SECTION 283133

TWO-WAY RADIO PES COMMUNICATIONS ENHANCEMENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bi-directional amplifiers.
2. In-building service antennas.
3. Outdoor donor antenna.
4. Coaxial cabling.
5. Couplers and splitters.
6. Remote indicator panels.

1.3 DEFINITIONS

A. AHJ – Authority Having Jurisdiction.

B. BDA – Bi-Directional Amplifier.

C. FCC – Federal Communications Commission.

D. PES – Public Emergency Services.

E. RF – Radio frequency.

F. TRCES – Two-Way Radio Communications Enhancement System.

1.4 SUBMITTALS

A. Comply with Division 28 specifications and drawings; state/local regulations, NFPA 72, and NFPA 1221.

B. Submit Action Submittals prior to applying for authority having jurisdiction installation permits (where required) and system installation.

C. Submit Informational Submittals after successful initial system testing and prior to scheduling authority having jurisdiction final approval demonstration testing.

D. Submit Closeout Submittals as part of project closeout procedure.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include approvals and listings, construction details, material descriptions, dimensions, profiles, and finishes.

2. Include rated capacities, operating characteristics, and electrical characteristics.

3. Include statement from TRCES vendor that all equipment and components are compatible and represent a complete TRCES meeting all requirements of the AHJ, FCC, NFPA 72, NFPA 1221, and this Specification.

B. Shop Drawings: For TRCES.

1. Floor Plans. Include floor plans to indicate final equipment, amplifier, power supplies, alarm panels, antennas, and cabling. Show complete point-to-point routing of all cable and pathways; indicate Class and Survivability Level. Show size and type of all conduits, cable, wire, and conductors. Indicate panel circuit designation for each normal power supply branch circuit.

2. Location Map. Include location map showing project site location, RF signal donor site location, and the distance between the two locations.

3. Riser Diagram. Include complete component accurate riser diagram; indicate equipment, amplifiers, power supplies, alarm panels, antennas, and cabling. Show each circuit and pathway; indicate Class and Survivability Level. Show size and type of all conduits, cable, splitters, couplers, wire, and conductors. Indicate panel circuit designation for each normal power supply branch circuit.

4. Equipment Wiring Diagrams. Include wiring diagrams for each system component including amplifiers, power supplies, alarm panels, and antennas.

5. Calculations - Power Supply and Battery Capacity. Include power capacity calculations inclusive of safety/spare capacity factor(s) for each system power supply and connected battery set.

6. Sequence of Operation. Include complete and detailed input/output sequence of operation narrative description.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Designers and Field Technicians.

B. Statement of Completion: Written statement that system has been installed in accordance with approved plans and tested in accordance with the manufacturer’s published instructions and appropriate NFPA 72/1221 requirements.

C. Record of Inspection and Testing. Detailed documentation of completed TRCES acceptance testing. Format shall be approved by the AHJ.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Record Drawings. Provide complete Shop Drawing re-submittal updated to reflect actual final system installation and sequence of operation of all components.

B. Operation and Maintenance Data: For TRCES to include in emergency, operation, and maintenance manuals.

1. Provide manufacturer's Owner's Operation and Maintenance Manuals with required related system warranty requirements.
2. Provide Record of Inspection and Testing.

1.8 QUALITY ASSURANCE

A. Designer and Field Technician Qualifications: Personnel trained and certified by the TRCES manufacturer as an approved technician; and as required by the AHJ, in possession of a professional engineering license, radio licensing authority license, and/or industry certification.

B. Source Limitations for TRCES: Single vendor source to provide TRCES components as a complete code-compliant, tested and functioning TRCES.

C. Electrical Components, Devices, and Accessories: Approved by the AHJ and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. Specific Agency Requirements for All Products: RF emitting devices certified by the Radio Licensing Authority.

1.9 COORDINATION

A. Definition, "Coordinate": Where Sections of the Work interact, the Contractor responsible for this Section of the Work initiates verbal and/ or written communication with one or more different Contractors responsible for other interacting Sections of the Work for the purposes of establishing a coordinated approach of product selections and installation sequencing that satisfies the individual requirements of the interacting Sections of the Work as well as the requirements of the Work as a whole.

B. Coordinate construction operations with those of other Sections of the Work and other entities to ensure efficient and orderly installation of each part of the Work.

C. Coordinate operations and product selections of this Section with operations and product selections included in different Sections that depend on each other for proper installation, connection, and operation.

D. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

E. Coordinate installation of different components with other Sections of the Work to ensure maximum performance and accessibility for required maintenance, service, and repair.

