CITY OF BURBANK
Fire Department (AHJ)
Communications Center (FCC Licensee)

EMERGENCY RESPONDER RADIO COVERAGE SYSTEMS

INTRODUCTION

Purpose: The purpose of this regulation is to establish a consistent standard for the design, installation, operation, and maintenance of Emergency Responder Radio Communications Systems (ERRCS).

Scope: This regulation applies to every structure hereafter constructed and to those existing structures designated by the Fire Code Official.

Authority: Title 47 Code of Federal Regulations Section 90.219 (FCC Rules & Regulations), 2025 California Fire Code Sections 104.1, 510, 1103.2, and 1103.7.9.8 (California State Fire Code), 2025 California Code of Regulations Title 16 (Professional and Vocational Regulations).

Referenced Standards:

1. **APCO Project 25** - A suite of standards for interoperable digital two-way radio products. Also referred to as "P25".
2. **NFPA 70** (2023 edition) – National Electrical Code
3. **NFPA 72** (2022 edition) – National Fire Alarm and Signaling Code
4. **NFPA 780** (2023 edition) - Standard for the Installation of Lightning Protection Systems
5. **NFPA 1225** (2022 edition) – Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
6. **NTIA Report 99-358** – Delivered Audio Quality Measurements on Project 25 Land Mobile Radios, U.S. Department of Commerce, 1998-11
7. **UL 2524** - ANSI/CAN/UL Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems

Terminology and Definitions are located in Appendix A

RESPONSIBILITY

Individuals and entities who own or manage structures that require ERRCS pursuant to Section 510 of the 2025 California Fire Code shall be responsible for compliance with this regulation.

The Burbank Fire Department shall issue permits for the installation of ERRCS and verify compliance with this regulation. The FCC License Holder or its designee will issue a Permit to Operate a Signal Booster in accordance with section 510.3.2 CFC (2025) and with FCC Rules & Regulations, and the Permit shall be renewed annually or the ERRCS shut down.

APPLICABILITY

The following buildings and/or portions of buildings (either newly proposed and/or constructed, or otherwise triggering the application of the current code, such as by a change of occupancy classification or use, addition of low emissivity materials, major tenant improvement, or removal of an existing wired communication system) shall be evaluated for the need of an ERRCS. The evaluation shall include empirical determination of the extent to which the existing coverage levels of the public safety communication systems (i.e., the "macro systems") utilized by the jurisdictional police, fire, and emergency medical authorities, measured at the exterior of the building, are reduced within the building itself. Building criteria triggering evaluation are any of the following:

1. Levels (*any* of the following):
    a. 2 or more levels above grade plane.
    b. Any basement or level that fully or partially extends below the grade plane.
2. Total Building Area: 12,000 square feet or more.
3. Fire Code Official Determination: Buildings determined by the Fire Code Official as requiring evaluation based upon fire- and life-loss potential.
4. Exception: Wood frame R1 single- or R2 two-family dwellings with no parking below grade shall not require evaluation.

POLICY

A building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95 percent of general areas, and 99% of critical areas as defined in 3(A) below, on each floor of the building meet the intelligibility requirements in the 2025 California Fire Code, Sections 510.4.1.1 and 510.4.1.2, Uplink and Downlink received signal strength is no less than -95 dBm, and in the presence of a Project 25 digital signal, received signal to noise plus interference (SINR) is no less than 17, and bit error rate (BER) is no greater than 2%. An evaluation to determine whether a building supports the minimum level of acceptable radio coverage shall be performed only by a person holding a valid NICET IB-PSC Level 2 or higher certification and a General Radiotelephone Operators License issued by the FCC.

Preliminary Benchmark Testing Requirements are located in Appendix B.

Uplink Power Calculation Formulas are located in Appendix C.

Structures with construction which does not allow for the minimum required signal strength (transmit and receive) shall be equipped with an ERRCS (a radiating cable system, a distributed antenna system, with FCC certified signal boosters, or other RF emitting devices) approved by the Fire Code Official and the FCC License Holder in order to achieve the required radio coverage.

To provide for consistent application and enforcement, the Fire Department and FCC Licensee have developed specific requirements to be used in the design, installation, Testing, operation, and maintenance of ERRCS. Failure to comply with the applicable provisions of Title 24 of the California Code of Regulations, Title 47 of the Code of Federal Regulations, and this regulation will result in enforcement actions.

REQUIREMENTS

System Design - When an ERRCS is required, the following design criteria shall apply:

1. **Federal Compliance** - ERRCS installation, components, and operation shall comply with all applicable Federal regulations, including but not limited to the Federal Communications Rules specified in Title 47 of the Code of Federal Regulations, including 47CFR §90.219. Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC shall not be installed without prior coordination and **the express written consent of the FCC license holder**.

2. **UL 2524 Listing** – All bidirectional amplifiers, fiber optic DAS, and backup power systems shall be certified to UL 2524 by a Nationally Recognized Testing Laboratory (NRTL) recognized by OSHA pursuant to Title 29 CFR §1901.7 et seq. to conduct UL 2524 testing.

3. **Radio Coverage** – Radio coverage shall be provided throughout the building as a percentage of floor area with Uplink and Downlink signal levels of no less than -95 dBm and shall be tested in accordance with the 2025 CFC, Section 510.5.4 (1) through (8) with the following additional conditions:

    A. **Critical Areas** – Critical areas, defined as:
        i. Fire alarm control panels.
        ii. Firefighter's smoke control panels.
        iii. The main electrical panel(s).
        iv. Throughout emergency and standby power rooms.
        v. Throughout the fire command center, complying with Section 508.

vi. Throughout the interior exit stairs.
vii. Throughout areas of refuge.
viii. Throughout the fire pump rooms.
ix. Throughout elevator machine rooms and elevator lobbies.
x. Throughout the building lobbies.
xi. Within elevator cars.
xii. Locations as determined by the Fire Code Official.

Shall be provided with 99 percent floor area radio coverage with received Uplink and Downlink power levels of no less than -95 dBm and minimum delivered audio quality (DAQ) of 3.4 as defined in NTIA Report 99-358.

