COSUMNES COMMUNITY SERVICES DISTRICT
FIRE DEPARTMENT
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CosumnesCSD.gov/Fire

FIRE PREVENTION CONSTRUCTION STANDARDS
Emergency Responder Radio Coverage for Non-High-Rise Buildings

Standard Number:	FPCS-1021
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Code Section:	2022 California Fire Code

STANDARD

1021.1 The Sacramento Regional Radio Communications System ("SRRCS") provides radio communications for fire, emergency medical services, and law enforcement agencies in the CSD Fire Jurisdiction. Buildings that do not have adequate radio coverage must be equipped with an "Emergency Responder Radio Coverage System" ("ERRCS") to boost the radio signals within the structure. Adequate radio coverage must be inspected at the completion of construction or improvements to the building and annually when an ERRCS is installed. The Owner is responsible for testing, documentation, and demonstrating adequate radio coverage. All formal tests must be witnessed by the Fire Inspector or may be performed by a 3rd test Service approved by the Cosumnes Fire Department.

a. Installing an ERRCS in a new building or an existing building requires special planning, permitting and building infrastructure to meet the fire code requirements. It is strongly advised that radio coverage be assessed at critical construction stages to mitigate construction costs and delays.

PURPOSE AND SCOPE

1021.2 Safety provisions in the 2022 California Fire Code ("CFC") address concerns regarding the reliability of portable radios used inside buildings by emergency responders including fire, emergency medical and police personnel. Building construction features and materials can have a negative impact on emergency responder communications by blocking critical messages. This standard defines the requirements for acceptable radio coverage and sets forth requirements for new and existing structures that must be equipped with an Emergency Responder Radio Coverage system.

APPLICATION

1021.3 Definitions

a. None

1021.4 Emergency Responder Radio Coverage System shall meet the criteria of the 2022 California Fire Code as amended by local ordinance, 2022 Standard for Emergency Services Communications ("NFPA 1225"), 2022 California Electrical Code ("CEC"), 2022 NFPA 72, and any other applicable documents and standards adopted by reference in the CFC. It is the designer's responsibility to ensure that the system complies with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219.

COVERAGE REQUIREMENTS

1021.5 Approved Radio Coverage

a. Approved radio coverage shall conform to the current standards of the Cosumnes Fire Department. These standards shall define the acceptable indoor signal levels to provide 90% coverage of the Sacramento Regional Radio Communication Systems (SRRCS) and Sacramento Regional Fire and Emergency Communications Center ("SRFECC") Public Safety Radio Systems inside structures (2022 NFPA 1225 9.6.7.5). Critical areas shall meet 99% floor coverage (2022 NFPA 1225 9.6.7.4). The fire code official may determine exceptions and additions to these standards as required to protect the integrity of the public safety radio system and provide acceptable signal levels in structures critical to public health and safety.

b. Adequate radio coverage shall include all of the following:

1. A minimum signal strength of -95 dBm available in 90% of the area of each floor of the building when transmitted from the closes Sacramento Regional Radio Communications System site (NFPA 1225 18.9 and 2022 CFC 510.4).

2. Critical areas shall meet 99% floor coverage (2022 NFPA 1225.9.6.7.4).

3. A minimum signal strength of -100dBm received at the closest Sacramento Regional Radio Communications site when transmitted from 95% of the area of each floor of the building (NFPA 1225 18.9).

4. The frequency range which must be supported shall be 806-809MHz and 851-854 MHz. The specific channels in use are specified in the following section on Acceptance Testing (NFPA 1225 18.9).

5. The maximum acceptable propagation delay through the amplifier to the donor shall not exceed 55uS (NFPA 1225 18.9).

6. A minimum acceptable Delivered Audio Quality (DAQ) 3.0 shall be received inside the building and at the Donor site in 95% of the floor area. (CFC 510.4.1).

1021.6 Amplification Systems Allowed

a. Buildings and structures which cannot support the required level of radio coverage shall be equipped with any of the following in order to achieve the required adequate radio coverage (CFC 510.4):

   1. A radiating cable system, distributed antenna system and/or a fiber optic distribution system connected to FCC type accepted bi-directional 800 MHz amplifiers as needed.

   2. If any part of the installed system or systems contains an electrically powered component, the system shall be capable of operating on an independent battery and /or generator system for a period of at least 12 hours without external power input.

