



# Long Beach Fire Department Bureau of Fire Prevention

FIRE PREVENTION REQUIREMENT  
NO. 1.043 03/18

## EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

### 2016 CALIFORNIA FIRE CODE, SECTION 510

This policy shall apply to all buildings in the City of Long Beach, excepted as those noted below. The California Fire Code (CFC), Section 510 requires that all buildings be provided with radio enhancement systems designed to provide radio coverage in all areas of buildings where signal strength does not meet the minimum criteria due to building construction and/or location. The intent of this guideline is to provide the Long Beach Fire Department (LBFD) interpretation of the minimum standards necessary to meet the requirements for emergency responder radio coverage (ERRC) in accordance with state code.

### **BUILDINGS REQUIRED TO HAVE AN EMERGENCY RESPONDER RADIO COVERAGE SYSTEM.**

Approved radio coverage for emergency responders shall be provided within all buildings meeting any one of the following conditions:

1. There are more than 3 stories above grade plane (as defined by the California Building Code Section 202);
2. The total building area is 50,000 square feet or more;
3. The total basement area is 5,000 square feet or more;
4. The building is equipped with a solar photovoltaic system.

### **PERMITS**

A construction permit is required for installation of or modification to ERRC systems and related equipment. To acquire an installation permit for ERRC systems, submit the following to the Long Beach Fire Department for high rise buildings or to Development Services for all other buildings at City of Long Beach located at 333 W. Ocean Blvd., 4<sup>th</sup> floor.

1. A completed Permit Application – provide all required information.  
(<http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=4336>)  
The permit applicant shall be the installing contractor. See CFC 510.5.2 for ERRC personnel qualifications.
2. All installing contractors shall have a California Electrical (C-10 or C-7) Contractor's License; a valid worker's compensation certificate; and a Long Beach Business license. When the design and plans are produced by a party other than the licensed contractor, the plans shall be stamped by a Professional Engineer.

3. A minimum of three sets of shop quality plans and one submittal packet for the proposed ERRC system – one set of plans will be retained by the City of Long Beach.
4. Installation, alteration, or demolition of a system shall not commence prior to the approval of plans and issuance of a permit. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.
5. The job card and approved Long Beach Fire Department/Development Services plans shall be kept at the project site at all times. Once the ERRC system has been given final approval, a set of plans shall remain with the owner.
6. Equipment shall have FCC certification prior to installation.
7. **Operating Permit** - An emergency responder radio coverage operating permit is required annually.

## PLANS

### A. General Requirements for all ERRC projects.

1. Plans and attachments shall be clearly labeled and legible.
2. Plans shall include a title sheet, an equipment list (manufacture name and model numbers), a written standard operating procedure, a floor plan, a system riser diagram, and secondary power calculations.
3. Attachments shall include highlighted manufacture's specification sheets for all equipment and devices such as; cables, amplifiers, ups, batteries and antennae; indicating the FCC certification.

### B. Title Sheet

1. The title (front) sheet shall contain the following information:
  - Project name and address of the project.
  - The designers full name, FCC General Radiotelephone Operator License (GROL) number and signature. The designer of record shall be responsible for the entire system being worked on.
  - Business name, address, and California Contractor's License number and FCC GROL of the installing contractor. If the designer of the ERRC system is not the installing contractor, the following shall be clearly indicated/printed on the plans:
    - **DESIGNED BY**
    - **INSTALLING CONTRACTOR**
  - Type of supervising station service as per NFPA 72. NFPA 1221 9.6.13
  - Number of basements, number of stories above basement, building height, total building area, and building construction type.
  - A note stating that the design and installation complies with NFPA 72 (2016 edition), NFPA 1221 (2016 edition) the California Electrical Code (2016 edition), the California Fire Code (2016 edition), the California Building Code (2016 edition), and the Long Beach Fire Department ordinances, policies and standards.

### C. Equipment List

1. Provide the model number, manufacturer's name, description, quantity, and symbols to be used (legend) for each device, equipment, and conductors proposed to be installed.

#### D. Floor Plan

1. The following shall be clearly indicated:
  - Scale used and a graphical representation of the scale. The minimum scale for ERRC plans is 1/8" = 1' -0". Metric scale shall not be accepted.
  - Room and room names.
  - The locations of partitions, non-rated walls, and rated walls.
  - The location of all Emergency Responder equipment.
  - Power and panel locations.
  - Raceway routing.
  - Conduit and conductor size.
  - Roof plan showing location(s) of antennae.
  - Location(s) of in building antennae

#### E. Riser Diagram

1. Provide the following:
  - Single-line wiring diagram (riser diagram) that shows the interconnection of equipment of the whole system.
  - Type and size of wire or conductor to be used.
  - Schematic drawing of electrical system and backup power.
  - Show supervisory points from repeater.

