

SECTION 27 53 23
EMERGENCY RESPONDER RADIO
Construction Specification

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Emergency Responder Radio (ERR) to support multiple in-building First Responder / Emergency Responder wireless services. The ERR integrator shall provide a complete turn-key system that supports all required frequencies within the code required coverage spaces.
- B. Related Sections
 - 1. Comply with the Related Sections requirements of:
 - a. Section 263200, Packaged Generator Assemblies
 - b. Section 263353, Static Uninterruptible Power Supply
 - c. Section 270000, "Basic Communications Requirements"
 - d. Section 270526, "Grounding and Bonding for Communications Systems"
 - e. Section 270528, "Building Pathways"
 - f. Section 271100, "Communications Equipment Rooms"
 - g. Section 283100, "Fire Detection and Alarms Systems"

1.2 REFERENCES

- C. Comply with the References requirements of Sections 263200, 263353, 270000, 270526, 270528, 271100 and Section 283100.
- D. In particular or addition to the codes and standards listed in Section 270000, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
 - 1. FCC Regulations:
 - a. Part 27: Miscellaneous Wireless Communications Services
 - b. Part 90: Specialized Mobile Radio Service
 - c. Part 95: Personal Radio Services Rules
 - 2. California Code of Regulations (CCR), Title 24, Part 9, Section 510 "California Fire Code", 2013 edition (or latest version)
 - 3. Local Ordinance:
 - a. <Example>: City and County of San Mateo

1.3 DEFINITIONS

- E. Definitions as described in Section 270000 shall apply to this section.
- F. In addition to those Definitions of Section 270000, the following list of terms as used in this specification defined as follows:
 - 1. "AHJ: Authority Having Jurisdiction
 - 2. "BDA": Bi-Directional Amplifier
 - 3. "FCC": Federal Communications Commission
 - 4. "LMR: Land Mobile Radio

5. "RF": Radio Frequency
6. "ERR": Emergency Responder Radio
7. "RSSI": Received signal strength indication
8. "SISO": Single-Input, Single-Output
9. "SMR": Specialized Mobile Radio (synonymous with trunked radio or public access mobile radio)
10. "SOW": Statement of Work
11. "TRC": Two-Way Radio Communications (NFPA)
12. "UPS": Uninterruptable Power Supply

1.4 SYSTEM DESCRIPTION

G. System Description

1. The in-building Emergency Responder Radio system, herein "system" or "ERR", shall reliably distribute RF signals and/or wireless services throughout the code required frequency ranges and the throughout the code required coverage spaces. The system shall be implemented based on proven state-of-the-art technology that can seamlessly integrate with the rapid evolution of wireless technologies. The system shall be flexible and shall easily accommodate additional wireless services within the system's frequency bands without requiring significant upgrades or system modifications.
2. The system shall include subsystems, equipment, components, transmission media, connection/ termination apparatus, etc., necessary for a complete operating system as required by code.
3. The ERR shall include a head end subsystem. The ERR head end shall provide common interface node to public safety / first responder equipment.
4. The ERR system power supplies shall provide 100% system operation utilizing one of the following criteria:
 - a. A ERR integrator provided storage battery dedicated to the system with at least 12 hours of 100 percent system operation capacity and arranged in accordance with NFPA 72 Section 10.6.10.
 - b. An automatic-starting, engine-driven generator serving the dedicated branch circuit or the system with at least 12 hours of 100 percent system operation capacity and ERR integrator provided storage batteries dedicated to the system with at least 2 hours of 100 percent system operation capacity and arranged in accordance with NFPA 72 Section 10.6.11.3.

H. Design Criteria

1. Frequency Range: The system shall support all code required emergency responder frequencies
2. The system shall distribute RF coverage at levels and in areas as required by code.
3. The system shall be able to simultaneously support the following wireless services, technologies and associated frequencies:
 - a. First Responder / Emergency Responder for the following entities (as required by code and the AHJ):
 1. Local PD
 2. City PD