B. **General Building Areas** – When an ERRCS is required, general building areas shall be provided with 95 percent floor area radio coverage with received Uplink and Downlink power levels of no less than -95 dBm and minimum delivered audio quality (DAQ) of 3.4 as defined in NTIA Report 99-358.

C. **DAQ** - NTIA Report 99-358 delivered audio quality (DAQ) is defined as follows:

DAQ	Definition
1	Unusable. Speech present but not understandable.
2	Speech is understandable with considerable effort. Requires frequent repetition due to noise or distortion.
3	Speech is understandable with slight effort. Requires occasional repetition due to noise or distortion.
3.4	Speech is understandable without repetition. Some noise or distortion is present.
4	Speech is easily understandable. Little noise or distortion.

4. **Operating Frequencies** - Any ERRCS installed to meet these requirements shall operate on the following frequencies, which use APCO 25 Phase I and Phase II trunking.

   Frequencies will be assigned by the FCC License Holder or its designee on a case-by-case basis. Frequency determination requires individual consideration by the FCC License Holder due to various factors, some of which may change over time, even for a single geographical location. A Technical Information Document providing the Operating Frequencies will be provided pursuant to §510.4.2.2 CFC.

5. **Donor Site** – A Donor Site will be assigned for each project by the FCC License Holder or its designee on a case-by-case basis. Donor Site determination requires individual consideration by the FCC License Holder due to various factors, some of which may change over time, even for a single geographical location. A Technical Information

Document providing the Donor Site will be provided pursuant to §510.4.2.2 CFC.

6. **ERRCS Propagation Delay** - The maximum allowable ERRCS propagation delay is 15 microseconds. Should this propagation delay be exceeded within the building, there shall be a minimum differential of 16 dB between the signal a portable radio receives from the signal booster and the signal a portable radio receives from the macro radio system.

7. **Frequency Changes** - The building owner shall modify or expand the ERRCS at its expense in the event frequency changes are required or additional frequencies are made available by the FCC. Prior approval of a public safety radio coverage system on previous frequencies does not exempt the building owner from this section.

8. **Interference Prohibited**
    A. The ERRCS shall not interfere with, or reduce the performance of, any public safety radio communications system or other FCC-licensed radio communications system.
    B. No system or equipment in the structure may cause any interference to, or reduce the performance of, the ERRCS.
    C. When measured outside the structure(s) served by the ERRCS, up to six feet from the exterior perimeter wall of the structure(s), Downlink radio signal power from the ERRCS shall be, at a minimum, 15 dB below the Downlink power measured from the macro radio system, and in no event may exceed -95 dBm.
    D. Uplink transmissions shall reach the assigned Donor site(s) at per-channel power levels not to exceed -75dBm at the face of the receive antenna.
    E. Bidirectional amplifiers shall have oscillation prevention circuitry and software. Oscillation prevention shall be activated in all bidirectional amplifiers.

9. **Portable Radio Testing Requirement** - Motorola model APX-6000 and APX-8000 portable radios are utilized by the Fire and Police Departments and shall be used for ERRCS design and Testing. ERRCS design shall assume the use of a portable radio worn on the user's hip.

10. **Signal Booster Components and/or Fiber Optic DAS Components** - Shall meet the following requirements:
    A. Signal Boosters shall be FCC Class A only.
    B. Signal Boosters shall be equipped with a sufficient number of channel filters to assign each frequency pair to a single channel filter.
    C. Signal Boosters shall have a field adjustable filter bandwidth for each channel filter which shall include 12.5, 25, 50, and 75 KHz bandwidths.
    D. Signal Boosters shall be channelized to operate only on the specific frequencies assigned and no other frequencies.

E. Signal Boosters shall have a discrete automatic gain control or automatic level control for each individual channel.
F. Signal Boosters shall have a discrete gain setting for each individual channel.
G. Signal Boosters shall have a muting or squelch feature, which shall be adjusted to place the Uplink power amplifier in a dormant state when the bidirectional amplifier is not receiving an Uplink signal of at least -80 dBm.
H. Signal Boosters shall be equipped with sufficient RF filtering to employ a single donor antenna port and a single service antenna port.
I. Signal Boosters and associated equipment shall be new and supported by the manufacturer for at least seven years after installation.
J. Signal Boosters shall be located in or near the fire control room or other area approved by the Fire Code Official.
K. Signal Boosters and Fiber Remote Units shall not be located in any room containing water other than fire sprinklers. This includes fire pump rooms, boiler rooms, restrooms, kitchens, and laundry rooms.
L. Signal Boosters and other radiofrequency signal-generating components shall have FCC certification prior to installation and shall be NFPA 1225, 2022 edition, and CFC 510 (2025) compliant.
M. Signal Boosters and Distributed Antenna Systems shall be compatible with analog FM, digital FDMA (Project 25 Phase I), and digital TDMA (Project 25 Phase II) modulation simultaneously at the time of installation.

11. **External Filters** – Filters in protective enclosures are permitted adjacent to the bidirectional amplifier, fiber headend, and fiber remote units.

12. **Couplers and Power Dividers** - BDA system design **shall not** utilize reactive "Tee" type connectors exhibiting less than 20dB isolation between ports for power division. Inductive couplers or isolated splitters rated for the maximum possible system power are required.

13. **Antenna Density**
    A. ERRCS shall be designed with a sufficient density of indoor service antennas to minimize the required amplifier gain, minimize signal leakage from the structure, and provide consistent signal power to and from radios in all areas within the structure. Indoor (service) antennas shall be spaced no more than 50 feet apart within occupied areas, and no more than 80 feet apart in open areas such as parking garages, auditoriums, conference centers, and ballrooms.
        i. Antennas shall be installed on every floor of the structure, using the required antenna spacing, without exception. This includes the top floor.
        ii. When antennas are installed in a wood frame structure with wood floors, with the intent that antennas on one floor will provide service to another floor, antenna spacing shall be reduced to compensate for attenuation

caused by building materials.

iii. Antennas installed in structures consisting of concrete and or metal may not be considered as providing any level of service to another floor.

B. ERRCS shall be designed to support two portable radios transmitting simultaneously on different talk paths, channels, or frequencies, one within eight feet of a service antenna, and one at the farthest possible distance from a service antenna while still in the designed service area of the service antenna, with no degradation of performance experienced by either radio in accordance with section 510.4.2.8 CFC (2025).

