EMERGENCY RESPONDER RADIO COVERAGE GUIDELINE

Effective Date: January 2017

All buildings shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building. This section shall not require improvement of the existing public safety communication systems. The intent of this guideline is to provide the SJFD interpretation of the minimum standards necessary to meet the requirements for emergency responder radio coverage in accordance with the state code.

1.0 GENERAL

1.1 **This guideline applies to all buildings within the City of San Jose**.

1.1.1 All new buildings, without regard to exemptions allotted below, shall be provided with the capability to support the installation of a radiating cable system, a distributed antenna system with Federal Communications Commission (FCC)-certified signal boosters, or other system approved by the fire code official in order to achieve the required adequate radio coverage if needed. Such capability shall be demonstrated to allow for the potential of future installation of a building EMERGENCY RESPONDER RADIO COVERAGE (ERRC) system.

Specifically, as further discussed in item 4.1 herein, all buildings may require an ERRC system at some point. Although it is a good idea for all building to plan for future needs, SJFD requires buildings meeting any of the following conditions to demonstrate on the building permit submittal plans that they can install an ERRC system if needed now or in future:

1. There are more than 3 *stories above grade plane* (as defined by the California Fire Code {CFC} Section 202);
2. Parking Structure;
3. The total building area is 30,000 square feet or more;
4. The total *basement* area is 5,000 square feet or more.
5. Facilities deemed Critical. Typically noted during Planning Approval.

1.1.2 Where approved the fire code official, a wired communication system in accordance with CFC 907.2.13.2 may be permitted to be installed and/or maintained in an existing building in lieu of an approved radio coverage system. Also see 2016 NFPA 72 Section 24.8.

Note: *Be prepared to discuss the affects the installation of an ERRC system will have and why it is not feasible for this building.*

1.1.3 **Buildings which will achieve radio coverage without amplification are exempt**. Where it is determined by a radio signal strength and clarity study that buildings and areas of buildings that have minimum radio coverage signal strength levels of the Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase 2 700 MHz Digital Trunked Radio System within the building in accordance with CFC Section 510.4.1 without the use of an indoor radio coverage system, the building is exempt.

1.1.4 **Negative impacts.**

1.1.4.1 In facilities where emergency responder radio coverage is required and such systems, components, or equipment required could have a negative impact on the normal operations of that facility, the fire code official shall have the authority to accept an automatically activated emergency responder radio coverage system. At a minimum, a fire detection system is required with interlocks as needed for firefighter use and an Emergency Plan as described in CFC Chapter 4.

Note: *Be prepared to discuss transmitter(s) on site and affects it (they) will have on overloading the Distributed Antenna Systems (DAS) Bi-Directional Amplifiers (BDA). Where the BDA is limited and to keep costs down a "Split DAS" solution may be proposed with separate uplink and downlink antennas to solve frequency conflicts particularly if physical separation cannot be accomplished.*

1.1.4.2 **Obstruction by proposed construction.** No obstruction of the public safety system backhaul shall be allowed without an *approved* mitigating plan. When the construction of a new building obstructs line of sight emergency radio communications to existing buildings or other locations, the developer of the new building shall develop an *approved* mitigating plan to correct the degraded radio coverage as necessary to restore communications capabilities in accordance with CFC section 510.

1.1.5 **Exterior irradiation**. We need to make sure that the ERRC enhancements are not impacting the communications outside the buildings they are augmenting. The common method to achieve compliance with CFC 510 is the installation of a bidirectional amplifier (BDA), an amplified distributed antenna system (DAS), or other proven signal amplification technology capable of achieving the required radio coverage.

A DAS is a network of cables and antennas configured to distribute the signals from the BDA evenly throughout the building. This is usually accomplished through the use of multiple antennas or radiating cable (also known as leaky coaxial cable). When combined with a BDA, DAS is usually the best option for enabling capacity and coverage inside dense infrastructures, such as shopping malls, multi-tenant commercial and residential centers, and high rise buildings. In addition to the standard coaxial cable distribution, DAS can also use a fiber-optic backbone to distribute signals. This fiber-optic option provides a lower loss solution for larger venues or more complex systems like business and residential campuses, as fiber-optics can extend out to over 10 miles before it impacts system performance.