#### F. Calculations

- Secondary power supply. Emergency responder radio coverage systems shall be provided with an approved secondary source of power per CFC 510.4.2.3. When primary power is lost, the power supply to the emergency responder radio coverage system shall automatically transfer to the secondary power supply. The design capacity shall be based on 100 percent load for 24 hours. UPS systems shall be enclosed in a NEMA Type 4 or NEMA 4X-type waterproof enclosure. Provide battery ventilation in accordance with code.
- Signal propagation map – Provide a color map indicating the signal strengths as designed and then as installed by As-Built.
- Attachments. Manufacturer's specification sheets for all devices, equipment, and materials to be used shall be submitted, including the cables, amplifiers, UPS, batteries, antennae and 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.

### **DESIGN AND INSTALLATION**

1. ERRC systems shall be designed and installed in accordance with NFPA 72 (2016 edition), NFPA 1221 (2016 edition), the California Electrical Code (2016 edition), the California Fire Code (2016 edition), the California Building Code (2016 edition), and the Long Beach Fire Department ordinances, requirements, and standards.

2. Design the ERRC to provide signal amplification on every floor of the building. Components used in the installation of the ERRC system, such as repeaters, transmitters, receivers, signal boosters, cabling, and fiber-distributed antennae systems, shall be tested for compatibility with the public safety radio system.
3. ERRC shall permit the simultaneous use of interoperability of analog and digital modulation radios. ERRC shall be neutral host and nonproprietary.
4. ERRC shall not infringe on or be overrun by adjacent building communication systems or cellular telephone service provider systems. Permanent external filters and attachments shall not be permitted.
5. Describe if a Class A (A is channelized) 24 channels; or Class B (requires special registration with FCC and notice to the City of Long Beach Emergency Operations Center) is being proposed.
6. **Critical Areas.** Critical areas, including fire command centers, fire pump rooms, exit stairs, exit passageways, elevators, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage. NFPA 1221, 9.6.7.4.
7. **General Building Areas.** General building areas shall be provided with 95 percent floor area radio coverage.
8. Documentation required is presented in 2016 NFPA 72, Chapter 7.
9. The fire and building codes determine when these systems are required in a building. NFPA 72 and NFPA 1221 tells you how these systems shall be installed when required by the fire and building codes, in addition to Section 510 of the Fire Code.
10. **Frequencies.** See Attachment A in this document for a list of frequencies used in the City of Long Beach.
11. **Location.** The ERRC headend including all common equipment shall be located in a room on the main floor or one floor below grade. Rooms housing ERRC equipment shall be separated from the remainder of the building by 2 hour rated fire barriers. A sign or map identifying location of room and master power switch shall be provided as needed to assure the location is readily identifiable to emergency responders. For buildings without a fire command center, the ERRC and/Emergency Power Off switch shall be located inside the fire alarm panel room.
12. Verify with the ERRC headend equipment manufacture as to whether or not the room housing the equipment shall be provided with continuous air conditioning to alleviate heat build-up.
13. Provide pathway (circuit) survivability in accordance with NFPA 72, 24.3.13.8.
14. Location of the main RF and donor site (site closest to the jobsite) and their power – Identify on the plans the Lat/Long coordinates. At no time will the contractor be allowed access to City radio sites. **Additional frequencies.** Provide ERRC expandability to permit future additions and changes to emergency responder radio 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 additional frequencies are made available by the FCC.” Place this sentence as a note on the cover sheet.
15. For emergency responder radio coverage systems that are combined with other non-emergency radio systems such as: cellular telephone signal enhancement, Wi-Fi systems, pager systems, and/or medical telemetry systems, repairs or modifications to any emergency or non-emergency system will require a construction permit from the City. Acceptance testing shall be conducted as part of the construction permit to verify there has been no negative impact to the emergency responder radio coverage system.