   3. The battery system shall automatically charge in the presence of an external power input. (CFC 510.4.2.3) The system alarms shall be interfaced and monitored by the Fire Alarm System as supervisory alarms. (CFC 510.4.2.5; NFPA 1225 18.13)

1021.7 Indoor Public Safety Radio Enhancement Systems

a. If required by this code, any indoor public safety radio enhancement systems must comply with current standards set by CFC Section 510.4, the Cosumnes Fire Department, and the regulations of the Federal Communications Commission. Systems shall be inspected, maintained, and modified as necessary to provide approved emergency responder

radio coverage. If changes in FCC regulations or modifications to the SRRC and SRFECC Public Safety Radio System require modifications to a public safety radio enhancement system, the building owner shall make necessary changes to conform to the existing standard. (CFC 510.4.2.6).

WHEN REQUIRED

1021.8 Emergency Responder Radio Coverage in New Buildings

a. All new buildings shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communications systems of the jurisdiction at the exterior of the building. Some exceptions apply. (2022 CFC 510.1).

1021.9 Emergency Responder Radio Coverage in Existing Buildings

a. The 2022 CFC requires radio coverage in existing buildings according to one of the following (2022 CFC 510.2):

   1. Whenever an existing wired communication system cannot be repaired or is being replaced, or where not approved in accordance with 2022 CFC Section 510.1, Exception.

   2. Within a time frame established by the adopting authority.

   3. Exception: Where it is determined by the fire code official that the radio coverage system is not required.

1021.10 Requirement for Approved Emergency Responder Radio Coverage in Buildings

a. All buildings shall have approved indoor radio coverage for emergency responders.

b. Except as otherwise provided, no person shall erect, construct, change the use of or provide an addition of more than 20 percent to, any building or structure or any part thereof, or cause the same to be done which fails to support adequate radio coverage for the Sacramento Regional Radio Communication Systems (SRRCS) and Sacramento Regional Fire and Emergency Communication Center (SRFECC) radio communication system.

c. Determining the existence of approved radio coverage and the correction of any deficiencies shall be the responsibility of the building owner. R3 Construction, buildings of one or two single family dwellings, or those below minimum areas as determined by the fire code official may be exempted from this requirement by the fire code official.

PERMITS REQUIRED

1021.11 A fire department construction permit is required to install or modify emergency responder radio coverage systems. (2022 CFC 105.6.4, 510.3 and 2022 NFPA 1225 18.7).

1021.12 A city of Elk Grove Building Inspection, City of Galt Building Department electrical permit or County of Sacramento Building Department permit or inspection for compliance with 2022 CEC may be required when changes to the electrical system or panels are needed.

1021.13 A separate fire department construction permit is required for any generator systems required for secondary power backup.

PLAN REVIEW SUBMITTAL DOCUMENTS

1021.14 A Cosumnes Fire Department permit application, drawings, and documentation shall be submitted through the online portal. Documentation needed:

a. A copy of Contractors license.

b. A copy of system designer and lead technician qualifications in accordance with 2022 CFC 510.5.3. The installation contractor and designer must have an FCC license and be qualified for the selected products.

c. A copy of a radio coverage assessment documenting the need for an ERRCS in the building and the areas to be improved.

d. A letter from a fire alarm C-10 licensed contractor or NICET Level III qualified technician certifying the fire alarm system modifications for system monitoring is compliant with CFC 510.4.2.5 and NFPA 1225 18.14 or submit two separate sets of fire alarm plans designed and

installed by a licensed fire alarm contractor to meet the monitoring requirements of 2022 NFPA 72 Ch. 24.

e. Scaled construction / design plans with at least the following per CFC 510.4.2:

1. Project name, address, and location map.

2. Designer name, contact information, and wet stamp.

3. Scope of work.

4. Site plan with north arrow, scaled or dimensioned.

5. Elevation and roof plans showing the subject building and surrounding property indicating the location and orientation of outdoor antennas, height, grounding, lightning protection, surge protection (NFPA 1225 13.8, 18.4), anchoring and cable entries demonstrating compliance with 2022 CFC Section 504.4.

6. Equipment list including manufacturer part number, description, quantity and symbol to be used on plans.

7. Floor plans for each interior space showing equipment, power, and antenna locations, coax routes, conduit size, and locations of any miscellaneous system components, including splitters, couplers, filters, inline amplifiers, and alarm/protection equipment. All components shall be named or labeled and referenced in the contactors materials lists and power budget calculation tables. (NFPA 1225 13.1, Ch. 18).