The building-by-building approach may accommodate start-up requirements, however, developing fiber optic systems that support multi building and larger applications should seriously be considered. Taking a system approach could reduce initial and life-cycle costs as well as provide improved control of the radio system.

2.0 PERMITS

2.1 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 San Jose Fire Department's Bureau of Fire Prevention (BFP) located at 200 E. Santa Clara St., Development Services, San Jose, California:

2.1.1. A completed Fire Protection and Special Systems Installation Permit – provide all required information and make sure the permit card (manila card) is legible.

2.1.2. A copy of the San Jose Fire Department Plan Check Comments – this may be obtained from the architect or general contractor.

2.1.3. A copy of any approved "variance" or "alternate methods" that is relevant to the ERRC system – check with the architect or general contractor if a "variance" or "alternate methods" was submitted to and approved by the City of San Jose.

2.1.4 **SVRIA system registration.** Prior to issuance of a construction permit, systems must be registered with the SVRIA at http://svria.org/resources/ and proof of registration shall be submitted to the ***fire code official*** upon plan submittal.

2.1.4.1 Contractor to complete the form to the best of their ability prior to the start of the project;

2.1.4.2 Prior to granting final, the completed form shall be submitted to ***SVRIA*** and the ***fire code official***.

2.1.5. A minimum of three sets of shop quality plans and one submittal packet for the proposed ERRC system – one set of plans shall be retained by the BFP.

2.2. **Permits are required for any of the following work**:

2.2.1 Installation of a new ERRC system.

2.2.2 Any alteration to an existing ERRC system.

2.2.3 Addition to an existing ERRC system.

2.2.4 Demolition of a part or of a whole ERRC system.

Note: *Maintenance performed in accordance with this code is not considered a modification and does not require a permit.*

2.3 Initial Permit fees based on 2 hours of plan review and inspection time plus the record retention fee will be collected when plans are approved. Fees for ERRC review and inspection are charged as additional Fire Architectural fees and charged in hours as needed to complete the process.

2.4 The permit applicant shall be the installing contractor. See CFC 510.5.2 and item 5.10 herein for ERRC personnel qualifications.

2.5 All installing contractors shall have a California Electrical (C-10 or C-7) Contractor's License; a valid worker's compensation certificate; and a San Jose 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.

2.6 Installation, alteration, or demolition of a system shall not commence prior to the approval of plans and the issuance of a permit.

2.7 The entire permit card and a San Jose Fire Department approved set of plans shall be kept at the project site until final approval of the permit, after which they shall remain in the possession of the owner.

2.8 Equipment shall have FCC certification prior to installation.

2.9 **Operating Permit** – An emergency responder radio coverage annual operating permit is required with the property owner when an ERRC system is installed. A temporary emergency responder radio coverage operating permit will be issued by the SJFD inspector at the project final. The owner/tenant shall contact Bureau of Fire Prevention at (408) 535-7687, as soon as possible after the project final, for obtaining the yearly operating permit.

3.0 PLANS

3.1 General Requirements for All ERRC Projects.

3.1.1 Plans and attachments shall be clearly labeled and legible.

3.1.2 Plans and all revisions to the plans shall be dated. If utilizing an existing drawing or portion of a drawing, the area of work shall be highlighted and clouded with an appropriate symbol (delta). Provide a revision list with a symbol, date, description, and initials.

3.1.3 When making alterations, additions, or deletions to an existing system, all existing devices and equipment shall be shown and properly identified on the floor plan and system riser (single-line) diagram.

3.1.4 Plans shall include a title sheet, an equipment list, a written standard operating procedure, a floor plan, a system riser diagram, and secondary power calculations See paragraphs 3.2 through 3.9, herein.

3.1.5 Attachments shall include the manufacturer's specification sheets for all equipment and devices such as; cables, amplifiers, ups, batteries and antenna; indicating the FCC certification. See paragraph 3.9, herein.