C. Antenna density in core and shell construction shall comply with this section.

D. Antennas shall be installed below any surfaces that are, or could be, painted.

E. Antennas shall be installed below any low-emissivity, metallic, mylar, or other RF attenuating materials.

14. **Uplink Noise** - Bidirectional amplifiers shall not exceed -150 dBm Uplink noise at the donor site, -43 dBm ERP Uplink noise within the authorized passband, and -70 dBm ERP Uplink noise at 1 MHz outside the authorized passband when in a quiescent state in accordance with section 510.4.2.9 CFC (2025) and Title 47 CFR section 90.219.

    A. A reduction in quiescent noise may be required, dependent upon the distance of the bidirectional amplifier from the donor site.

15. **Isolation** - Radio Frequency (RF) isolation between the outdoor donor antenna and the indoor service antennas shall not be less than 20 dB greater than the maximum ERRCS gain in accordance with section 510.4.2.4(4) CFC (2025). Measured isolation, not including amplifier gain, shall be 90 dB or greater.

16. **Amplifier Gain** - Bidirectional amplifiers shall use the **minimum gain** required to meet the performance requirements herein. Amplifier Uplink gain shall not exceed 65 dB unless an exception has been approved in writing by the Fire Code Official and the FCC License Holder, or designee.

17. **Labeling Requirements are Located in Appendix D.**

18. **Multi-Building Deployments** - Where more than one building on any property (or in the same complex/campus) is constructed within one thousand feet of one another, a single Public Safety Dedicated active fiber DAS system shall be installed to provide coverage to all buildings. The DAS head end and donor antenna shall be located in the building nearest, and with a clear line of sight, to the assigned Donor Site. Other buildings, either currently erected or when constructed in the future, shall be equipped with remote units interconnected by supervised fiber-optic cables to the head end. All other ERRCS requirements herein shall apply to these installations.

    A. Donor Antennas shall be located in the area closest to the Donor Site, and

should not point toward any other building included in the fiber DAS, or housing an operating BDA.

B. This section applies to all buildings as described herein regardless of current or future ownership.

19. **Donor Path Rights -** Any person or entity constructing a new structure that blocks the donor path of existing ERRCS shall be responsible for resolving coverage and system performance degradation experienced by existing ERRCS at its expense.

20. **Pathway Survivability**
    A. Pathway survivability levels shall be as described in NFPA 1225, 2022 edition, section 13.5.1 et seq., except as stated herein.
    B. Donor antenna feeder cables, riser cables, cables providing connection between amplification equipment, and/or other active signal distribution devices, all connections made between backbone and antenna distribution coaxial and fiber optic cables, and all fiber optic cables, are defined as "Backbone" cabling.
    C. ERRCS active equipment and backbone cabling shall have a survivability that matches the building's fire rating, **and in no event shall be less than 2 hours**.
        i. An alternative minimum 2-hour pathway survivability performance methodology may be approved by the Fire Code Official.
    D. All backbone, antenna distribution, radiating, and fiber optic cables shall be rated as plenum cables.
    E. Coaxial and fiber optic cables shall be enclosed within electrical metallic tubing (EMT) conduit and metal junction boxes.
    F. Coaxial cables shall be supported to the point of termination.
    G. Fiber optic cables shall be supported and protected to the point of termination.
    H. Bends in coaxial cables shall not exceed the manufacturer's specified bending radius.
    I. No coaxial cable shall be coiled.
    J. The donor riser rooftop appearance shall be enclosed within a NEMA-3R, NEMA-4, or NEMA-4X-rated enclosure.
    K. Weather-heads are only allowed to be used with a highly-flexible cable with a manufacturer-specified repeated bending radius of 2 inches or less.

21. **Protection Against Water Intrusion**
    A. All amplifiers, active devices, fiber optic headend, and fiber optic remote units shall be enclosed within NEMA-4 or NEMA-4X-rated enclosures.
    B. All standby battery units, battery chargers, power supplies, and external filters shall be enclosed within NEMA-3R, NEMA-4, or NEMA-4X-rated enclosures.
    C. All alarm and power connections, power dividers, and hybrid couplers, located at the headend, shall be enclosed within NEMA-4 or NEMA-4X, watertight enclosures.

i. Standard metal electrical junction boxes (4S type or equivalent) are not allowed.

D. All connections into and out of NEMA-rated, water-resistant, and watertight enclosures shall maintain protection against water intrusion using watertight entry ports or boots and liquid-tight flexible nonmetallic conduit (LFNC) or equivalent.
E. All penetrations into enclosures shall be fully sealed to prevent water intrusion.
F. All components shall be mounted at least 12 inches above the floor to protect against water intrusion due to flooding.

22. **Climate Control**

A. Bidirectional Amplifiers, Fiber Headend Units, Fiber Remote Units, Battery Backup Units, and related active components contain sensitive electronic components that are damaged by heat. All active equipment must be installed in rooms that have appropriate climate control.

23. **Power Sources**

A. At least two independent and reliable power supplies shall be provided for all active components, one providing primary operating power, and one providing backup power.
B. The primary power source shall be supplied from a dedicated branch circuit and comply with NFPA 70, 2023 edition, and NFPA 72, 2022 edition, section 10.6.5.1
C. The secondary power source shall comply with one of the following:
D. A storage battery dedicated to the ERRCS with at least 24 hours at 100 percent ERRCS operation capacity and designed in compliance with UL2524, NFPA 70, 2023 edition, and NFPA 72, 2022 edition, section 10.6.10 et seq.
E. A generator with an internal combustion engine and a fuel supply providing 24 hours of continuous operation at 100 percent ERRCS operation capacity serving the dedicated branch circuit shall be used with a storage battery dedicated to the ERRCS with at least 12 hours at 100 percent ERRCS operation capacity and designed in compliance with NFPA 70, 2023 edition, and NFPA 72, 2022 edition, section 10.6.10 et seq.
F. Power Switches - Bidirectional amplifiers (BDAs) shall be equipped with two power switches adjacent to the BDA.
    i. One switch shall both disconnect and reconnect AC power to the battery power supply.
    ii. The second switch shall cause the immediate shutdown of the BDA.
    iii. Both switches shall have protection against water intrusion.
    iv. Both switches shall have a lockout/tagout feature.
    v. Exception: If the circuit breaker is located in the same room as the battery power supply, the AC disconnect switch shall not be required.