F. Make adequate provisions to accommodate items scheduled for later installation.

G. Coordination Drawings: Contribute to preparation of Coordination Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. FCC certified Two-Way Radio Communications Enhancement System (TRCES) inclusive of Bi-Directional Amplifier(s) (BDA), transmission lines, cables, power supplies, antennas and other ancillary equipment that allows radio signals to pass to and from the interior of a structure for the purpose of facilitating radio communications using public emergency services (PES) and campus facilities radio frequencies.

B. System components, and power supplies inclusive of boards and expansion modules necessary to support the specified system performance criteria, minimum quantity of circuits, and NFPA 72/1221 circuit pathway class designations.

C. System circuiting and component power loading to provide minimum specified spare capacities, safety factors, and redundancies.

D. Component Primary Power: 24-V dc obtained from premises AC power supply.

1. Capacity: Component current draw of components connected to each power-supply module no greater than 80 percent of the power-supply module rating.

E. Component Standby Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Base Capacity: System operation for 24 hours.

2. Spare Capacity: 20 percent.

F. TRCES status signals displayed at a dedicated TRCES Remote Indicator Panel and supervised by the protected premises Fire Alarm System.

2.2 PERFORMANCE REQUIREMENTS

A. Operational Performance: TRCES shall provide no less than minimum downlink and uplink radio signal strength coverage in all critical and general building areas as required by the AHJ. TRCES shall be capable of transmitting all radio frequencies assigned to the jurisdiction as required by the AHJ. TRCES shall be capable of using any modulation technology in current use by the public safety agencies in the jurisdiction as required by the AHJ.

2.3 BI-DIRECTIONAL AMPLIFIERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced RF Technologies, Inc.

2. Bird Technologies

3. Comprod

B. General: RF signal booster suitable for public safety emergency responder communications; field-programmable gain adjustment; microprocessor-based control system for monitoring voltage, current, temperature, and output level control status; with panel-mounted backlit LCD display, controls, and LED indicators for indication of system status.

C. Primary Power Supply: 120-V ac.

D. Secondary Power Supply: 24-V dc supply system including sealed lead acid batteries, automatic float-charge battery charger, and automatic transfer switch.

E. Supervision: Auxiliary contacts for remote status supervision of signal booster failure, antenna malfunction, loss of primary power, low battery voltage, battery charger failure at a minimum; additionally any other system status supervision required by the AHJ.

F. Cabinet Enclosures: For amplifiers, power supplies, and other system components. NEMA 4 steel back-box with top, bottom, and side knockouts metal raceway;; key-lock latching, left or right swing hinged, removable steel front door panel; with trim accessories for flush mount where indicated in Part 3 “Equipment Installation” and Drawings; steel box and door surfaces in factory-finish red enamel.

2.4 IN-BUILDING SERVICE ANTENNAS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Comprod
2. Fractal Antenna Systems, Inc.
3. Laird Technologies, Inc.
4. PCTEL Antenna Products Group, Inc.

B. General: Wideband omnidirectional, multi-band type; low-profile ceiling-mount, white finish.

1. Single band permitted if multi-band is not required within the applicable jurisdiction and approved by the AHJ.

C. Plenum Application Fire Test Listing: UL 2043.

1. Manufacturer’s standard flame retardant/flame resistant product option permitted for non-plenum applications.

2.5 OUTDOOR DONOR ANTENNA

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Comprod
2. Laird Technologies, Inc.
3. PCTEL Antenna Products Group, Inc.

B. General: Factory assembled and tuned directional UHF Yagi antenna; welded or seamless corrosion resistant aluminum construction; DC grounded; with stainless steel mounting hardware.

C. Wind Velocity Withstand Rating: Comply with minimum Building Code wind load requirements for building appurtenances.

2.6 COAXIAL CABLING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CommScope, Inc.

2. Trilogy Communications, Inc.
3. West Penn Wire

B. Riser Coaxial Cable: Nominal 0.5-inch, 50 Ohm coaxial cable, with corrugated copper or aluminum outer conductor and UL 1666 CATVR jacket.

C. Plenum Coaxial Cable: Nominal 0.5-inch, 50 Ohm coaxial cable, with corrugated copper or aluminum outer conductor and UL 910 CATVP jacket.

D. Plenum Radiating Coaxial Cable: Nominal 0.5-inch, 50 Ohm radiating coaxial cable, with corrugated copper or aluminum outer conductor and UL 910 CATVP jacket.