Note: *Failure to provide any of the information required in sections 3.1 through 3.9, herein, will result in the plans being disapproved.*

3.2 Title Sheet

3.2.1 The front sheet shall contain the following information:

3.2.1.1 Project name and address of the project.

3.2.1.2 The designer's full name (no initials, pseudonyms, acronyms, or aliases) FCC License number and signature. The designer of record shall be responsible for the entire system being worked on.

3.2.1.3 Business name, address, and California Contractor's License number and FCC issued License 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:

3.2.1.3.1 **DESIGNED BY** - followed by the designer's business name, address, designer of record's full name and signature. See CFC 510.5.2 and item 4.10 herein for qualifications.

3.2.1.3.2 **INSTALLING CONTRACTOR** - followed by the installing contractor's business name, address and California Contractor's License number. See CFC 510.5.2 and item 4.10 herein for qualifications.

3.2.1.4 Name and type of supervising station service monitoring the system as per NFPA 1221 section 9.6.13. See SJFD Handout for Fire Alarm Systems for further direction at http://sanjoseca.gov/ > Government > Departments & Offices > Departments & Offices D-H > Fire Department > Bureaus >Fire Prevention & Permits > Development (Construction) > Policies based on 2016 Code > Fire Alarm Systems – Requirements.

3.2.1.5 Occupancy group(s) of building or area as defined by the California Building Code.

3.2.1.6 Number of basements, number of stories above basement, building height, total building area, and building construction type.

3.2.1.7 Scope of work. If the scope of work is the demolition of an existing ERRC system, justification for removal shall be provided. See item 1.1.3 herein.

3.2.1.8 Description of transmission zone assignments such as complex name, address, or campus and designation.

3.2.1.9 A note stating that the design and installation complies with the CFC (2016 edition), NFPA 72 & 1221 (2016 editions), the California Electrical Code (2016 edition), the California Building Code (2016 edition), and the San Jose Fire Department ordinances, policies, and standards.

3.2.1.10 A clear site map and/or vicinity map.

3.2.1.11 All other pertinent notes.

3.2.2 A key plan of the building and/or complex indicating the street location and the ERRC System Controls within the building shall be provided.

3.2.3 State the required performance objective of the ERRC per CFC 510.4 and NFPA 1221, section 9.6. Should the codes conflict, the most stringent shall prevail.

3.3 Equipment List

3.3.1 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 *(Note: The Fire Department reserves the right to disallow any listed product due to past performance)*.

3.3.1 The symbols used on the plans shall match the legend. Strike out any "typical" symbols that do not pertain.

3.4 Floor Plan – the following shall be clearly indicated:

3.4.1 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.

3.4.2 Room and Room Names.

3.4.3 The locations of partitions, non-rated walls, and rated walls.

3.4.4 The location of all Emergency Responder equipment.

3.4.5 Power and Panel locations.

3.4.6 Raceway routing.

3.4.7 Conduit and conductor size.

3.4.8 Roof plan showing location(s) of antennae.

3.4.9 Location(s) of In Building Antennae.

3.4.10 Band width.

3.5 Riser Diagram – provide the following:

3.5.1 Single-line wiring diagram (riser diagram) that shows the interconnection of equipment of the whole system.

3.5.2 Type and size of wire or conductor to be used.

3.5.3 Schematic drawing of electrical system and backup power.

3.6 Detail Diagram – Show Supervisory points from repeater.

3.7 Calculations

3.7.1 Secondary power calculation – See item 4.19 herein.

3.8 Signal propagation Map – Provide a map indicating the signal strengths as designed and then as installed by As-Built. These maps are generally printed in color, however they are scanned in Black and White (B&W). The map(s) must be graphically distinct such that having been scanned into B&W it/they will still demonstrate the system design.

3.9 Attachments

3.9.1 Manufacturer's specification sheets for all devices, equipment, and materials to be used shall be submitted, including the cables, amplifiers, ups, batteries, antenna 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.