16. All repeater, transmitter, receiver, signal booster components, external filters and battery system components shall be contained in National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet(s) or other *approved* enclosures. NFPA 1221, 9.6.11.2
17. **Emergency Power Off (EPO).** A disconnect relay connection that will disengage the power shall be provided and be the only method of turning off a UPS system. DC systems shall have a Battery Disconnect Switch. To turn the entire ERRC off, two actions must be completed. 1) Turn off the secondary power supply using the EPO switch and 2) Turn off the circuit breaker to cut the normal AC. The switch(es) shall be readily identifiable. The location of such power switches and signage identifying their location, shall be made during plan review.
18. **Supervision.** See 2016 ed. of NFPA 1221, section 9.6.13 for monitoring requirements of ERRC systems. As a minimum, provide supervision of the ERRC antennas, signal boosters, power supplies and UPS. Trouble signals shall be generated for power supplies. The system shall include automatic supervisory and trouble signals for: antennae malfunction, signal booster failure, low battery capacity, sending a supervisory signal at 70% of battery capacity, loss of normal AC power and failure of battery charger. Program the fire alarm system to relay ERRC supervisory and trouble signals to the appropriate supervising station. If the building does not have a fire alarm or sprinkler monitoring panel, a dedicated function fire alarm control unit, as defined in NFPA 72, shall be provided. Should a fire alarm system not be provided at the premise, a dedicated monitoring panel shall be provided in accordance with NFPA 1221, section 9.6.13.2. Monitoring the integrity of power supplies shall be in accordance with section 9.1.2.2 of NFPA 1221, 2016 edition.
19. **Wiring.** The wiring shall be in metal raceways for any interconnecting conductors, cables or other physical pathways for systems employing a Level 1 survivability. See 2016 NFPA 72, section 12.4.2. The conduit is not required to be dedicated to radio system cable. Radio system cable may be commingled in the conduit with fiber-optic and other cable that will not impede signal transmission and complies with the California Electrical Code.
20. The feeder and riser coaxial cables shall be rated as plenum cables. The feeder coaxial cables shall be connected to the riser coaxial cable using hybrid coupler devices of a value determined by the overall design.
21. Riser coaxial cables shall be rated as riser cables and routed through a 2-hour-rated enclosure. The connection between the riser and feeder coaxial cables shall be made within the 2-hour-rated enclosure, and passage of the feeder cable in and out of the 2-hour-rated enclosure shall be fire-stopped to 2-hour ratings.
22. Systems shall have lightning protection that complies with NFPA 780.
23. All installed materials and cabinets shall be listed U.L., NRTL or equivalent, or listed in the field for electrical safety by a third-party testing laboratory approved by the City of Long Beach. The equipment shall bear such listing at time of rough inspection.
24. **Signage.** Signage shall be provided in accordance with section 509 of the California Fire Code. Show the location and the verbiage on the plans of what the sign will look like. Example: A sign shall be located above or near the building Knox box stating "THIS BUILDING IS EQUIPPED WITH AN EMERGENCY RESPONDER RADIO COVERAGE SYSTEM".

## TESTING

1. "Prior to conducting acceptance testing, an electrical inspection shall be conducted and witnessed by the Building Department Electrical Inspector. Proof of Final Electrical signoff shall be made available at the time of Final Fire Inspection." .Place these sentences on the plans.
2. "Inspection is required to demonstrate compliance with the provisions of CFC 510. The owner or an authorized agent of the owner is responsible to obtain and fund special inspection services by contract with a contractor approved by the Authority Having Jurisdiction (AHJ). The owner is responsible to provide acceptable radio coverage within the facility, access to documentation and to request inspection after a system is first installed, annually and when modifications are made to the facility. Inspection requests will identify the testing service who will propose a schedule and provide supporting records. The contractor will provide as-built documentation, commissioning test data and observations of the physical installation and performance of the signal booster system as verification of proper system operation prior to placing the system on-the-air and to document indoor radio coverage of the system." . Place this paragraph on the plans.
3. **Acceptance testing.** Upon completion of installation, the building owner shall have the radio system tested to ensure that ERRC on each floor of the building is functional
4. A qualified tester shall test the entire system using their own equipment and provide a copy of this report to the Long Beach Fire Department for review.
5. Upon completion of the testing and a review of the report the contractor shall schedule an inspection with the Fire Inspector who will spot test the system on each floor.
6. **Amplifiers shall not be placed on air before they are verified.** The two primary considerations for Acceptance Tests are 1) Equipment Validation (before it is placed on the air) and 2) Coverage Validation (to document the improved coverage).
7. Maximum Output Power Testing(Uplink)
  - Class A Amplifier:
    1. Perform and document two measurements: a) Determine the maximum level into the amplifier by transmitting from a portable radio directly below a DAS antenna. b) Determine the minimum input into the amplifier by transmitting from the furthest point into a DAS antenna. This establishes the range of inputs. The range should not exceed the AGC range of the amplifier or the output level will be affected.
    2. Perform and document a link calculation for the radio path between the building and the Donor Site.
    3. Adjust the gain of the amplifier to ensure the uplink signal level received at the radio site is above -95 dBm
  - Class B Amplifier
    1. Document all transmissions within the pass band filter. Calculate the composite power output based on full channel loading, including unwanted signals.
    2. Minimum/Maximum readings: a) Document the maximum level into the amplifier by transmitting from a portable radio directly below a DAS antenna. b) Document the minimum input into the amplifier by transmitting from the furthest point into a DAS antenna. This establishes the range of inputs. The range should not exceed the AGC range of the amplifier or the output level will be affected.
    3. Record the measured noise floor out of the amplifier.

