.4.2.5.

510.4.1 Radio signal strength. The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in *95 percent* of all areas on each floor of the building meet the signal strength requirements in Sections 510.4.1.1 and 510.4.1.2.

Exception: Critical areas, such as the fire command center(s), the fire pump room(s), interior exit stairways, exit passageways, elevator lobbies, standpipe cabinets, rescue air filling stations, sprinkler sectional valve locations, restrooms and other areas required by the *Fire Code Official*, shall be provided with *99 percent* floor area radio coverage.

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510.4.1.1 Minimum signal strength into the building. A minimum signal strength of -95 dBm shall be receivable in 95% of the area of each floor within the building when transmitted from the Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase 2 700 MHz Digital Trunked Radio System.

510.4.1.2 Maximum signal strength out of the building. A maximum signal strength of -95 dBm shall be received by the Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase 2 700 MHz Digital Trunked Radio System at the donor site when transmitted from 95% of the area of each floor within the building.

510.4.1.3 Signal strength differential. The system shall be designed to ensure that there is a minimum 20 dBm difference between the interior and exterior signal strength.

510.4.1.4 Delivered audio quality. The radio coverage system shall provide a minimum delivered audio quality of level 3.4 (DAQ “3.4”) on each floor of the building or structure. DAQ 3.4 constitutes audio quality that makes speech understandable with repetition only rarely required with some noise and distortion.

510.4.1.5 Building conduit and pathway survivability. All buildings (new and existing) shall provide not less than two-hour fire restive rating for all cabling utilized by the **ERRCS**; and, shall mechanically protect all **ERRCS** cabling from physical damage for survivability of the **ERRCS**. The fire restive rating may be directly satisfied by the cable alone with appropriate listing/rating, or in conjunction with *approved* mechanical protection (e.g. conduit, enclosures), or in conjunction with *approved* fire suppression systems to create a 2-hour rating. Mechanical protection and survivability may be directly satisfied by the cabling alone (with *approval*) or with not less than a two-inch (2”) metal conduit installed for the donor/feeder cable, for the riser distribution cable when present, and all horizontal distribution cable. Alternatively, mechanical protection and survivability may be satisfied (with *approval*) by the ability to detect individual malfunctions/failures of each cable within the **ERRCS** (see 510.5.3.9). All **ERRCS** components shall have a level 1 pathway survivability.

Cable other than **ERRCS** cable is allowed to co-mingle with the radio cable in the conduit provided it is listed, shielded cable that will not interfere with the radio cable. At each floor and the roof, an opening shall be made to allow easy access to the conduit junction boxes from the ceiling.

510.4.2 System design. The **ERRCS** shall be designed in accordance with Sections 510.4.2.1 through 510.4.2.5.

510.4.2.1 Amplification systems allowed.

Buildings and structures that do not support the required level of radio coverage (from existing SVRIA radio sites) shall be equipped with a distributed antenna system with Federal Communications Commission (FCC)-certified, Class A channelized (spectrum agile) public

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safety grade BDA/DASs (bi-directional amplifiers) designed for the frequencies specified by the *Fire Code Official*, in order to achieve the required radio coverage.

The City of Palo Alto will utilize the frequencies necessary to complete the West simulcast cell. Contact SVRIA for the required frequencies.

510.4.2.2 Technical criteria. The *Fire Code Official* shall provide the various frequencies required, the location of radio sites, effective radiated power of radio sites, and other supporting technical information upon request by the building owner or owner's representative.

510.4.2.2.1 The **ERRCS**, extending from the head-end amplifier to the distributed antennas shall not be combined with other DAS systems installed in the building.

510.4.2.2.2 Where fiber distribution systems are used to extend the Public Safety radio system throughout the building or to other buildings, the horizontal fiber runs shall be enclosed in conduit meeting at least the building conduit requirements in Section 510.4.1.5.

510.4.2.3 Power supply sources. **ERRCS** shall be provided with at least two independent and reliable power supply sources conforming to NFPA 72 and the Electrical Code, one primary and one secondary. The standby power supply shall be an approved UPS system capable of operating the **ERRCS** for a duration of not less than 24 hours. When primary power is lost, the power supply to the **ERRCS** shall automatically transfer to the standby power supply.

510.4.2.3.1 Emergency power off (EPO).

An emergency power off switch shall be provided to disconnect primary and secondary power to the ERRS equipment in a location approved by the *Fire Code Official*.

510.4.2.4 BDA/DAS requirements.

- a. All BDA/DAS components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet.
- b. Battery systems used for the emergency power source shall be contained in a NEMA 4-type waterproof cabinet.
- c. The BDA/DAS system and power supply(ies) shall be electrically supervised and monitored in accordance with NFPA 1221.
 - 1.c.i. For buildings without a fire alarm system, a dedicated monitoring panel in accordance with NFPA 72 shall be provided to annunciate automatic supervisory/trouble signals for the BDA/DAS system, power supply and sound an audible signal at a constantly attended location.

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- d. BDA/DAS Equipment shall have FCC certification prior to installation.

510.4.2.5 Additional frequencies and change of frequencies. 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. Cost of changes shall be the responsibility of the building owner.

510.5 Installation requirements. The installation of *ERRCS* system shall be in accordance with Sections 510.5.1 through 510.5. ((4))6. System training issued by one of the following:

- a. Associated Public Safety Communications Officials (APCO),
- b. National Association of Business Education Radio (NABER),
- c. Personal Communications Industry Association (PCIA) or,
- d. the manufacturer of the equipment being installed.