24. **Donor Antennas**

A. Donor antennas shall be highly directional.
B. Antenna elements shall be welded.
C. Antennas shall be anodized unless an exception has been granted.
D. The antenna gain shall not be less than 9 dBd for VHF, 12 dBd for UHF, or 14 dBd for 700 and 800 MHz bands.
E. The antenna horizontal half-power (-3 dB) beam width shall be as narrow as possible, and shall not exceed 45 degrees.
F. The antenna front-to-back ratio shall not be less than 20 dB for VHF and UHF frequency bands, or 30 dB for 700 and 800 MHz frequency bands.
G. Antennas must be permanently mounted to the structure.
H. Each donor antenna should be mounted in the area of the roof nearest to its donor site.
I. The bottom of each donor antenna shall be at least six feet above the roof, and at least three feet above any obstructions.
J. The antenna and antenna mast shall be secured to a structure strong enough to carry the weight of the installation with necessary allowances for wind and vibration, and shall be securely anchored to the structure.
    i. Attachment of the antenna to the riser cable conduit is permissible if the conduit is sufficiently strong and is appropriately supported and securely attached to structural elements of the building.
K. Antennas shall not be attached to, or supported by, vent pipes.
L. Mast supports shall be secured in such a way that the supporting structure is not damaged or weakened.
M. Antenna supports shall have attached signage stating: WARNING, PUBLIC SAFETY RADIO SYSTEM, MOVEMENT OR REPOSITIONING OF THIS ANTENNA IS PROHIBITED WITHOUT APPROVAL FROM THE FIRE CODE OFFICIAL AND FCC LICENSEE.
N. Masts that extend ten feet or more above the top of their mounting point are engineered structures that are to be constructed under a separate building permit.

25. **Grounding, Bonding, and Lightning Protection**
A. All active devices shall be grounded pursuant to NFPA 780 (2023) unless otherwise directed herein.
B. All active devices shall be grounded to the master building utility (Ufer) ground bus.
C. All ground connections shall be made with stranded copper wire no smaller than 2 AWG.
D. No copper wire shall come into direct contact with aluminum, tinned aluminum, or plated aluminum.
E. Ground lugs used with 2 AWG or larger copper wire shall be copper, tinned copper, or plated copper, with a crimped or welded connection to the wire,

manufactured with holes permitting two bolts to be used for attachment to the ground bus bar.

F. All ground bus bars shall be copper.
G. No copper bus bar shall come into direct contact with aluminum.
H. Donor antenna feedline shall include protection against electrical surges caused by lightning or electrostatic discharge (Lightning Protection).
I. No jumpers, adapters, or passive devices shall be installed between the donor antenna and the Lightning Protection.
J. The donor antenna feedline outer conductor shall be grounded to the master utility ground bus (Ufer) using a coaxial grounding kit with 2-hole crimped copper lugs between the donor antenna and Lightning Protection
K. Lightning Protection shall be located within the building and as close to the antenna feedline building entry point as possible.
    i. Lightning Protection shall be grounded to the master building utility ground bus (Ufer).
    ii. An additional ground attachment shall be made to grounded structural steel at the building entry point whenever possible.
    iii. Lightning Protection shall be mounted directly to the grounded copper bus bar.
    iv. Exterior mounting of the Lightning Protection is permitted within 24 inches of the building entry port, provided the Lightning Protection and copper ground bus bar are fully enclosed within a grounded metal NEMA-4, 4X, or 3R enclosure.
        a. The grounded metal enclosure shall be sufficiently large to readily allow for maintenance, and no smaller than 18 inches tall by 18 inches wide by 6 inches deep.
        b. Conduit from the building to the enclosure shall be continuous.
    v. All exterior antenna feedlines shall be enclosed in solid conduit, properly supported, or permanently attached to the structure. There shall be no exposed outdoor feedline except at the connection to the antenna.
L. Donor antenna mounting structures shall be grounded to the master building utility ground.

26. **System Monitoring** - The ERRCS shall include automatic supervisory and trouble for malfunctions of the signal booster, and power supplies that are annunciated by the fire alarm system, which is monitored by an approved supervising station monitoring company in accordance with NFPA 72, or monitored at a constantly attended location at the building, and comply with the following:
    A. Circuit Integrity - The integrity of circuit monitoring signal boosters and power supplies shall comply with NFPA 1225, 2022 edition, section 18.14.1 et seq.
    B. Signal Booster - Supervisory signals shall include the following:
        i. Donor antenna malfunction.

ii. Signal booster failure.
iii. Active RF emitting device malfunction (Fiber Remote Units).
iv. Oscillation of active RF emitting device(s).
v. Failure of the communications link between the fire alarm system and the

C. Power Supply - Signals shall include the following for each signal booster.
    i. Loss of commercial AC power.
    ii. Failure of the battery charger.
    iii. Low battery indication when 70 percent of the 24-hour operation capacity has been depleted.
    iv. Low fuel level indication when 70 percent of the backup generator fuel capacity has been depleted (when applicable).
    v. ERRCS.
D. Single Supervisory Input – A single supervisory input to the fire alarm system to monitor all system supervisory signals may be permitted by the Fire Code Official in accordance with section 510.4.2.5.1 CFC (2025).
E. Dedicated Panel – A dedicated monitoring panel shall be provided in an area adjacent to the fire alarm remote annunciator, or fire control center, as directed by the Fire Code Official to annunciate the status of all signal booster locations. The monitoring panel shall be clearly marked with: "In-Building Radio System Status," and "When In Alarm Use Direct Radio Channels," and shall provide a visual and labeled indication of the following for each signal booster:
    i. Donor Antenna Trouble
    ii. Signal Booster Failure
    iii. Active RF Device Malfunction
    iv. Low Battery
    v. Low Generator Fuel (when applicable)
    vi. AC Power Loss
    vii. Battery Charger Failure
    viii. Oscillation of active RF emitting device(s)
    ix. Failure of the communications link between the fire alarm system and the ERRCS.
F. Active Equipment
    i. All active equipment shall include alarm indications on or adjacent to the equipment.
G. Remote Control and Monitoring
    i. All new and existing ERRCS shall be equipped to permit the FCC License Holder or its designee to remotely monitor and control the bidirectional amplifier (BDA) or other RF-emitting device(s) pursuant to Title 47 CFR §90.219.
        a. A 50 Mbps or faster Ethernet connection with an active connection to the Internet and a DHCP-assigned IP address shall be provided within 18 inches of the BDA.

