



The University of Texas at Austin

Design and Construction Standards

Technical Specification

SECTION 27 51 29.17

Emergency Responder Communication Enhancement Systems

All renovation and new construction activities on The University of Texas at Austin campuses are required to meet the UT Austin Design and Construction Standards (DCS) from the planning and design stages through actual construction and facilities maintenance. These standards reflect the planning, design, construction, maintenance, and other facilities asset expertise of University personnel. Any exceptions shall be submitted by the Project Manager as a Standards Exception Request and incorporated after approval is received from the respective Division Champion. The Design and Construction Standards are managed by Campus Operations, and updated with the advice of multiple campus groups at The University of Texas at Austin. This document is the property of UT Austin, and use of this document, in part or in whole, for any purpose other than for a UT Austin project may not be done without written permission of the University.

Technical Specifications are intended to be incorporated and edited where applicable on each project by the Professional Service Provider. When submitting specifications for review, the PSP shall use a “track changes” editing function to indicate where text differs from the existing text. “Strikethrough” shall be used to show deleted content and to indicate where the edits deviate from the DCS specification. Significant deviations from the material specifications shall be submitted as a Standards Exception Request.

For any comments or questions related to UT Austin Design and Construction Standards, please contact Campus Operations at: campus_standards@austin.utexas.edu or by phone at (512) 471-0665.

The issuance and revision history of this Section is tabulated below. Please destroy any previous copy in your possession.

Rev Date	Pages	Remarks	Documents Referenced
7/31/2023	All	New Technical Specification submitted for review by UT Fire Prevention Services.	
9/29/2023	All	New Technical Specification published.	
8/30/2024	5-6, 8, 14-16	Minor Edits – Sections 1.7.B.7-14; 1.12.A.4-5; 4.1.A-G; 4.2.A.2-3; and 5.1.C-D	

SECTION 27 51 29.17 – EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF STANDARD

- A. This Standard is intended provide requirements for the selection, design and installation of Emergency Responder Communication Enhancement Systems (ERCES) in buildings at the University of Texas at Austin.

1.2 SUMMARY

- A. Drawings are necessarily diagrammatic by their nature and are not intended to show every connection in detail or every pipe or conduit in its exact location. Carefully investigate structural and finish conditions and coordinate the separate trades in order to avoid interference between the various phases of Work. Organize and lay out Work so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Install all Work parallel or perpendicular to building lines unless otherwise noted.
- B. The intent of the Drawings is to establish the types of systems and functions; not to set forth each item essential to the functioning of the system. Install the Work complete, including minor details necessary to perform the function indicated. Review pertinent Drawings and adjust the Work to conditions shown. Where discrepancies occur between Drawings, Specifications, and actual field conditions, immediately notify the Owner's Project Manager for Owner's interpretations.
- C. All dimensional information related to new structures shall be taken from the appropriate Drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the Site.

1.3 SCOPE OF WORK

- A. *The PSP shall state the scope of work as applicable to the specific project in this item.*
- B. The latest published edition of a referenced document shall be applicable to this Project unless identified by a specific edition date.
- C. All reference amendments adopted prior to the effective date of this technical specification shall be applicable to this Project.
- D. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the Contract Documents.
- E. Standards of the publications, codes and referenced guidelines as well as those listed in Division 01, may be referenced in the specification. Unless noted otherwise, references are to standards or codes current at the time of bidding.
- F. The work addressed in this section consists of an Emergency Responder Communication Enhancement System, which may include, and at least will be coordinated with all of the following building systems or components:
 - 1. Fire Alarm System.
 - 2. Emergency power systems.

1.4 REFERENCED CODES, STANDARDS AND PUBLICATIONS

- A. Referenced Publications: The documents or portions thereof listed in this section shall be considered part of the requirements of this document. (Utilize latest editions/revisions, except on CIP projects where the NPFA 101 Code specified by the project references another edition/revision.)
1. NFPA 1 – Fire Code
 2. NFPA 3 – Standard for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems Testing
 3. NFPA 70 – National Electrical Code
 4. NFPA 72 – National Fire Alarm and Signaling Code, including all Annex material.
 5. NFPA 101 – Life Safety Code
 6. NFPA 110 – Emergency and Standby Power Systems
 7. NFPA 170 – Standard for Fire Safety and Emergency Symbols
 8. NFPA 1225 – Standard for Emergency Services Communications
 9. NFPA 5000 – Building Construction and Safety Code
 10. IBC – International Building Code
 11. IFC – International Fire Code with City of Austin Amendments as applicable
 12. NECA 1 – Standard Practice for Good Workmanship in Electrical Contracting
 13. NECA 305-2001 – Standard for Fire Alarm System Job Practices
 14. UT Design and Construction Standard – Section 28 46 00 – Fire Alarm and Signaling
 15. UT Design and Construction Standard – Section 28 01 80.71 – Fire Alarm and Signaling – Revisions and Upgrades of Fire Alarm and Detection (Modification of existing FA Systems)
- B. Acronyms / Abbreviations
1. AFD – Austin Fire Department
 2. AHJ – Authority Having Jurisdiction
 - a. The AHJ for all UT Campus Construction projects is Fire Prevention Services (FPS).
 3. ANSI – American National Standards Institute
 4. ASME – American Society of Mechanical Engineers
 5. BDA – Bi-Directional Amplifier
 6. BER – Bit Error Rate
 7. CC – UT Campus Construction
 8. CIP – Capital Improvement Projects