8. Construction details indicating the location of the 12-hour secondary power source and the power budget calculations. (2022 CFC 510.4.2.3, NFPA 1225 18.13.2).

9. Construction details and or notes indicating how signal booster components and battery systems will be protected in NEMA 4-type waterproof cabinets. (2022 CFC 510.4.2.4).

10. Construction details indicating how the ERRCS system is connected to the building fire alarm or monitoring system including a description

of sequence of events associated with testing the alarms. (2022 CFC 510.4.2.5).

11. Construction details indicating how the cable is protected against physical damage in areas that have public access.

12. Plenum rated coaxial cables will be used inside buildings. Cables that are exposed to sunlight shall be UV rated and suitable for outdoor use.

13. Construction details for the 2-hour rated riser for the coaxial cables between the amplifier, donor antennas and horizontal cable runs on each floor. Construction details for pathway survivability meeting Level 1, 2 or 3 on each of the cable extension from the riser to the indoor mounted antennas or from electrical and alarm panels to the amplifier and power equipment. (2022 NFPA 1225 18.2, NFPA 72:12.4).

14. Single line diagram showing the interconnection of the whole system and detailing expected signal levels through the system to/from the indoor antennas.

15. Schematic drawing of electrical system, backup power and emergency power off switch.

16. Schematic drawing of alarm interconnection.

17. Matrix showing FCC issued certification numbers for all electronic equipment.

18. Location of new breakers if added.

f. Equipment specification sheets for:

1. Amplifiers

2. Antennas

3. Coaxial cables and connectors

4. Splitters, combiners, couplers, or any other components proposed.

5. NEMA 4-type waterproof enclosure for repeaters, transmitters, receivers, signal booster components and battery system components.

6. Any equipment requiring FCC certification. (2022 CFC 510.4.2.4).

7. Backup battery and charging system or if used, generator specifications and plans.

INSPECTION DOCUMENTATION

1021.15 A written statement by the installing contractor that the system has been installed in accordance with the approved plans and tested in accordance with the manufactures published instructions and regulating requirements. (2022 NFPA 1225 21.3).

1021.16 A written statement by the fire alarm service provider / contractor that the system has been installed in accordance with the approved plans and tested in accordance with the manufacturers published instructions and other regulating requirements. (2022 NFPA 1225 21.3).

a. If the fire alarm system is certificated a new certificate shall be issued.

b. City of Elk Grove or City of Galt Building Department electrical permits have been obtained for compliance with 2022 CEC, if required.

c. A test certificate / report by a third-party testing company approved by the AHJ that documents the operation of the ERRCS and indoor radio coverage. (2022 CFC 510.5.4, 510.6.1; NFPA 1225 21.3).

d. As-Built construction drawings (2022 CFC 510.4.2.7).

e. Equipment and software manuals to owner (NFPA 1225 21.3, 21.6 and 21.7).

INSPECTION PROCEDURES

1021.17 Inspection Requests

a. To request an inspection, go to www.cosumnescsd.gov/303, “Request Inspection.”
b. To prepare for the inspection:

1. Supply the required inspection documentation.

2. Coordinate the physical inspection of ERRCS and cable pathway prior to closing walls or ceilings.

3. Cosumnes Fire Department reserves the right to inspect radio coverage at any time with reasonable notice. (2022 CFC 510.6.4)

ACCEPTANCE TESTING

1021.18 Acceptance testing is required to demonstrate compliance to the provisions of CFC Section 510. The owner or an authorized agent of the owner is responsible to obtain and fund special inspections services by contract with a 3rd Party Test Service approved by the AHJ (2022 CFC 510.5.4).

a. The two primary considerations for the Acceptance Tests are Equipment Validation (before it is placed on the air) & Coverage Validation (to document the improved coverage). The contractor will not place an amplifier on air before it is verified.

b. After completion of the Acceptance Tests, Cosumnes Fire Department will schedule a walk through to survey the building and verify Fire Command and Dispatch radio operation. Failure of the operational check will require that the owner correct deficiencies and re-schedule Acceptance Testing.

1021.19 Equipment validation will be performed with the contractor present to demonstrate operation of the system including frequency settings, signal levels, gain settings, antenna isolation, alarm operation and backup power operation.

a. The goal is to achieve the minimum power required to carry out the desired operation.

b. The test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests.

c. If the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.

d. 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.

e. This test shall be conducted at time of installation and subsequent annual inspections.