4.0 DESIGN AND INSTALLATION

4.1 Because technology advancements, induction of noise into the network and any unforeseen issue(s) may arise, all new buildings as described in item 1.1.1 herein, shall be constructed with the ERRC system infrastructure (i.e., rated enclosures, pathways, conduit, access panels, etc.) installed at the start of the project. There shall not less than a two-inch (2") conduit having a minimum two-hour fire resistive rating installed between the either the first floor or the bottom subterranean floor to the roof. If the conduit is installed to be shared, load calculations shall be provided demonstrating the volume capacity is not diminished by the size installed.

4.1.1 All rated enclosures, pathways, conduit, access panels, etc., shall be clearly identified on the building electrical (and fire alarm if exist) plans if no ERRC permit is being pulled. All rated enclosures, pathways, conduit, access panels, etc., shall be clearly and permanently labeled.

4.2 ERRC systems shall be designed and installed in accordance the design and installation complies with the CFC (2016 edition), NFPA 72 & 1221 (2016 editions), the California Electrical Code (2016 edition), the California Building Code (2016 edition), and the San Jose Fire Department ordinances, policies, and standards.

4.2 **Emergency Communications Systems**: CFC, section 510 determines when these systems are required in a building. 2016 NFPA 1221 – "Installation, Maintenance, and Use of Emergency Services Communications Systems" tells you how the system should be installed when required by the fire code.

4.3 **Critical Areas.** As directed by 2016 NFPA 1221, section 9.6.7.4, critical areas, including fire command centers, fire pump rooms, exit stairs, exit passageways, 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.

4.4 Prior to installation, the developer shall meet with the Fire Department to ensure that the required radio study is prepared to assess existing and proposed signal strength and clarity. The radio study shall provide specific recommendations to the developer to achieve compliance. The radio study shall be submitted along with the applicant's formal application for permit. This document shall contain, but not be limited to, the various frequencies required, the location of radio sites, the effective radiated power of radio sites and other supporting technical information.

4.5 Documentation required is presented in 2016 NFPA 1221 Chapter 12.

4.6 **Amplification systems allowed.** Buildings and structures which cannot support the required level of radio coverage shall be equipped with a radiating cable system, a distributed antenna system with Federal Communications Commission (FCC)-certified, public-safety grade signal boosters (amplifiers) designed for the bands and frequencies specified by the *fire code official*, or other system allowed by the *fire code official* in order to achieve the required adequate radio coverage.

4.7 Design the ERRC to provide signal amplification on every floor of the building. During installation, install infrastructure (equipment space, electrical power and cable pathways) throughout the building. However, install amplification only on floors that fail to pass the Contractor's pre-installation and acceptance tests.

4.8 Components used in the installation of the ERRC system, such as repeaters, transmitters, receivers, signal boosters, cabling, and fiber-distributed antenna systems, shall be tested for compatibility with the public safety radio system.

4.9 ERRC shall not infringe on or be overrun by adjacent building communication systems or cellular telephone service provider systems.

4.10 Permanent external filters and attachments shall not be permitted.

4.11 A single antenna system is allowed provided the antennas are capable of passively distributing all frequencies between 698MHz and 2.7GHz and the hardware for both Public Safety and wireless carrier frequencies are completely separate with necessary filters. The single antenna system must also be tested and certified by a qualified contractor.

4.12 **Isolation.** As directed by 2016 NFPA 1221, section 9.6.9, if a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas (interior and exterior signal strength) to a minimum of 20 dB under all operating conditions.

4.13 **Retroactivity:** Unlike most installation standards, ERRC is intended to be enforced retroactively on existing buildings. See CFC 510.2 and 1103.2.

4.14 Emergency responders include but are not limited to the following:

4.14.1 City of San Jose Fire and Police Departments

4.14.2 Santa Clara County Sheriff and California State Police Departments

4.14.3 Ambulance

4.15 **Supported Frequencies**: A frequency range supported ***from*** the Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase 2 700 MHz Digital Trunked Radio System as determined by the *fire code official* (base transmitter frequencies), and a frequency range supported ***to*** the Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase 2 700 MHz Digital Trunked Radio System as determined by the *fire code official* (radio field transmit frequencies) on each floor of the building. See **FREQUENCY INFORMATION** table herein page 13 of 14.