3. County Sheriff
 4. Fire Department
 4. The system shall have the capability for separate control over each service to allow the ability to adjust and control power levels without disturbing other services/operators.
 5. The system shall support multiple services in a modular architecture so services can be added or removed without requiring new infrastructure, without readjustment of signal power levels, or disturbing existing services.
 6. The system shall enable services to be added without requiring additional cabling or antennas within the frequency range specified.
 7. The system shall not impede any management features or functionality of any attached network and/or device management system. The system shall allow for proactive management and end-to-end alarming of active electronics. The system shall provide fault management information.
 8. The system's antennas shall be mounted above the ceiling grid. RF design, antenna placement and mounting must be coordinated with both the architect and the general contractor/trades.
 9. The system shall interface with the building Fire Alarm System signaling meeting compliance with California Fire Code for monitoring and annunciation.
 10. The System shall distribute public safety channels as defined in the IBC, NFPA 72 and California Fire Code.
 11. The ERR system shall extend the first responder / emergency responder radio services frequencies from the head end system by interfacing to either a passive or active ERR that is deployed in each of the building structures
 12. The system shall be FCC certified with the specific access points that are to be deployed.
 13. The system and the associated wireless devices shall comply with FCC's and Regional regulatory authorities' emission rules for wireless devices.
 - a. Refer to: FCC advisory: "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety Rules, Procedures, and Practical Guidance", FCC's OET Bulletin 65, FCC Rule 47-part 17 and (ANSI/IEEE C95.1-1992) Hazardous Emission document.
- I. Base Bid Work
1. The work of this section includes furnishing materials, installation, and coordination of the system design and installation with the AHJ, owner, architect, general contractor, electrical contractor, fire alarm engineer and other trades for a complete, operational, and balanced system. Furnish necessary materials, accessories, fasteners, etc., and the labor and associated services required to provide the system specified herein.
 2. The work of this section includes the following:
 - a. Project management services
 - b. Detailed system design
 - c. Production of a permit package with a licensed engineer stamp, including permit fees, review and approval process with the AHJ.
 - d. Validate first responder frequencies with appropriate entities such as local fire, police, sheriff

- e. Provide Bidirectional Amplifier (BDA) for each code required emergency responder frequency (including donor antenna and all required cable and components).
 - f. Antenna placement and mounting coordination with architect, owner and contractor.
 - g. Installation and system balancing
 - h. Coordination with the overall construction team and usage of pathways provided by others
 - i. Installation of ancillary pathways not provided by others.
 - j. Manage FCC Licensing
 - k. Manage all FCC registration including Part 90 requirements
 - l. System acceptance testing, documentation and walk through (as required) with emergency responder entities and AHJ
 - m. System turnover and testing to the owner
3. The work of this section requires particular attention to the following:
- a. Ceiling Types: The installer shall fully understand every ceiling type and its interaction with the system. For example, some ceiling types may impede RF signals and, subsequently, system performance.
 - b. Mounting details: the installer shall coordinate mounting of antenna and the RF impact. It may be preferred that antenna be mounted above or below ceiling grid. Coordination with both architect and owner is required.
 - c. Pathways: The work of this section requires the installer fully understand the pathways and to coordinate placement of cables within those pathways.
 - d. Fiber Distribution system: The ERR integrator shall provide separate fiber distribution for the ERR system (as required).
 - e. Roof Antenna Mounting: The ERR integrator shall provide all mounting hardware for roof mounted antennas. Roof mounted systems may require development and submission of seismic anchoring details for review and approval by the AHJ.
 - f. Seismic engineering, permitting, submission, review and approval by the AHJ.
 - g. Maintenance Contract for support services for 12-months from the completion of the project
- J. Work Covered Under Other Sections
- 1. Pathways – backbone conduits and primary pathways
 - 2. Telecommunications Rooms – equipment support (racks), power, cooling, and grounding
- 1.5 SUBMITTALS
- K. Comply with Submittal procedural, quantity, and format requirements of Section 270000.
 - L. Submittal Requirements with the Bid:
 - 1. A FCC-issued general radio operator's license (GROL) for the testing personnel
 - 2. A certificate from the manufacturer of the equipment to be installed stating that the ERR installer is trained and qualified on the equipment.

