



FIRE PREVENTION STANDARDS	DATE: 3/1/2023	NUMBER: FP0-018
	APPROVED: 	REVISED: 01/22/2026
	TITLE: Emergency Responder Communication Enhancement System (ERCES)	

The intent of CFC 510 is to provide emergency first responders the same level of radio coverage in the interior of a new building as they would receive on the exterior of that same building. Santa Cruz County fire agencies adhere to the current edition of the CA Fire Code Section 510 for permit issuance, installation, acceptance testing, and maintenance of Emergency Responder Communication Enhancement System (ERCES). Refer to the following sections of the CFC for more information: 907.2.13.2, 510.1 to 510.6.3(inclusive), NFPA 72, and NFPA-1.

It is highly recommended that a building’s architect should engage a RES (Radio Enhancement System) designer to estimate the needs for enhanced coverage and to plan for the installation of an RES. The building’s owner is ultimately responsible for the initial testing, design, permitting, purchasing, and maintenance of devices to meet the requirements of CFC 510, and Santa Cruz County Information Services department. The list below includes some, but not all, of the buildings where an RES may be required:

1. Where radio coverage signal strength is most likely not consistent with minimal signal strength outlined in the CFC and this document.
2. When a building is 3 or more stories above grade.
3. Any portion of a building below grade with an area of 5,000 square feet or more (ie: parking garage).
4. In any structure with structural components that are known to interfere with radio signal transmissions (i.e.: concrete, masonry, all-steel construction, e-glass, “wrapped buildings”).
5. Photovoltaic system installed on a roof.
6. Buildings where transmissions from an interior space are deliberately impeded (Faraday cage).
7. The system must be capable of functioning with the current infrastructure as well as being modified to accommodate additional frequencies and current industry technology (ie P25 Phase II).
8. When determined the construction of a new building obstructs the line of site emergency radio communications to existing buildings or other locations. The developer of the new building shall correct the degraded radio coverage as necessary to restore communication capabilities of the AHJ at no cost to the jurisdiction.

MINIMUM SIGNAL STRENGTH

The building shall be considered to have acceptable in-building emergency responder communication enhancement system where signal strength measurements of 95% of all areas and 99% of areas designated critical by the fire code official, on each floor of the building meet the signal strength below:

1.) Minimum Signal Strength Into the Building

The minimum downlink signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the fire code official. The downlink signal level shall be



sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 throughout the coverage area using either narrowband analog, digital or wideband LTE signals or an equivalent bit error rate (BER), or signal-to-interference-plus-noise ratio (SINR) applicable to the technology for either analog or digital signals.2.) Minimum Signal Strength Out of the Building

The minimum uplink signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the fire code official. The uplink signal level shall be sufficient to provide not less than a delivered audio quality (DAQ) of 3.0 using either narrowband analog, digital or wideband LTE digital signals or an equivalent bit error rate (BER), or an equivalent SINR applicable to the technology for either analog or digital signals.

INITIAL TEST REPORT

Initial testing is the responsibility of the owner. Test reports should be submitted to the AHJ and Santa Cruz County Information Services radio shop which includes: a cover sheet, project information, signal interference study, building information, address and tenant info, square footage, project scope of work; color signal strength/quality measurement scheme (“red” [fail] and “green”[pass]).

Complete and submit the BDA Test Report to the AHJ and Santa Cruz County Radio Shop.

WORK PERMITS

Construction permits for all work on RES are required by the fire agency having jurisdiction **and** Santa Cruz County Information Services radio shop. Vendor must complete the registration form BDA/DAS Installation for In-Building Public Safety Radio System Coverage and submit to the Santa Cruz County Radio Shop for approval prior to start of work.

CONSTRUCTION DOCUMENTS

1. A minimum of three (3) copies of the plan, wet-signed by the architect or engineer of record shall be submitted. The minimum plan size for this type of submittal is 24-inches by 36-inches (1/8” scale minimum). The AHJ may require electronic plan submittal and it is up to the permittee to verify.
2. A minimum of three (3) material data packages (in separate binders) shall accompany the plans and include all designer and installer documentation. Material data packages shall include all manufacturers’ specification sheets for all devices, equipment, and materials to be used shall be submitted, including the transponder to the supervising station. Highlight on the cut sheet which device or equipment is being used, the listing information, and the application per listing, as well as manufacturer’s installation instructions.
3. Shop drawings shall be of sufficient clarity and detail to fully describe the proposed installation and equipment. Shop drawings shall include, but are not limited to the following:
 - a) Size, type, and protection method of cable to be utilized;
 - b) Single-line riser diagram of system of entire system, including interconnection fire alarm control panel;
 - c) Design calculations for signal levels at each terminal point and initial input signal strength;
 - d) Signal propagation map (color map indicating the signal strengths as designed);
 - e) Battery calculations;
 - f) Voltage calculations;
 - g) Overcurrent protection devices and equipment (NEC 110.9 and 110.10).
4. Pathway survivability: Pathway survivability shall consist of cable installed in metal raceway, or approved metal sheathing.