4. Provide a link calculation for the radio path between the building and the Donor Site.
5. Document the gain of the amplifier is adjusted to ensure the uplink signal level at the radio site is above  $-95$  dBm and the amplified noise received at the radio site is below  $-130$  dBm.
8. **Dummy load:** When conducting a test, or loading up procedure, a dummy load on the "Donor" antenna connection of the amplifier shall be used or the array shall be disconnected from the donor antenna until the Equipment/System operation has been demonstrated to the Inspector. A dummy load is a large resistor capable of dissipating the radio energy from your transmitter as heat into the air. This capability is necessary during the testing and repair of radio gear. When repairing the transmitter of a radio is often required to transmit for a short time in order to diagnose the problem. But instead of transmitting an unnecessary test signal live on the air, technicians connect a dummy load to the antenna jack. This allows them to transmit a test radio signal that is absorbed in the dummy load. This forces the amplifier to be off the air until power levels, gain and antenna isolation are checked. The installer can perform all of his checks and adjustments by using a signal generator and keeping all transmissions inside the building.
9. After completion of the Signal Level Measurements and evaluation of Audio Quality, LBFD will be asked by the contractor to schedule a Fire Department representative to survey the building to verify Fire Command and Dispatch radio operation. Failure of the operational check will require that the owner correct deficiencies and re-schedule Acceptance Testing.

## **ANNUAL TESTING AND PROOF OF COMPLIANCE**

1. The emergency responder radio coverage system shall be inspected and tested by qualified personnel annually, or, whenever structural changes occur in or around the complex including additions or remodels that could materially change the original field performance tests. A final test report provided by the Owners Testing Agency shall be provided to LBFD.
2. **Dummy load.** When conducting a test, or loading up procedure, a dummy load on the "Donor" antenna connection of the amplifier shall be used or the array shall be disconnected from the donor antenna until the Equipment/System operation has been demonstrated to the Inspector. A dummy load is a large resistor capable of dissipating the radio energy from your transmitter as heat into the air. This capability is necessary during the testing and repair of radio gear. When repairing the transmitter of a radio is often required to transmit for a short time in order to diagnose the problem. But instead of transmitting an unnecessary test signal live on the air, technicians connect a dummy load to the antenna jack. This allows them to transmit a test radio signal that is absorbed in the dummy load. This forces the amplifier to be off the air until power levels, gain and antenna isolation are checked. The installer can perform all of his checks and adjustments by using a signal generator and keeping all transmissions inside the building.
3. Testing shall also be in compliance with CFC 510.6.1.
4. The City of Long Beach Radio Communications and Fire Department 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.

5. **Minimum qualifications of personnel.** Only certification of in-building training is considered demonstration of adequate skills and experience. The minimum qualifications of the system designer and lead installation personnel shall include possession of:
  1. **A valid FCC-issued general radio operators license; and**
  2. **Certification of in-building system training issued by –**
    - a) **Association of 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.**
    - e) Other nationally recognized organizations or schools.

Note: All design documents and all tests shall be recorded and the data signed by a person meeting the minimum qualifications required by CFC 510.5.2 and herein.