b. A monitoring and remote-control component specified by the FCC License Holder shall be installed in a NEMA-4 or 4X enclosure and shall provide monitoring of alarms from, and secure remote connectivity to, the BDA(s), fiber master or headend, and associated power supply(s).
c. The monitoring and control component shall be powered by the BDA primary and secondary (backup) power supplies.

ii. It is the ongoing responsibility of the building owner to provide remote monitoring and control capability for the FCC License Holder or its designee.

27. **System Submittal**

A. A permit must be obtained prior to the construction **or modification** of an ERRCS. A copy of the approved plans and Field Inspection Record shall be posted visibly on the main active component or at the point of primary system operation.

B. The plans will be reviewed and recommended for approval by the Fire Code Official and the FCC Licensee or their designee(s) in accordance with section 510.5.2 et seq. CFC (2025). Plan check and acceptance testing fees will be assessed for these services.

C. No permit shall be issued without approved plans. Such plans shall contain at a minimum the following elements:

i. Pursuant to CCR Title 16, Sections 832.07 and 832.10, the minimum qualification of the ERRCS installing entity shall be a valid classification C7 or C10 California Contractors License.

ii. The minimum qualifications of the ERRCS designer and installation personnel shall be in compliance with Section 510.5.3 of the 2025 California Fire Code and the following.

a. Each person designing, installing active equipment, or commissioning a BDA shall possess a valid FCC-issued General Radiotelephone Operators License (GROL); and

b. A NICET IB-PSC Certification: and

a. The Designer must hold a current Design certification and be listed in the plans as such.
b. The Commissioning Engineer must hold a current Level 3 certification and be listed in the plans as such.
c. The Lead Installer must hold a current Level 2 or higher certification and be listed in the plans as such.
d. Each installer of passive components shall hold a valid Level 1 or higher certification and be listed in the plans as such.

c. Each person designing, installing active equipment, or commissioning an ERRCS shall possess a valid certification issued

by the manufacturer of the equipment being installed for the specific equipment being installed.

D. Plans shall be electronic high-resolution PDF, Architectural E size, scaled or dimensioned, with physical measurements, and 1/8" = 1'0" scale, clearly noted.
E. Images and text shall be clearly legible at 300% zoom.
F. North shall be indicated on plan views.
G. Elevation measurements shall be displayed in elevation views.
H. Include the site name, address, and elevation name or floor number on each plan sheet.
I. All attachments shall be included in a single plan set. If multiple files are submitted, the submittal will be rejected.
J. Include the Architectural Plan View of the subject building, building construction type, and surrounding property.
K. Provide a map to clearly indicate the distance and operating carrier of any commercial carrier macro sites within 1000 feet of any proposed donor antenna.
L. Provide a Roof View which shall clearly indicate the location and orientation of all donor antennas associated with the proposed ERRCS.
    i. The Roof View shall also clearly indicate the location and orientation of any antennas employed in a commercial carrier amplification system employed within the structure.
M. Include a detailed drawing of the antenna grounding and Lightning Protection in accordance with the California Electrical Code and this regulation.
N. Include drawings of the location and method of all grounding connections.
    i. All grounding connections shall be made using two-bolt crimped copper or tinned or plated copper lugs.
O. Plan view of each interior floor where indoor antenna systems are proposed shall include antenna numbers, coax routes, and the locations of any other ERRCS components, including splitters, couplers, filters, amplifiers, etc.. Include any adjacent RF radiating antennas, such as those associated with a commercial carrier DAS.
    i. Commercial carrier DAS antennas shall be installed at least 20 feet from any ERRCS DAS antenna.
P. Include a schematic diagram of the proposed distributed antenna system (DAS) showing every component with its absolute gain or loss, and its Uplink and Downlink power levels.
Q. Include a link budget analysis spreadsheet for the (1) service antenna with the greatest DAS RF power loss to the BDA and (2) the least DAS RF power loss to the BDA.
    i. Show Uplink and Downlink power in dBm for radios operating within five to eight feet of each antenna (near), and as far from each antenna as possible while in the operating area of the antenna (far).
    ii. Downlink and Uplink power out of the BDA shall be calculated as power

per channel for the maximum number of channels programmed in the BDA.

iii. Include a link budget analysis for each frequency range included in the ERRCS, using the highest frequency in each frequency range.

R. Uplink power received at the donor site shall not be greater than -75 dBm or less than -95 dBm.

S. Include a color-coded propagation model displaying signal strength on each floor or level throughout the structure. Include the parameters and assumptions used to create the propagation model.

T. Include peak (for a conventional macro system) or average (for a trunking macro system) Downlink signal strength measurements taken at ground level, from the exterior of the structure, at the approximate center of each side of the structure.

U. Include peak (for a conventional macro system) or average (for a trunking macro system) Downlink signal strength measurements taken from at least four areas on the roof of the structure.

V. If the building envelope has been closed, include a preliminary signal strength assessment, including all data in Appendix B.

i. Conduct this assessment using a calibrated Spectrum Analyzer or other approved test instrument to measure the Downlink signal strength throughout every floor or level of the structure.

ii. Divide each floor or level into 20 grid test areas of approximately the same size.

iii. Each 20-area test grid shall not exceed 25,000 square feet in area.

iv. Measure and record the average Downlink signal strength within each grid test area and calculate the Uplink signal strength for the corresponding grid test area.

a. Use the formula in Appendix C to calculate Uplink power.

v. Subjective Downlink and Uplink DAQ shall be determined using two radios of the same make and model as those in service with the Police and Fire Departments.

vi. On Project 25 digital channels, Downlink DAQ shall be measured using an instrument that decodes the Project 25 bitstream and provides a SINR or SNR measurement.

a. Passing SINR or SNR is 20 dB or greater, and passing Bit Error Rate, BER, or FBER is no greater than 2%.