E. Connectors: Nominal 0.5-inch, 50 Ohm N-type coaxial cable connectors.

2.7 COUPLERS AND SPLITTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cobham Wireless
2. CommScope, Inc.
3. Scientific Components Corp as Mini Circuits

B. General: 50 Ohm RF couplers and splitters; bandwidth and dB rating as required by TRCES performance requirements; NEMA 4/IP65 enclosure with nominal 0.5-inch N-type coaxial cable connectors.

2.8 REMOTE INDICATOR PANELS

A. General: Zone indicator panel constructed of 16-gauge steel with factory applied red enamel finish; with LED indicators and corresponding factory-screened labels; includes piezo sounder and switches for lamp test and alarm silence.

B. LED Indicators: Green indicator for primary power in normal state; Red indicators for each individual fault status required to be indicated by the AHJ.

C. Basis-of-Design Product: Subject to compliance with requirements, provide M08 Mini Annunciator, manufactured by Space Age Electronics Inc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare and submit “Pre-Installation Submittals” prior to equipment procurement.

3.2 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed before installation begins.

B. Confirm fire resistance rating of building construction required to perform as TRCES Survivability protection before installation.

C. Examine depth of stud walls to verify clearance for flush-mount equipment before installation.

D. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

E. Examine proposed mounting locations of equipment cabinets with user displays and/or controls with the local fire official to verify satisfactory access and ease of identification before installation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 EQUIPMENT INSTALLATION

A. Comply with the most restrictive requirements of this Section and applicable Division 26 sections for the installation of low voltage electrical systems.

B. Comply with NFPA 72/1221, and requirements of authorities having jurisdiction for installation and testing of TRCES. Install all electrical wiring to comply with requirements in NFPA 70.

C. Arrange equipment cabinets, wire-ways, and conduits with adequate clearances to facilitate access for inspection, maintenance, and component replacement.

D. Install equipment cabinets with top and bottom of cabinets not more than 72 inches above finished floor and not less than 12 inches above finished floor, respectively.

E. Install battery cabinets with top and bottom of cabinets not more than 48 inches above finished floor and not less than 12 inches above finished floor, respectively.

F. Install equipment cabinets with user displays and/or controls including fire alarm control unit nodes and remote annunciators with displays and/or controls at natural user height.

G. Flush-mount equipment cabinets/back-boxes not located in designated equipment rooms.

H. Surface-mount equipment cabinets/back-boxes located in designated equipment rooms.

I. Install outdoor donor antenna with clear view to donor site with a minimum 2-ft vertical clearance above nearby obstacles.

J. Secure outdoor donor antenna to mounting mast in accordance with manufacturer requirements.

K. Install NFPA 780 compliant lightning protection at connection to outdoor donor antenna.

3.4 CABLE AND PATHWAY INSTALLATION

A. Comply with NFPA 70, NFPA 72/1221, and requirements of authorities having jurisdiction.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with Division 26.

B. Comply with AHJ requirements for TRCES component identification.

3.6 GROUNDING

A. Comply with Division 26.

B. Comply with each TRCES component's manufacturer installation guidelines for grounding.

3.7 FIELD QUALITY CONTROL

A. Components installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Components placed in service before all other trades have completed cleanup shall be replaced.

C. Field inspections and testing shall be performed by factory-authorized service technicians.

D. Prepare a typewritten computer-output Test Plan that clearly establishes the scope of TRCES testing. Include at a minimum testing methods, personnel, duration, and required coordination for integrated testing of fire alarm system interfaces.

E. Functional field tests shall be witnessed by the Construction Manager (CM) and their designees; provide notifications a minimum of two (2) weeks in advance.

F. Acceptance field testing shall be witnessed by the CM, their designees, and authorities having jurisdiction (AHJ); provide notifications a minimum of two (2) weeks in advance.

G. Perform visual inspections in accordance with NFPA 72/1221. Correct deficiencies.

H. Document inspections via formal check-list format or AHJ approved format report.

I. Provide written notifications for functional field tests; include Test Plan.

J. Perform functional testing in accordance with NFPA 72/1221 and AHJ requirements for plotted interior building RF signal strength and/or delivered audio quality (DAQ) score. Correct deficiencies.

K. Document 100 percent satisfactory functional tests via AHJ approved report format.

L. Provide written notifications for acceptance field tests; include Test Plan, Inspection Report, and Functional Test Report.

M. Perform acceptance field testing. Demonstrate system operation to the satisfaction of the AHJ. Correct AHJ noted deficiencies.

N. Place system into normal operating service without system faults or outstanding work.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include twelve (12) months' full maintenance by skilled and certified employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform visual inspections at intervals required by NFPA 72/1221 and the AHJ.

2. Perform tests at intervals required by NFPA 72/1221 and the AHJ.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.

END OF SECTION