1021.20 Coverage Validation documents that at least 95% of the general floor area meets the minimum signal level and audio quality requirements specified in the fire code.

a. This can be either “native” or “amplified” coverage levels. It is not uncommon for a building to have acceptable radio coverage without a signal booster.

b. Coverage Validation is performed as follows (2022 CFC 510.5.4):

1. Each floor of the building shall be divided into a grid of 20 approximately equal test areas (grid cell). A measurement will be made in each grid cell.
2. Critical locations including entries, stairwells, elevator lobbies, electrical rooms and fire control rooms will also be documented. A measurement will be made in each critical location.

3. A test location approximately in the center of each grid cell 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 public 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 failure of that test area. Additional test locations shall not be permitted.

4. Signal levels will be measured using a spectrum analyzer or calibrated receiver. Audio Quality checks will be conducted using a portable radio of the latest brand and model used by the agency talking through the agency’s radio communications system.

5. Failure of one test area shall not result in failure of the test.

6. If 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 a maximum of two nonadjacent 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 requirements.

7. Critical locations are required to have 99% coverage.

SYSTEM RADIO FREQUENCIES

1021.21 The current downlink frequencies are:

002 (2)	Countywide System	Sacramento	853.8750	853.4500	853.1875	852.3500	852.0750	851.6000	853.9000
			853.6125	853.1625	852.5750	851.8250	851.6250	853.7125	852.7375
			852.4625	852.3000	851.7500	851.3847	853.8000	852.6875	851.8500
			851.6750	851.3250	851.0500	853.2625	852.2500	851.8000	851.6500
			851.4375	851.2625					

1021.22 The current uplink frequencies are 45 MHz lower than the downlink (starting with 806.16250).

1021.23 The number of channels may increase, or change should the County of Sacramento make modifications to the SRRCS. The emergency responder radio coverage system 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. The AHJ will provide a notice to the building owner and sufficient time to implement changes to the signal booster system. (2022 CFC 510.4.2.6).

MAINTENANCE AND ANNUAL TESTING

1021.24 The emergency responder radio coverage system shall be maintained operational at all times in accordance with 2022 CFC Sections 510.6 through 510.6.4. The Owner is responsible to provide acceptable radio coverage within the facility, access to documentation and to request

inspections after a system is first installed, annually and when modifications are made to the facility. (2022 CFC 510.6)

a. Annual Tests:

1. When an in-building radio system is required, the building owner shall test all active components of the system, including but not limited to amplifiers, power supplies backup batteries, and the radio coverage inside the building a minimum of once every 12 months.

2. Amplifiers shall be tested to ensure that the gain 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.

4. If within the 1-hour test period, in the opinion of the testing technician, the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the testing technician confirms the integrity of the battery.

5. All other active components shall be checked to determine that they are operating within the manufacturer's specifications for the intended purpose. Indoor radio coverage will be verified to ensure adequate coverage. (2022 CFC 510.5.6).

b. Qualifications of Testing Personnel:

1. Annual Inspection and Test shall be conducted by an approved 3rd party test service.

2. Test personnel shall have a current FCC license, or a current technician certification issued by the Associated Public Safety Communications Officials International ("APCO") or have demonstrated skills and experience satisfactory to the fire code official.

3. All test records shall be retained on the inspected premises by the building owner and a copy submitted to the fire department officials. (2022 CFC 510.6.1).

c. Maintenance:

1. The emergency responder radio coverage system will be maintained operational at all times. The building owner will contract with a maintenance supplier to perform routine checks and repair of degrading or failed equipment (2022 CFC 510.6).

1021.25 Field Testing

a. Police and fire personnel, after providing reasonable notice to the owner or his representative, shall have the right to enter onto the property to conduct field-testing to be certain that the required level of radio coverage is present. (2022 CFC 510.6.4)

MAINTENANCE REPORTS

1021.26 At the conclusion of annual testing, a report, which shall verify compliance with 2022 CFC Section 510.5.4, shall be submitted to the fire code official. (2022 CFC 510.6.1) The building owner shall maintain as-built records of the emergency responder radio coverage system to include construction/installation documentation, manuals, software, spec sheets, MSDS, test records and a log of routine and remedial maintenance activities performed on the system. (2022 NFPA 1225 21.3, 21.6).

REFERENCES

1021.27 2022 California Fire Code

1021.28 Cosumnes Fire Department Fire Code Ordinance 21

1021.29 2022 National Fire Protection Association 1225, *Standard Development*

1021.30 2022 California Electrical Code

1021.31 2022 National Fire Protection Association 72, *Fire Alarm Code*