3. Current calibration and test data on the test equipment to be used in the system commissioning.
 4. Equipment cut sheets on any equipment proposed for substitution
- M. Submittal Requirements Prior To Start Of Construction:
1. Statement of Work (SOW): The contractor shall submit a SOW that has been accepted by the customer or customer's designated representative.
 2. Acceptance Test Plan (ATP): The contractor shall submit an ATP that has been accepted by the customer or customer's designated representative.
 3. Final RF link budgets
 4. Product Data Submittal
 5. Shop Drawings Submittal: Shop drawings shall include the following information:
 - a. System or functional block/line diagrams
 - b. Fiber optic backbone riser diagram
 - c. Plans indicating equipment, antenna and/or component locations, mounting details, cable routes, and other installation information – identify construction elements that would affect the system's performance (such as metallic ceiling materials)
 - d. Coverage plans, showing the design RF coverage (signal strength) for each frequency band required in 1.04 B.3 using IBWave or another industry acceptable RF modeling tool. State the number of channels in each frequency band for the RF coverage plots.
 - e. Equipment and/or wall / rack elevations, showing equipment layout, space requirements and integration with other systems (outside the scope of the ERR)
 - f. Installation details for antenna mounting, specialty cable hangers, and other components unique to the system, and other information that depicts the intended installation
 - g. Seismic Calculations: Include structural calculations for anchorage and seismic restraint of floor-mounted equipment (such as racks, frames, cabinets), wall-mounted equipment (BDA, etc.), and overhead-mounted equipment (such as antenna, overhead cable support, etc.) in conformance with CBC, Section 1601A. Calculations shall be based on fully loaded equipment and support systems. Calculations shall demonstrate that the equipment and support systems will remain attached to the mounting surface during and after experiencing seismic forces in conformance with the CBC. A Structural Engineer registered in the State of California shall prepare Structural Calculations, and shall wet stamp and sign them. Obtain approval from the structural engineer of record for the calculations.
- N. Submittal Requirements Prior to Acceptance Testing:
1. Acceptance Testing Procedures Submittal: describes in detail the procedure for testing the system's performance and balancing the system's signal strength, including a description of the test data (or an example of the test report). The Contractor shall demonstrate the desired services have been successfully deployed and tested. Specifically, the ERR must be deployed with the AHJ and code required criteria and approval.
- O. Submittal Requirements at Close Out:
1. As-Built Drawings including

- a. Donor antenna, grounding and lightning protection details
 - b. Cable routing, splitters, couplers and coverage antenna locations
 - c. Active component locations, layout and configuration
2. Test Reports
 - a. AHJ: Submit accepted ATP reports confirming the requirements have been met.
 - b. Cable Test Reports: Submit cable test results for all cable segments. Testing shall include Return Loss (RL), Distance to Fault (DTF) and Passive Intermodulation (PIM).
 - c. Field Reports: Submit Power Meter and OTDR test results for all fiber runs.
 3. Operations and Maintenance Manual (refer to Section 270000 for contents)
 4. Warranty Documents
 - a. Submit for all manufactured components specified in this section
 - b. Submit Contractor's System Warranty
 - c. Submit Manufacturer's Extended Warranty
 5. Integration of components and pathways into the Building Information Model (BIM)

1.6 QUALITY ASSURANCE

- P. Comply with Quality Assurance requirements of Section 270000.
- Q. Comply with manufacturers specifications.
- R. ERR integrator must be an authorized distributor and installer for product supplied. Installing technicians must have manufacturer's certificate of appropriate training.
- S. ERR integrator must have and provide applicable state licenses including professional engineer license.
- T. ERR integrator personnel shall meet the licensing, qualifications, systems training and other requirements as defined in the applicable code section for the project (e.g. California Fire Code).

1.7 DELIVERY, STORAGE, AND HANDLING

- U. Comply with Delivery, Storage and Handling requirements of Section 270000.

1.8 WARRANTY

- V. Warrant Work and system to perform as described within this Section for a period of five year(s), including components, electronics, etc., and coverage. Correct deficiencies within 24 hours of notification.

PART 2 PRODUCTS

2.1 BI-DIRECTIONAL AMPLIFIER

- A. Axell
- B. Motorola
- C. Or equal

2.2 DISTRIBUTION SYSTEM

- A. Andrews/Commscope
- B. Motorola
- C. MobileAccess
- D. Tyco
- E. Solid
- F. Or equal

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with the Execution requirements of Section 270000.
- B. Comply with manufacturers specifications.

3.2 EXAMINATION AND PREPARATION

Prior to the start of this section's installation Work, examine communications rooms and pathways for completeness, compatibility with the work of this section, and readiness for connections with the work of this section. Confirm network is ready for connection to the system.

3.3 INSTALLATION

- A. Project Management Services: Assign a single-point-of-contact to this project with overall responsibility for communications and ultimate delivery of contracted materials, installation, performance criteria, and services – "PM". This PM shall be responsible for interfacing with the owner, General Contractor, Engineer, and their own subcontractors. The PM shall present the design iterations to the owner, coordinate cable routes with the Engineer, coordinate on-site construction activities with the General Contractor, shall manage the process to coordinate bringing wireless operators into the facility, and shall close out the project with the owner.
- B. Permits: Produce a permit package, licensed engineer stamp, permit fees, review and approval process
- C. Detailed system Design: Use the requirements of this Section to complete the detailed design of the system. Design shall include computer RF modeling and site surveys. The detailed design shall deliver the pre-construction submittals, including iterations for the owner's review and sign-off. The Contractor will show design RF signal levels to sub-room precision for all rooms within the defined coverage areas. The Contractor will obtain compatible drawings from architect. If drawings are within BIM then it is the responsibility of the contractor to modify the BIM model for use in their wireless modeling which includes the creation of 2-D floor plans, RCP plans and elevations.
- D. Installation: Coordinate the installation and schedule with the owner, General Contractor and Electrical contractor (i.e. Electrical Connections) prior to and during the course of installation activities. Installation activities and system acceptance and turnover are critical to the certificate of occupancy for the building/project and must coincide with the project schedule for completion and occupancy.
- E. System Balancing: Balance the system component (e.g., antenna) signal strength to the device signal levels.