4.16 **On Site Location:**

4.16.1 The ERRC head-end shall be located at the fire command center (FCC) when the building has one.

4.16.2 For buildings without a *fire command center* the communications control equipment and portable handsets shall be located inside the building near the fire alarm control panel, or other *approved* location.

4.16.2.1 ERRC head end including all common equipment should be located in a room on the main floor or one floor below grade. Locate the head end equipment in the telecommunications Building Entrance (BE) room whenever possible. 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

4.16.2.2 Locate the EERC node equipment in Telecommunications Rooms (TRs).

4.16.2.3 Provide the ERRC head-end room and the TRs containing ERRC equipment with continuous air conditioning to alleviate heat build-up within the rooms. Connect the air conditioning system to normal building power circuits. The ERRC equipment can operate at an elevated temperature during a power outage.

4.16.3 Rooms housing ERRC equipment to be in Pre-Approved locations separated from the remainder of the building by 2 hour rated fire barriers. See item 4.24 herein for wiring survivability.

4.16.4 Location of the main RF and donor site (site closest to the jobsite) and their power - The Lat/Long coordinates will be provided to the contractor developing the DAS system and will vary by location. At no time will the contractor be allowed access to City radio sites.

4.17 **Additional frequencies.** Provide ERRC expandability to permit future additions and changes to the emergency responder radio frequencies. See item 4.1 herein.

4.17.1 SJFD is part of the Silicon Valley Regional Communications System (SVRCS). A 700MHz system is in process of being deployed and this will also be a requirement for the building owner. For planning purposes, factor the data from the 800MHz tests to model the indoor 700MHz requirements. 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. Prior approval of a public safety radio coverage system on previous frequencies does not exempt this section.

4.17.2 ERRC shall comply with the requirements of and obtain licensee consent from the FCC as required.

4.17.3 Do not combine the ERRC with other radio systems such as:

4.17.3.1 Cellular telephone signal enhancement.

4.17.3.2 Wi-Fi systems.

4.17.3.3 Pager systems.

4.17.3.4 Medical telemetry systems

4.18 All signal booster components shall be contained in National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet(s) or other *approved* enclosure(s).

4.19 **Secondary power supply** - Emergency responder radio coverage systems shall be provided with an approved secondary source of power per 2016 NFPA 1221 section 9.6.12 in addition to CFC 510 section 4.2.3 and 604.2.3.

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

4.19.2 Connect the UPS (12-hour capacity on full operational load) to a generator-backed emergency power circuit if available.

4.19.3 As a Minimum:

4.19.3.1 UPS shall be enclosed in a NEMA Type 4 waterproof enclosure.

Exception*: Listed systems that are contained in integrated battery cabinets*.

4.19.3.2 UPS batteries shall be of the sealed maintenance-free type.

4.19.3.3 Provide battery ventilation in accordance with code.

4.19.4 Monitoring the integrity of power supplies shall be in accordance with 2016 NFPA 1221 section 9.1.2.

4.19.5 As a Minimum:

4.19.5.1 UPS shall be enclosed in a NEMA Type 4 waterproof enclosure.

Exception*: Listed systems that are contained in integrated battery cabinets*.

4.19.5.2 UPS batteries shall be of the sealed maintenance-free type.

4.19.5.3 Provide battery ventilation in accordance with code.

4.20 **Emergency Power Off (EPO)** - A disconnect relay connection that will disengage the Power shall be provided in a Pre-Approved location(s) and be the only method of turning off a UPS system. DC Systems shall have a Battery Disconnect Switch.

4.21 **Supervision** - See 2016 NFPA section 1221 section 9.6.13.1 for monitoring requirements of ERRC Systems. As a Minimum, Provide supervision of the ERRC antennas, signal boosters, power supplies, UPS and components.