W. Provide the runtime of the proposed ERRCS while running exclusively on backup power calculated using the power requirements of the Signal Booster and any associated active components and the rated capacity of the backup power system.

X. Include the detailed manufacturers' specifications for each component and the calculations used to derive the 24-hour minimum runtime.

Y. Specify the backup power source. Provide supply calculations to verify that the

ERRCS shall be capable of operating on an independent battery power supply, and generator, where applicable, for at least 24 hours without external power input. The battery power supply shall automatically charge in the presence of an external power input.

Z. Provide copies of the manufacturer's specification sheets, including:
    i. Amplifiers, Antennas, Coax, Couplers, Splitters, Combiners, or any other passive components proposed.
    ii. Backup battery and charging system, and generator (if applicable) specifications.

AA. Provide the following notes on the plans:
    i. The ERRCS shall not be powered on unless it is employed on a non-radiating load and not on a live antenna system, before the final inspection by the Fire Code Official and the FCC Licensee, or their designee.
    ii. The ERRCS shall be approved by the Fire Code Official and the FCC Licensee, or their designee, and documentation identifying the approval shall be retained on site in a clearly labeled enclosure during installation, and throughout the operational life of the ERRCS.

28. **Testing**

A. Acceptance testing shall be in accordance with Section 510.5.4 of the 2025 California Fire Code with the following clarifications.

B. The final ERRCS Acceptance test shall be conducted by a person holding a General Radiotelephone Operators License issued by the FCC, a NICET IB-PSC Level 3 certification, and a certification by the manufacturer of the equipment being inspected, for the specific equipment installed.
    i. No person may conduct an Acceptance test unless that person fully complies with this requirement and is approved by the Fire Code Official and the FCC Licensee to conduct Acceptance testing.
    ii. A person holding a NICET IB-PSC Level 2 certification may conduct an Acceptance test provided that the person is supervised by a person holding a NICET IB-PSC Level 3 certification, and the inspection report is certified by the person holding the Level 3 certification.

C. An Acceptance test shall not be deemed to have been successfully completed until accurate as-built plans have been received by the Fire Code Official and FCC Licensee or their designee.

D. Acceptance tests shall include the following:
    i. A visual inspection of the physical installation of the ERRCS with detailed photographic documentation.
    ii. Backup batteries and backup power supplies will be tested under load for 1 hour.
    iii. Backup batteries and backup power supplies will be tested using a pulse load battery tester when the batteries are compatible with pulse load

testing.

iv. Calibrated test equipment will be utilized to evaluate the ERRCS for all included frequency ranges.
    a. Measure and document spurious Uplink signals to ensure they are not being generated.
        a. The donor antenna shall be connected during this test.
    b. Measure and document Downlink power reaching the amplifier at the donor antenna port for each included frequency range.
    c. Measure and document ambient radiofrequency (RF) noise from the donor and service antennas at the amplifier with the amplifier shut down.
    d. Measure and document maximum quiescent ERRCS noise. Quiescent noise shall not exceed -43 dBm ERP from the donor antenna and -150 dBm at the donor site.
        a. The donor antenna shall be connected during this test.
    e. Measure and document the isolation between the donor (outdoor) and service (indoor) antennas and ensure isolation is at least 20 dB greater than the maximum amplifier gain.
    f. Measure and document the Uplink and Downlink amplifier gain and maximum output power for each individual channel.
        a. The donor antenna or service antennas shall be connected during this test.
    g. Measure and document donor antenna return loss.
    h. Measure and document DAS return loss at the headend and remote units.
    i. Measure and document the signal strength from the donor site(s), measured in an area of the building roof with a clear line of sight to the donor site(s).
    j. Measure and document the power level of the exterior perimeter ERRCS signal leakage. Leakage shall not exceed 15 dB below the received macro system Downlink signal.
    k. The Downlink and Uplink signal levels must be a minimum of -95 dBm within 95 percent of general areas and 99 percent of critical areas on each level of the building. This test is conducted on both amplified and non-amplified levels. Uplink power shall be measured at the Donor Site receiver multicoupler or calculated using the formula in Appendix C.
    l. Radiofrequency (RF) grid test measurements shall be gathered utilizing an omnidirectional antenna of the same model used on the portable radios currently in service with the Police and Fire Departments.
v. A portable radio of the type currently in service with the Police and Fire

Departments, as specified herein, worn on the hip and using a remote speaker-microphone, shall be used to confirm each tested grid test area provides a minimum delivered audio quality (DAQ) of 3.4 as defined in NTIA Report 99-358.

vi. On Project 25 digital channels, Downlink DAQ shall be measured using an instrument that decodes the Project 25 bitstream and provides a SINR or SNR measurement. A passing SNR or SINR is 20 dB or greater, and a passing Bit Error Rate, BER, or FBER is no greater than 2%.

29. **Testing and Maintenance**

A. The ERRCS shall be maintained operational at all times in accordance with Section 510.6 of the 2025 California Fire Code.

B. Annual Testing and proof of compliance shall be in accordance with Section 510.6 of the 2025 California Fire Code, with the following clarifications.

C. Annual Tests shall be conducted by a person holding a General Radiotelephone Operators License issued by the FCC, a NICET IB-PSC Level 3 certification, and a certification by the manufacturer of the equipment being inspected.

i. No person may conduct an Annual Test unless that person fully complies with this requirement.

ii. A person holding a NICET IB-PSC Level 1 or 2 certification may conduct an Annual Test provided that the person is directly supervised by a person holding a NICET IB-PSC Level 3 certification, and the inspection report is certified by the person holding the Level 3 certification.

D. Annual Tests shall include the following:

i. A visual inspection of the physical installation of the ERRCS with detailed photographic documentation.

ii. Backup batteries and backup power supplies will be tested under load for 1 hour.

iii. Backup batteries and backup power supplies will be tested using a pulse load battery tester when the batteries are compatible with pulse load testing.

iv. A calibrated spectrum analyzer and other suitable test equipment will be utilized to evaluate the ERRCS for all included frequency ranges.

a. Measure and document spurious Uplink signals to ensure they are not being generated.

a. The donor antenna shall be connected during this test.

b. Measure and document Downlink power reaching the amplifier at the donor antenna port for each included frequency range.

c. Measure and document ambient radiofrequency (RF) noise from the donor and service antennas at the amplifier with the amplifier shut down.

d. Measure and document the maximum quiescent ERRCS noise.