- F. System Balancing: Balance the system component (e.g., antenna) signal strength to the device signal levels.
- G. Active Survey: Perform an active wireless survey demonstrating performance according to the design criteria of Part 1 (above). From this survey, produce an active survey report, including floor plans.

3.4 CONNECTIONS TO SYSTEM

- A. Manage connection to system: Represent the owner during negotiations with AHJ to obtain their approval, coordinate site preparation, assist with wireless service providers' installation, and coordinate connection of wireless service providers to the system. Coordinate any RF rebroadcasting agreements with operators. Integration includes providing Bi-Directional Amplifier (BDA), donor antenna, mast, and update of telecommunication drawings.
- B. Manage FCC License: Acting as a representative of the owner, obtain required licenses for operation under FCC Regulations.
- C. Verify that all system connections meet the code and AHJ requirements for the project.

3.5 LABELING

- A. General Requirements
 - 1. Labeling, identifier assignment, and label colors shall conform to the TIA/EIA-606-A Administration Standard and as approved by the owner's representative before installation.
 - 2. Permanently label equipment, components, and cables. Affix label as close as practical to each end of cables.
 - 3. Coordinate labeling and identifier assignment with the Engineer or owner. Submit a labeling plan to the Engineer for approval prior to labeling work.
- B. Label Format
 - 1. Provide permanent labels with machine-generated text; hand written labels will not be accepted.
 - 2. Labels on cables shall fully wrap around cable jackets with a self-laminating feature to provide permanent marking.

3.6 SYSTEM ACCEPTANCE TESTING AND TURN OVER

- A. Complete the acceptance testing as prescribed in the accepted testing procedures submittal. Third Party testing may be required. Verify with AHJ
- B. Complete the acceptance testing as prescribed in the approved Acceptance Test Plan (ATP) submittal. The ERR system shall be tested by a person or persons who are holders of a FCC General Radio Operator's License (GROL) or by the AHJ or his/her designees.
- C. Testing Procedure
 - 1. Test system according to code and AHJ required testing criteria.
 - 2. Equipment Requirements
 - a. Test equipment shall be allowed to stabilize in the test environment prior to calibration for a minimum of thirty minutes. Any change in temperature can void the calibration.

- b. Signal generator must be connected to the Head-end downlink (TX) interface via tested and approved coaxial cabling and connectors.
 - c. Signal generator transmits frequency (MHz) and power (dBm) must be preapproved by the project engineer prior to testing. The control channel from the base station can be used as a signal source as well.
 - d. Verify that all remote units for the area under test are ON.
 - e. Test frequency and power must be recorded corresponding to the date and time of each site walk measurements.
 - f. Spectrum analyzer with unity gain (0dB, frequency specific) dipole receive antenna must be preapproved by the project engineer.
 - g. Site walk screen shots shall be saved with frequency span +/- 20 MHz relative to the center / measured frequency.
3. Documentation
- a. Document test results according to code and AHJ required criteria for the project.
- D. Present the completed system and wireless services to the owner, including functionality, features, ongoing maintenance, and warranty procedures. Demonstrate to owner and Engineer system operation, including signal strength at select locations. Turnover at least one set of both electronic records and printed records, per the owner's request.

3.7 EXTENDED SUPPORT SERVICES

- A. Provide support services for 12 months following the owner's acceptance of the system (for services such as integration of additional wireless operators).
- B. Provide first annual testing and proof of compliance report to AHJ as required by California Fire Code.

3.8 FINAL INSPECTION AND CERTIFICATION

- A. Punch the Work of this Section compliant to the requirements of Section 270000.
- B. Comply with system acceptance and certification requirements of Section 270000.
- C. Provide Certificate of Compliance with manufacturers specifications
- D. Submit code and AHJ required testing to AHJ for review and acceptance of system testing for the project.
- E. Perform walk through with AHJ and Emergency Responder Agencies for system acceptance.
 1. Request system acceptance memo from AHJ and Emergency Responder Agencies for record and submission to owner for TCO.

3.9 TRAINING

- A. Comply with training requirements of Section 270000.
- B. For this system, provide up to 8 hours of training for the owner.

END OF SECTION