4.21.1 Program the fire alarm system to relay ERRC supervisory and trouble signals to the appropriate supervising station. Instruct supervising station personnel to notify the San Jose Fire and Police Departments of the impairment.

4.22 **Dedicated Panel** - See 2016 NFPA 1221 section 9.6.13.2 for monitoring requirements of ERRC Systems.

4.23 **Antennas** - If outdoor antennas are required, obtain City of San Jose Planning Department approval of antenna locations. Provide access for maintenance and code-required fall protection.

4.24 **Building conduit and pathway survivability**.

4.24.1 Provide pathway (circuit) survivability in accordance with 2016 NFPA 1221, section 9.6.2.

4.24.2 When installing to the **prescriptive** methods required by 2016 NFPA, section 9.6.2.1.1, the system shall have a pathway survivability of at least Level 1.

4.24.2.1 Pathway survivability Level 1 shall consist of pathways in buildings that are fully protected by an automatic sprinkler system in accordance with 2016 CFC 903.3.1.1 for corridors with any interconnecting conductors, cables, or other physical pathways installed in metal raceways. See 2016 NFPA 1221, section 5.10.2.

4.24.2.2 Where leaky feeder cable is utilized as the antenna, it shall not be required to be installed in metal raceway. See 2016 NFPA 72, Section 24.3.13.8.1.

4.24.2.3 The feeder and riser coaxial cables shall be rated as plenum cables. See 2016 NFPA 72, Section 24.3.13.8.1.1.

4.24.2.4 The feeder coaxial cables shall be connected to the riser coaxial cable using hybrid coupler devices of a value determined by the overall design. See 2016 NFPA 72, Section 24.3.13.8.1.2.

4.24.3 When installing to the **performance** methods required by 2016 NFPA, section 9.6.2.1.2, the system shall be:

4.24.3.1 Rated as riser cables and routed through a 2-hour–rated enclosure.

4.24.3.2 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.

4.24.4 All feeder cable shall be either protected by an automatic sprinkler system in accordance with 2016 CFC 903.3.1.1 for corridors or installed within approved metal raceway.

4.24.5 All radio cable (riser and feeder) is required to be plenum-rated. Cable other than radio cable is allowed to comingle with the radio cable in the conduit provided it is listed, shielded cable that will not interfere with the radio cable and complies with the California Electrical Code.

4.24.6 At each floor and the roof, an opening shall be made to allow easy access to the conduit from the ceiling.

4.24.7 Access in either the form of a drop ceiling or access panel shall be made along hallways and through firewalls.

4.24.8 All floors of the subterranean parking garages shall have a similar conduit installation and access.

4.24.9 Identify all required outside plant fiber optic cables required to connect ERRC to remote antennas, other services and other buildings.

4.24.10 The Circuit Conductors and Fiber-Optic Strands wiring shall be installed as required by 2016 NFPA 72 section 27.7.

4.25 **Signage**. Signage shall be provided in accordance with CFC 509 as directed by the inspector.

4.25.1 Buildings equipped with an emergency responder radio coverage system shall be identified by an *approved* sign located above or near the building key box stating: "Radio System Installed". A sign stating "Radio System Equipment" will be placed on or adjacent to the door of the room containing the main system components. These signs shall meet the SJFD current ERRCS sign standard. Metal backed, red background, with blue reflective lettering. See example herein, page 14 of 14.

5 **Exception**: In existing buildings, riser cable mechanically protected by metal conduit can be routed through a sprinkler-protected, 1-hour rated enclosure.

5.0 TESTING

5.1 Inspection is required to demonstrate compliance to the provisions of CFC Section 510. The Owner or an authorized agent of the owner is responsible to obtain and fund special inspections services by contract with a Contractor approved by the 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.

5.2 **Field testing.** Radio protocols will need to be coordinated with PD/Fire dispatch operations. As they will be testing on the City's main dispatch channels, use clear regular voice communications and avoid any code or call signs.