510.5.1 Approval prior to installation. Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC shall not be installed without prior coordination and approval of the *Fire Code Official*.

510.5.2 Minimum qualifications of personnel. The minimum qualifications of the system designer, lead installation personnel and personnel conducting radio system testing shall include possession of both of the following:

1. A valid FCC-issued general radio operators license; and
2. Certification of in-building

All design documents and all tests shall be documented and signed by a person meeting the minimum qualification noted in this section.

510.5.3 Acceptance test procedure and system certification. When an *ERRCS* is required, and upon completion of installation, the building *owner* shall have the radio system tested to verify that two-way coverage on each floor of the building is in accordance with Section 510.4.1. The test procedure shall be conducted as follows:

1. Talk-back testing from a site to the Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase 2 700 MHz Digital Trunked Radio System shall use City of Palo Alto radio(s) on the designated control channel (Channel 2) and may be witnessed by a representative of the City of Palo Alto Fire Department.
2. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.

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3. 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 Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase 2 700 MHz Digital Trunked Radio 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 failure of that test area.

4. The test for emergency responder radio coverage will be considered passed when 95% of the test locations on each floor are able to pass two-way communications to and from the outside of the building.

Exception: Critical areas shall be provided with 99 percent floor area radio coverage.

5. In the event that three of the test areas on a floor fail the talk-back test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. If the system fails the 95% coverage requirement for the 40-area test, the ERRCS shall be altered to meet the 95-percent coverage requirement.

Exception: Critical areas shall be provided with 99 percent floor area coverage.

6. The gain values/output levels 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 BDA/DAS. This test shall be conducted at time of installation and subsequent annual inspections.

8. Individuals conducting initial benchmark and system acceptance tests shall meet the minimum qualifications in accordance with Section 510.5.2. All test results are required to be validated by an *approved* third party, independent of the system designer and installer.

9. **Supervision / Monitoring:** ERRCS, BDA and DAS, shall be electronically monitored by the buildings fire alarm control panel. At a minimum the following seven points shall be monitored: Loss of normal AC power; Failure of UPS: Low-battery capacity; BDA malfunctions/failure; DAS electronics malfunctions/failure; Feeder/riser/horizontal distribution cable; and, DAS antennas.

Prior to issuance of the building Certificate of Occupancy, a system acceptance test report shall be submitted to the **Fire Code Official**, maintained on the premises and be made available to the public safety department upon request. The report shall verify compliance with Section 510.5.4, and include the **ERRCS** equipment data sheets, diagram showing device locations and wiring schematic, and a copy of the electrical permit and system certification letter.

510.5.4 FCC Compliance. The **ERRCS** installation and components shall also comply with all applicable federal regulations, including, but not limited to, FCC 47 CFR Part 90.219.

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510.5.5 Location of equipment. For buildings without a *fire command center* the communications control equipment shall be located inside the building near the fire alarm control panel, or other *approved* location. An emergency power off switch shall be provided to disconnect primary and secondary power to the ERRS equipment.

510.5.6 Signage. Buildings equipped with an *ERRCS* shall be identified by an *approved* sign located above or near the building key box stating: “Radio System Installed”. A sign stating “ERRCS” will be placed on or adjacent to the door of the room containing the main system components. These signs shall meet the City of Palo Alto’s current ERRCS sign standard. All weather Metal backed, red reflective background, with blue reflective lettering (Helvetica 1.5” lettering)

510.6 Maintenance. The *ERRCS* shall be maintained operational at all times in accordance with Sections 510.6.1 through 510.6.5

510.6.1 Testing and proof of compliance. The *ERRCS* shall be inspected and tested annually or whenever structural changes occur including additions or remodels that could materially change the original field performance tests. Individuals conducting the tests shall meet the minimum qualifications in accordance with Section 510.5.2. All test results are required to be validated by an *approved* third party, independent of the system designer and installer. Testing shall consist of the following:

1. In-building coverage test as described in Section 510.5.3.
2. BDA shall be tested to verify that the gain/output level is the same as it was upon initial installation and acceptance.
3. Backup batteries and power supplies shall be tested under load 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 additional 1-hour periods until the integrity of the battery can be determined.
4. All other active BDA/DAS system 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 Sections 510.5.3 and 510.6 shall be submitted to the *Fire Code Official* and a copy maintained on the premises and made available to the *authority having jurisdiction* upon request.
6. Annual **ERRCS** testing is required at the building owner’s expense.

510.6.2 Additional frequencies. Upon notification by the authority having jurisdiction that frequency changes are required by the FCC or additional frequencies are made available by the FCC the *building owner* shall modify or expand the *ERRCS* at their expense. Prior approval of a public safety radio coverage system on previous frequencies does not exempt this section.

510.6.3 Field testing. City of Palo Alto and/or its representatives 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.

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510.6.4 Qualifications of testing personnel. All tests shall be documented and signed by a person meeting the minimum qualifications set forth in Section 510.5.2.

510.6.5 Continuing operation/supervision. The occurrence of any fault in an *ERRCS* where the system function is decreased shall result in the transmission of a supervisory signal to a supervisory service. Systems that are out-of-service for more than 8 hours require notification to the *Fire Code Official*.

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Design Details for Approved Building Signage Required in Section 510.5.6:

6" x 8" Metal backed Sign
½" Lettering

2" x 4" Graphic

Red Background with Blue
Letters and Graphic



Radio System Installed