## **INSPECTIONS**

1. Field inspections shall be scheduled only after a permit has been issued.
2. Inspections shall be scheduled by the installing contractor only. When scheduling for inspection, request for sufficient time to complete a thorough inspection of the work performed. Travel time is included in your inspection time.
3. Inspections may be scheduled by calling the phone number on the permit card. The following information is required: Permit Number. The amount of time required for inspection (including travel time) name, and number of contact person. An inspector will call to schedule the time and date of the inspection.
4. Missed inspections or inspections canceled within 48 hours shall be counted against inspection time. The installing contractor shall conduct a complete test of the system and shall complete all parts of the "Record of Completion" (Section 7.7 of NFPA 72, 2016 edition) **prior** to the Long Beach Fire Department (LBFD) inspection date.
5. Necessary coordination shall be made such that representatives of other contractors whose equipment are involved in the testing are present.
6. There shall be sufficient personnel and equipment to demonstrate the installation.
7. At the time of inspection, the contractor shall hand the following documentation (see 2016 NFPA 72 section 7.5) to the inspector upon his/her arrival, which includes:
  - a) Approved and stamped plans and complete permit (white, pink, hard card).
  - b) A copy of the completed "Emergency Communications Systems Supplementary Record of Completion". The Emergency Communications Systems Supplementary Record of Completion shall include the Names and contact information of personnel to be contacted at any time (24/7/365) if access to the equipment is needed.
  - c) As-built plans if installation has deviations from the approved plan.
  - d) All previous records of inspections.
8. After the successful completion of the tests/inspections, provide the following to the LBFD inspector:
  - a) For central station service systems, a copy of the listing organization's certification that the installation complies with NFPA 72 or a copy of the placard from the listed central station certifying that the installation



complies with NFPA 72. Permit shall not be "finaled" without this certificate or placard.

- b) The permit card (for inspector's signature).
  - c) Documents specified in 2016 NFPA 72 sections 7.5.
9. After final completion and acceptance of the project, the contractor shall provide the following to the owner:
- a) Documents specified in 2013 NFPA 72 section 24.8.
  - b) All literature and instructions provided by the manufacturers describing proper operation and maintenance of all devices and equipment,
  - c) A copy of the approved plan and as-built plan, if applicable,
  - d) A copy of the Certificate of Completion, and
  - e) The signed and finaled permit card.
10. Code requires one set of ERRC technical information and documentation to be filed in the Fire Command Center (if one exists) or in the ERRC headend room. After final completion and acceptance of the project, the Owner shall maintain the following on site:
- a) Documents specified in 2016 NFPA 72 section 24.15.1.
  - b) All literature and instructions provided by the manufacturers describing proper operation and maintenance of all devices and equipment,
  - c) A copy of the as-built plan,
  - d) Summary drawing showing locations of ERRC headend and node equipment, and antenna sites,
  - e) Summary of ERRC frequencies utilized,
  - f) Table of effective radiated power at antenna sites,
  - g) Keys to radio equipment room in key box
  - h) Label indicating ERRC system on premises at lock box
  - i) A copy of the Certificate of Completion, and
  - j) The Names and contact information of personnel to be contacted at any time (24/7/365) if access to the equipment is needed.

**ATTACHMENT A:**



**CITY OF LONG BEACH**

DEPARTMENT OF TECHNOLOGY & INNOVATION

5590 Cherry Ave. Long Beach, CA 90805 562.570-4801 Fax 562.570-4825

WIRELESS COMMUNICATIONS DIVISION

**Technical Specifications for Emergency Responder Radio Communications  
System Operated by the City of Long Beach  
April 24 2017**

The Emergency Responder radio system operated by the City of Long Beach includes:

Multi-site VHF and UHF Analog Conventional Systems  
Single Site 700 MHz P25 Digital Trunked System

Radio Frequencies used by City of Long Beach First Responders Include:

Downlink	Uplink	Type	ERP (W)
460.1250	465.1250	Conventional	200
460.2250	465.2250	Conventional	200
460.3500	465.3500	Conventional	200
460.2000	465.2000	Conventional	200
453.1000	458.1000	Conventional	400
453.3500	458.3500	Conventional	400
460.5000	465.5000	Conventional	200
462.9750	467.9750	Conventional	73
463.1500	468.1500	Conventional	73
153.9500	156.1950	Conventional	208
153.9200	158.9400	Conventional	150
151.1600	159.3750	Conventional	150
771.45625	801.45625	Trunking	400
771.46875	801.46875	Trunking	400
771.83125	801.83125	Trunking	400
771.84375	801.84375	Trunking	400
772.08125	802.08125	Trunking	400
772.09375	802.09375	Trunking	400
772.33125	802.33125	Trunking	400
772.34375	802.34375	Trunking	400
772.58125	802.58125	Trunking	400
772.59375	802.59375	Trunking	400
Location	Latitude	Longitude	AMSL
Signal Hill	33-47-58.0N	118-9-47.2W	108.0 M