5.3 SJFD Departmental interaction procedure for testing:

5.3.1 Contact **Fire Communications Administration at 408-794-1280 to schedule any testing on active Fire Department frequencies. A minimum of 2 full business days lead time is required.**

5.4 Typically SJFD allows testing on its frequencies only during our slack time between 0500-0700 hours. Authorized contractors can do testing as our activity level permits. The contractors must understand that they need to monitor what is going on, and hold their traffic (especially on SJFIRE) if we start getting busy.

5.5 Fire Communications dispatch operations will not be used to determine the Delivered Audio Quality (DAQ) for either analog or digital signals.

5.6 Contractors will call us at 408-277-8952 prior to starting their testing to ensure that they are OK to proceed and have agreed to finish by time (usually 0700 hours). They will provide their contact information, and we can call them to postpone their testing if needed.

5.7 Two-way radios for testing shall be provided by the installation contractor and the technician shall be trained in the proper use of emergency radios.

5.8 SJFD Frequencies may not be used for anything other than short test counts. Conversation between employees at the site shall not take place on SJFD frequencies.

5.9 **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.

5.9.1 **Amplifiers shall not be placed on air before they are verified**.

5.9.2 The two primary considerations for the Acceptance Tests are:

5.9.2.1 Equipment Validation (Again - before it is placed on the air) &

5.9.2.2 Coverage Validation (to document the improved coverage)

5.9.3 Any transmitter test shall document that the transmitter is set to the minimum power required to carry out the desired.

5.9.4 Document that the measured peak output power (EIRP) complies with the de facto EIRP limit (+36 dBm – 4W unless otherwise noted) for all proposed antennas.

5.9.4.1 Note that the output power limit was reduced in order to comply with the de facto EIRP limit if required.

5.9.5 Radio Shop - Uplink level verification.

5.9.5.1 With the donor EIRP known, document an accurate measurement of the downlink to identify the signal loss between the two locations. Given that the uplink path will have the same signal loss, therefore, if the uplink output power is measured the signal level at the donor site can be accurately calculated and documented.

5.9.5.2 If the minimum/maximum levels into the DAS are within the automatic gain control (AGC) range of the amplifier, the output levels from the amplifier (uplink) will be relatively constant from anywhere in the building. If the minimum/maximum range is greater than what the amplifier will handle, the lowest level needs to be used in the link calculation to determine the uplink gain of the amplifier and documented.

5.9.6 Maximum Output Power Testing (Uplink):

5.9.6.1 Class A Amplifier:

5.9.6.1.1 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.

5.9.6.1.2 Perform and document a link calculation for the radio path between the building and the Donor Site.

5.9.6.1.3 Adjust the gain of the amplifier to ensure the uplink signal level received at the radio site is above -95dBm

5.9.7 **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.

5.9.8 After completion of Signal Level Measurements and evaluation of Audio Quality, SJFD will be asked by the contractor to schedule a Fire Crew to survey the building and verify Fire Command and Dispatch radio operation. Failure of the operational check will require that the Owner correct deficiencies and re-schedule Acceptance Testing.

5.10 **Annual testing and proof of compliance.** 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 SJFD.

5.10.1 **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.

5.10.2 San Jose Fire Department and other Agency 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.

5.11 **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, lead installation personnel and personnel conducting radio system tests shall include possession of:

5.11.1 **A valid FCC-issued general radio operators license; and**

5.11.2 **Certification of in-building system training issued by –**

5.11.2.1 **Association of Public Safety Communications Officials (APCO)**

5.11.2.2 **National Association of Business Education Radio (NABER)**

5.11.2.3 **Personal Communications Industry Association (PCIA) or**,

5.11.2.4 **The manufacturer of the equipment being installed**.

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.*

6.0 INSPECTIONS

6.1 Field inspections shall be scheduled only after a permit has been issued.

6.2 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.