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Exception: High-Rise Buildings and Buildings with Voice Evacuation Systems pathway survivability shall consist of one or more of the following:

- a. 2-hour fire-rated circuit integrity (CI) cable;
 - b. 2-hour fire-rated cable system [electrical circuit protective system(s)]; 2-hour fire-rated enclosure or shaft.
 - c. 2-hour performance alternatives as approved.
5. Supervision/Monitoring: System(s) shall be electronically monitored by the buildings fire alarm control panel. At a minimum, the following five points shall be monitored:
- a. Loss of normal AC power supply.
 - b. System battery charger(s) failure.
 - c. Signal source malfunction.
 - d. Failure of active RF-emitting device(s).
 - e. Low-battery capacity at 70 percent of the 12-hour operating capacity has been depleted.
 - f. Failure of critical system components.
 - g. The communications link between the fire alarm system and the in-building emergency responder communications enhancement system.
 - h. Oscillation of active RF-emitting device(s).
- a. Single Supervisory Input - Where approved, a single supervisory input to the fire alarm system to monitor all system supervisory signals shall be permitted.
6. Signage: Buildings equipped with an emergency responder communication coverage system shall be identified by an approved sign "Building is equipped with an Emergency Responder Communication Coverage System" located adjacent to the fire alarm control panel remote annunciator, or at the fire alarm control panel if no remote annunciator is installed. Sign shall consist of a red background with minimum ½" white lettering. Example:

**Building is Equipped with an Emergency
Responder Communication
Enhancement System**

ANNUAL TESTING REQUIREMENTS:

The Emergency Responder Communication Enhancement System (ERCES) shall be inspected, tested, and maintained **annually** in accordance with **NFPA 1225** and the District's Fire Code Amendments. The annual test shall be conducted by a qualified system technician and must include, at minimum, the following:

1. **Signal Strength Testing**
 - o Verification that both inbound and outbound signal strength meet the minimum requirements throughout the building.
 - o Testing must demonstrate that all critical areas (elevator lobbies, stairwells, fire pump rooms, sprinkler riser rooms, emergency command centers, etc.) achieve required signal levels.
2. **Backup Power and Battery System**



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- Test the integrity and capacity of backup power systems, including batteries and power supplies.
- Confirm the system can operate at full load for the duration required by code.
- 3. **System Monitoring and Alarms**
 - Confirm proper monitoring of system faults, battery conditions, and power failures.
 - Ensure all supervisory and trouble signals transmit correctly to the fire alarm control unit or monitoring station, as required.
- 4. **Amplifier and Equipment Performance**
 - Verify bi-directional amplifier (BDA) functionality.
 - Inspect all donor antenna connections, cabling, NEMA enclosures, and pathway survivability components.
- 5. **Antenna and Cable Infrastructure**
 - Inspect all system components for physical damage, corrosion, or loose connections.
 - Verify that pathways, conduits, and cable supports remain compliant.
- 6. **Documentation and Reporting**
 - A written test report shall be provided to the Fire District within **10 business days** of system testing.
 - Reports must include signal readings, grid testing maps, equipment condition, identified deficiencies, and corrective actions taken or required.
- 7. **Deficiencies**
 - Any deficiencies identified during annual testing shall be corrected within the timeframe specified by the Fire District.
 - Systems failing to meet minimum performance requirements shall be considered **non-compliant** until corrected.