Quiescent noise shall not exceed -43 dBm ERP at the donor antenna and -150 dBm at the donor site.
    a. The donor antenna shall be connected during this test.
e. Measure and document the isolation between the donor (outdoor) and service (indoor) antennas to ensure isolation is at least 20 dB greater than the maximum amplifier gain.
f. Measure and document the Uplink and Downlink amplifier gain and maximum output power for each individual channel.
    a. The donor antenna or service antennas shall be connected during this test.
g. Measure and document donor antenna return loss.
h. Measure and document DAS return loss at the headend and remote units.
i. Measure and document the actual measured signal strength from the donor site(s).
    a. Measured in an area of the building roof with a clear line of sight to the donor site(s).
    b. Measured at the donor antenna port of the BDA.
j. Measure and document the power level of the exterior perimeter ERRCS signal leakage. Leakage shall not exceed 15 dB below the received macro system Downlink signal.
k. Measure and document the Downlink and Uplink signal level. Signal power shall be a minimum of -95 dBm within 95 percent of general areas and 99 percent of critical areas on each level of the building. This test is conducted on both amplified and non-amplified levels. Uplink power shall be measured at the Donor Site receiver multicoupler or calculated using the formula in Appendix C.
l. Radiofrequency (RF) grid test measurements shall be gathered utilizing an omnidirectional antenna of the same model used on the portable radios currently in service with the Police and Fire Departments.

v. A portable radio of the type currently in service with the Police and Fire Departments, as specified herein, worn on the hip and using a remote speaker-microphone, will be used to confirm each tested grid test area provides a minimum delivered audio quality (DAQ) of 3.4 as defined in NTIA Report 99-358.
vi. On Project 25 digital channels, Downlink DAQ shall be measured using an instrument that decodes the Project 25 bitstream and provides a SINR or SNR measurement. A passing SNR or SINR is 20 dB or greater, and a passing Bit Error Rate, BER, or FBER is no greater than 2%.

E. The Fire Code Official or FCC Licensee or their designee may, at any time during routine business hours, conduct independent Testing of the ERRCS to verify

proper operation and shall be provided unimpeded access at any time, 24 hours a day, 365 days a year, to investigate a case of interference with public safety radio communications systems.

F. Annual Testing shall be completed at no expense to the Jurisdiction or the FCC Licensee.
G. Annual Test results shall be filed with the Fire Code Official and FCC Licensee as directed.

30. **ERRCS End of Life**
    A. ERRCS that are 10 years or more from the date of installation are considered End of Life.
    B. ERRCS installed according to previous requirements, and non-compliant with the requirements herein will not be "grandfathered" without the express written consent of the FCC Licensee or designee.
    C. The property owner shall replace, modify, and/or repair the ERRCS to bring the system into compliance with the requirements herein at no cost to the jurisdiction or the FCC Licensee.
    D. The expected service life of batteries for all battery backup systems shall be determined by the manufacturer's specifications and derated based upon the ambient operating temperature. In the absence of the manufacturer's specifications, the End of Life of the batteries shall be three years.

31. **Service-Affecting Failure** - In the event of a service-affecting failure of any portion of the ERRCS, an initial evaluation shall be completed by a qualified technician within 24 hours. Repairs shall be completed within five working days. The building owner or manager shall notify ICI System Network Operations at (818) 548-3733 within 8 hours of any service affecting outage.

APPENDIX A –TERMINOLOGY AND DEFINITIONS

1. **AGC/ALC** – Automatic Gain Control / Automatic Level Control.
2. **APCO** - Association of Public-Safety Communications Officials.
3. **BDA** – Bidirectional Amplifier.
4. **BBU** – Backup Battery Unit.
5. **CBC** – California Building Code.
6. **CCR** – California Code of Regulations.
7. **CFC** – California Fire Code.
8. **CFR** – Code of Federal Regulations.
9. **DAQ** – Delivered Audio Quality.
10. **DAS** – Distributed antenna system. A network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure (47CFR§90.219).
11. **dBm** – Decibels referenced to 1 milliwatt.
12. **Donor Antenna** – An antenna located at the site of the ERRCS that is used to communicate with the larger wide-area communications system (i.e., with the "macro system"). The donor antenna is part of the ERRCS/microsystem, whereas its macro system counterpart (with which it communicates) is the donor site.
13. **Donor Site** – The specific wide-area communications (i.e., "macro system") site designated by the macrosystem operator as the communications site through which the individual ERRCS donor antenna shall link into the macrosystem. The donor site is part of the macrosystem, whereas its ERRCS counterpart is the donor antenna.
14. **Downlink** – The signal from the base station/tower site to the portable radio.
15. **ERP** – Effective Radiated Power (ERP), the power emitted from the donor antenna, which includes all gains and losses in the RF transmission system.
16. **ERRC** – Emergency Responder Radio Coverage. This can also sometimes be referred to as Emergency Responder Communication Coverage (ERCC).
17. **ERRCS** – Emergency Responder Radio Communications System. An infrastructure solution installed within a building to enhance the communications capabilities for first responders that utilizes solutions such as a signal booster, voting receiver, base station, or other technology capable of enhancing the radio frequency (RF) to ensure effective public safety communications. This can also sometimes be referred to as a "microsystem", or an Emergency Responder Communication Enhancement System (ERCES). System types include, but are not limited to, a radiating cable system and a distributed antenna system (DAS) with FCC-certified signal boosters.
18. **Et seq.** – and what follows (used in page-/section-number references).
19. **FCC** – Federal Communications Commission.
20. **IB-PSC** – In-Building Public Safety Communications.