6.3 Inspections may be scheduled by calling (408) 535-3555. 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.

6.4 Missed inspections or inspections canceled within 48 hours shall be counted against inspection time.

6.5 The installing contractor shall conduct a complete test of the system and shall complete all parts of the "Record of Completion" {2016 NFPA 72 Figure 7.8.2(b) & (k) "other"} **prior** to the San Jose Fire Department (SJFD) inspection date.

6.6 Necessary coordination shall be made such that representatives of other contractors whose equipment are involved in the testing are present.

6.7 There shall be sufficient personnel and equipment to demonstrate the installation.

6.8 The contractor shall schedule a SJ Station Fire Crew to survey the building and verify Fire Command and Dispatch radio operation through the Fire Prevention Bureau per item 5.9.8 herein.

6.9 At the time of inspection, the contractor shall hand the following documentation (see 2016 NFPA 72 section 7.5) to the SJFD inspector upon his/her arrival, which includes:

6.9.1 Approved and stamped plans and complete permit (white, pink, hard card).

6.9.2 A copy of the completed "Emergency Communications Systems Supplementary Record of Completion".

6.8.2.1 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.

6.9.3 As-built plans if installation has deviations from the approved plan.

6.9.4 All previous records of inspections.

6.10 After the successful completion of the tests/inspections, provide the following to the SJFD inspector:

6.10.1 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.

6.10.2 The permit card (for inspector's signature).

6.10.3 Documents specified in 2016 NFPA 72 sections 7.5.

6.11 After final completion and acceptance of the project, the contractor shall provide the following to the owner:

6.11.1 Documents specified in item 6.5 herein.

6.11.2 All literature and instructions provided by the manufacturers describing proper operation and maintenance of all devices and equipment,

6.11.3 A copy of the approved plan and as-built plan, if applicable,

6.11.4 A copy of the Certificate of Completion, and

6.11.5 The signed and finaled permit card.

6.12 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 head-end room. After final completion and acceptance of the project, the Owner shall maintain the following on site:

6.12.1 Documents specified in item 6.5 herein.

6.12.2 All literature and instructions provided by the manufacturers describing proper operation and maintenance of all devices and equipment,

6.12.3 A copy of the as-built plan,

6.12.4 Summary drawing showing locations of ERRC head-end and node equipment, and antenna sites,

6.12.5 Summary of ERRC frequencies utilized,

6.12.6 Table of effective radiated power at antenna sites,

6.12.7 Keys to radio equipment room in key box

6.12.8 Label indicating ERRC system on premises at lock box

6.12.9 A copy of the Certificate of Completion, and

6.12.10 The Names and contact information of personnel to be contacted at any time (24/7/365) if access to the equipment is needed.

7.0 Document Revisions

7.1 This document is subject to revisions. For general information and to verify that you have the most current document, please call (408) 535-7750, and request the current version date.

FREQUENCY INFORMATION

Systems shall be compatible with Silicon Valley Regional Interoperability Authority (SVRIA) P25 Phase II digital radio system. Systems shall have the capability to support a minimum of 24 channels in the 700/800 MHz band and be field programmable. For Donor Site frequencies, register with the SVRIA at http://svria.org/resources/. If the Site Location(s) are not yet commissioned, use the County Emergency Medical Services Agency (CEMSA) frequencies to estimate if a Distributed Antenna System (DAS) / Bi-Directional Amplifier (BDA) system is likely to be needed. County Communications Administration can be reached at 408-977-3220 to set up the testing. If CEMSA frequencies come in with sufficient strength, it can be assumed that a DAS/BDA system will NOT be needed. If the CEMSA frequencies are weak, before installation, a retest of the Silicon Valley Regional Communications System (SVRCS) Project 25 Land Mobile Radio (LMR) system shall be performed after the prevailing donor sites are commissioned.

After registering, if testing determines that a DAS/BDA system is not necessary, SVIRA will be informed that the registration can be deleted and SJFD will be copied on the correspondence.

Design Details for Approved Building Signage Required in Section 510.5.6:

6” x 8” Metal backed Sign
½” Lettering
2” x 4” Graphic
Red Background with Blue Reflective Letters and Graphic

Radio System Installed