Attached: Santa Cruz County Communication Department – BDA Test Results form

Attached: Santa Cruz County Communications Department – BDA/DAS Installation for In-Building Public Safety Radio System Coverage form

Santa Cruz County
691 ocean st
Santa Cruz CA 95060
Radio Shop
831-454-2025

REGISTRATION
**BDA/DAS Installation for In-Building Public
Safety Radio System Coverage**

Do NOT transmit from Donor Antenna without prior authorization from Santa Cruz Radio Shop

SECTION 1: Requesting Party Information

I hereby request to register a BDA/DAS for in-building public safety radio system coverage, according to the specifications below:

Requestor Name/Company: _____

Requestor Email: _____

Phone Number: _____

Date: _____

SECTION 2: Information to be provided by Building Owner or Designee

1. Company and/or building name: _____
2. Address: _____
3. Contact name for building owner: _____
4. Daytime phone: _____
5. Email address: _____
6. 24 hour emergency contact name*: _____
7. 24 hour emergency contact number: _____
8. Location of equipment in building (floor and room): _____
9. Designed by: _____
10. Installed by: _____
11. Tested by (Company/Technician): _____
12. Make/Model: _____
13. Antenna type (panel, yagi, omni, etc.): _____
14. Antenna gain (dBd): _____
15. ERP to donor site (dBm): _____
16. ERP Measurement of intermodulation products at 10kHz measurement bandwidth: _____
17. ERP measurement of noise within the passband at 10 kHz measurement bandwidth: _____
18. ERP measurement of noise spectrum more than 1 MHz outside of the passband at 10 kHz measurement bandwidth: _____
19. Spurious emissions from signal booster measurement within any 100 kHz measurement bandwidth: _____
20. Antenna coordinates (NAD83): _____
21. HAAT (feet) and exact location on the roof or building: _____
22. Date commissioned (first turned on): _____
23. Projected signal level at donor site (-dBm): _____
24. Measured signal level at donor site (-dBm): _____

REGISTRATION
**BDA/DAS Installation for In-Building Public
Safety Radio System Coverage**

25. Measured signal strength from the native system on all exterior walls of the North, South, East and West sides of the building (-dBm):

North: _____ South: _____ East: _____ West: _____

26. Measured signal strength delivered by the BDA on all outer interior walls of the North, South, East and West sides of the building (-dBm):

North: _____ South: _____ East: _____ West: _____

27. BDA Squelch Setting: _____

28. Per Channel Bandwidth (minimum 25 kHz): _____

29. BDA Delay (please also indicate if delay is a setting or an engineered number): _____

30. Donor Antenna Azimuth: _____

31. Donor Tower Name and Donor Cells (do not use ECOMM/Walsh*): _____

32. Loaner Radios Needed on Date of Optimization: _____

33. Optimization Technician Name and Phone Number: _____

* If at any time during or after installation the BDA/DAS system negatively impacts the Silicon Valley Regional Communication System, the building owner will be required immediately to turn off the malfunctioning BDA/DAS, until correct functioning is restored.

* Do not use ECOMM/Walsh until further notice.

SECTION 3: Information that will be provided by Santa Cruz Radio Shop to Building Owner or Designee

Upon receipt of the completed form, the Santa Cruz Radio Shop will provide the appropriate frequencies and donor site location info based on the installation sites provided.

INSTRUCTIONS FOR SUBMITTING THIS FORM

Items 1 through 33 on the "REGISTRATION" form are completed by the customer.

Forms can be emailed to Santa Cruz Radio Shop at Fred.berge@santacruzcountyca.gov

NOTE REGARDING DESIGN LOCATION AND INITIAL ACTIVATION OF NEW BDA/DAS SYSTEMS

New BDA systems must obtain donor location approval from Santa Cruz County Radio Shop and may require donor re-orientation if located within close proximity of other existing BDA systems.

Coordination with the Local Jurisdiction Public Safety Communications or Fire Department is required before a new BDA/DAS system is turned on for the first time. Arrangements must be made with the local authorities.

If at any time during or after installation the BDA/DAS system negatively impacts the Santa Cruz County Communication System, the building owner will be required immediately to turn off the malfunctioning BDA/DAS, until correct functioning is restored.

The Authorization to Repeat Frequencies must be posted with the BDA equipment onsite.

County of Santa Cruz

Communications Department
691 Ocean st
Santa Cruz, California 95060
(831) 454-2025



BDA Testing Results	
Building Address	
Registration #	
Company Name Testing System Contact Name and Number	
Date of Optimization / Testing	
System Tested	
Frequency(s) Used for Testing	
Radio Site Used (physical location name or names)	
Test Results (pass / fail)	
Santa CruzCounty Communications Representative Verifying Operational Compliance Parameters	Santa Cruz County Communications

* This is an authorization to do testing on supplied frequencies from Santa Cruz County radio shop

*This is not a BDA certification.