21. **Macro System** – The wide-area communications system within which, and from which, a microsystem, such as an ERRCS, must gain permission to operate. For the purposes of this document, the macrosystem is the wide-area communications system used by the fire, police, and/or other public-safety agencies having jurisdiction.
22. **NEMA** – National Electric Manufacturers Association.
23. **NFPA** – National Fire Protection Association.
24. **NICET** – National Institute for Certification in Engineering Technologies.
25. **NTIA** – National Telecommunications and Information Administration.
26. **OSHA** – Occupational Safety and Health Administration of the United States Department of Labor.
27. **RF** – Radio Frequency.
28. **Service Antenna** – See DAS.
29. **Signal Booster** - A device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas, and other locations where these signals would otherwise be too weak for reliable communications. Signal booster systems may contain both Class A or Class B signal boosters as components, although only Class A signal boosters are allowed under this regulation.
30. **SINR** – Signal-to-Interference-plus-Noise Ratio.
31. **§** – Section, as in a section number of a code, law, or standard.
32. **Uplink** – The signal from the portable radio to the base station/tower site.
33. **UPS** – Uninterruptible Power Supply.

APPENDIX B - ERRCS PRELIMINARY BENCHMARK TESTING REQUIREMENTS

ERRCS preliminary benchmark tests shall include the following.

1) The project site construction address is used on the building permit.
2) The project site's decimal GPS coordinates from Google Earth.
3) Distance to the donor site.
4) Azimuth (degrees true) to the donor site.
5) The path profile to the donor site (you can use an image from Google Earth).
6) The average rooftop line-of-sight power for each tested macro radio system.
7) Signal level in dBm per frequency.
8) Bit Error Rate (BER or FBER) per P25 frequency.
9) Signal to Interference, Noise, and Distortion (SINAD or SNR or S/N) per P25 frequency.
10) Delivered Audio Quality (DAQ) per frequency using ICI-S or L.A. County radios.
11) The frequency or frequency group must specify the frequency or frequencies tested.
12) Calculate the Uplink signal strength using the Uplink formula in Appendix C.
13) The free space path loss (485 MHz and 800 MHz).
14) Photographs of the path to the donor site from the rooftop.
15) Photographs of the building showing the state of construction.
16) The make and model of the antenna used for Testing.
17) The calibration certificate for the equipment used for Testing.
18) The FCC license of the testing technician.
19) The NICET IB-PSC certification of the testing technician.

APPENDIX C - UPLINK POWER CALCULATION FORMULA

Without BDA

$P_{TX} - L_{BLDG} - L_{PATH} - L_{CLUTTER} = P_{UPLINK}$

Portable Radio TX Power (dBm): P_{TX}
Building Materials Loss (Calculated as the difference between the rooftop average power, minus the power measured in each grid test area.) (dB): L_{BLDG}
Free Space Path Loss (dB): L_{PATH}
Path Loss Due to Clutter (dB): $L_{CLUTTER}$
Uplink Power at Donor Site Antenna (dBm): P_{UPLINK}

With BDA

$DP_{BDA} - P_{GRID} = L_{DAS}$
$L_{DAS} + P_{TX} + G_{BDA} = UP_{BDA}$
$UP_{BDA} - L_{FEED} + G_{ANT} - L_{PATH} - L_{CLUTTER} = P_{UPLINK}$

Measured Downlink BDA (Service) TX Power (dBm): DP_{BDA}
RF Power Measured in Grid Test Area (dBm): P_{GRID}
DAS Loss (Calculated as the difference between the BDA Downlink power and the power measured in each grid test area.) (dB): L_{DAS}
Portable Radio TX Power (dBm): P_{TX}
BDA Uplink Gain (dB): G_{BDA}
BDA Uplink Power (dBm): UP_{BDA} (Cannot exceed BDA AGC power limit.)
Feedline Loss (dB): L_{FEED}
Donor Antenna Gain (dBd): G_{ANT}
Free Space Path Loss (dB): L_{PATH}
Path Loss Due to Clutter (dB): $L_{CLUTTER}$
Uplink Power at Donor Site Antenna (dBm): P_{UPLINK}

APPENDIX D - LABELING REQUIREMENTS

NOTE: Quotation marks "" are included here for clarity and should not appear on labels.

Amplifier, battery enclosure, and ancillary enclosures must have visible identification, including the following.

1. "City of (city name)" "Public Safety Radio System" (Amplifier only).
2. The full model and serial number of each active device and external filter shall be affixed to the front of the device.
3. The location of the circuit breaker panel, panel number, and circuit number.
4. The annual Permit to Operate issued by the FCC License Holder or designee (Amplifier only).
5. The date of the last most recent successful inspection (Amplifier only).
6. Contact information of the most recent current inspection service provider.
7. Contact information (name, address, office and mobile numbers, and email) for the building representative with access to system components and records.
    a. Must be available 24/7 to provide access on demand.
        1. 24/7 Contact Center
        2. Building Owner.
        3. Building Manager.
        4. Building Engineer.

Remote monitoring and control. Ethernet cables providing Internet connectivity shall be labeled "FIRE DEPT. RADIO" "DO NOT DISCONNECT" at every Ethernet connection starting at the originating switch.

ERRCS dedicated annunciator panel. "IN-BUILDING RADIO SYSTEM STATUS" "WHEN IN ALARM USE DIRECT RADIO CHANNELS"

Coaxial cabling. Cables, cable segments, grounds, and passive RF devices shall be labeled with the identification number from the plans and "PUBLIC SAFETY RADIO".

DAS antennas. Antennas must be labeled with the identification number from the plans and "PUBLIC SAFETY RADIO" "DO NOT PAINT".

Donor Antenna

1. Permanent signage or labeling that is readily visible.
2. Secured to antenna mast at eye level or below, at least 2 feet above base of mast.
3. "WARNING" "PUBLIC SAFETY RADIO SYSTEM" "MOVEMENT OR REPOSITIONING OF THIS ANTENNA IS PROHIBITED WITHOUT APPROVAL FROM THE FIRE CODE OFFICIAL AND THE FCC LICENSEE".

Power Distribution Panel (Circuit Breaker Panel). Breaker(s) to be clearly and legibly labeled "ERRCS" on the Panel Schedule and adjacent to the breaker.

Disconnects and EPO Switches. Label stating "ERRCS AC Service Disconnect" or "ERRCS BDA Shutoff".