9. CoA – City of Austin
10. DAS – Distributed Antenna System
11. DAQ – Delivered Audio Quality
12. ERCES – Emergency Responder Communication Enhancement Systems
13. FACU – Fire Alarm Control Unit
14. FSSS – Fire Safety Systems Shop
15. FPS – Fire Prevention Services
16. GROL – General Radiotelephone Operator License
17. IBC – International Building Code
18. IBPSC – In-Building Public Safety Communications
19. IEC – International Electromechanical Commission
20. IFC – International Fire Code
21. NECA – National Electrical Contractors Association
22. NEC – National Electrical Code
23. NFPA – National Fire Protection Association
24. NICET – National Association for Certification in Engineering Technologies
25. O&M – Operation and Maintenance
26. PE – Professional Engineer
27. PSDAS – Public Safety Distributed Antenna System
28. PSP – Professional Service Provider
29. SINR – Signal to Interference Plus Noise Ratio
30. UL – Underwriters Laboratories
31. UT – The University of Texas
32. UTPD – University of Texas Police Department
33. WCSD – Wireless Communication Services Division

1.5 OBJECTIVES

- A. This Standard is intended to achieve consistency in the determination of requirements for an ERCES in an existing building or in a newly constructed building. Where it is determined that a system is required, this standard is intended to achieve consistency in the selection, design, and installation of ERCES at the University of Texas at Austin Campus.

1.6 CITY OF AUSTIN CONTACT INFORMATION AND REQUIREMENTS

A. Contractors shall Notify UT FPS in writing of their intent and then contact the City of Austin (CoA) Wireless Communication Service Division to obtain required frequency and tower location information for performing system design and tests.

1. Contact UT FPS at:

fpsengineering@austin.utexas.edu

2. Contact CoA – WCSA at:

wcsdgatearrsignalboosterrequest@austintexas.gov

1.7 DETERMINATION IF AN ERCES IS REQUIRED IN AN EXISTING OR NEWLY CONSTRUCTED BUILDING BY TESTING

A. For existing or newly constructed buildings, determination if an ERCES shall be required can be determined by performing a test to document if radio signals in the building meet applicable code requirements.

B. Upon completion of the test, the contractor shall provide a report documenting the results of the test to UT FPS for review. The report shall include the following:

1. Name of the Building.

2. Address of the Building.

3. Name of the company performing the test.

4. Name of personnel performing the test and their qualifications (copies of Factory Training certificates, NICET certification, etc.).

5. Copy of the General Radiotelephone Operators License.

6. Date of the test.

7. List of equipment utilized to perform the test shall include:

a. Manufacturer and model number of the test equipment used.

b. Software release / revision number.

c. Documentation indicating when the equipment was last calibrated.

d. Test equipment utilized shall be capable of measuring and providing readings for the following:

i. -dBm (power reading)

ii. Signal to Interference Plus Noise Ratio (SINR)

iii. Bit Error Rate (BER)

8. Building plans for each floor with grid lines indicating the test areas and with critical areas identified.

9. Critical areas shall be those indicated in NFPA 1225 and IFC – International Fire Code with City of Austin Amendments as applicable on each floor.

a. In addition to the critical areas indicated in NFPA 1225 and the IFC, emergency generator rooms shall also be included as critical areas as required by the AFD.

10. Readings shall be taken in all grid areas and at all areas identified as critical areas. Readings in critical areas shall be taken with door(s) to the critical area closed (where applicable).
11. Indication if DAQ passed or failed in each general grid area.
12. Indication if DAQ passed or failed in each critical area.
13. A report in tabular form with the following information.
 - a. All test parameter settings for the test equipment.
 - b. Test results for each floor by grid and critical area.
 - c. Readings in each general grid area and critical area shall include:
 - i. -dBm
 - ii. SINR
 - iii. BER
 - d. Each grid area that includes a critical area shall include a description of the critical area in the Comments column of the report (i.e. – floor level with room number or stair name/number, Fire Command Room, Fire Pump Room, etc.)
 - e. DAQ pass/fail in each general area.
 - f. DAQ pass/fail in each critical area.
 - g. Percentage of grid areas per floor that meet the minimum signal strength into the building and minimum signal strength out of the building of -95dBm that are sufficient to provide not less than a DAQ of 3.0.
 - h. Percentage of critical areas that meet the minimum signal strength into the building and minimum signal strength out of the building of -95dBm that are sufficient to provide not less than a DAQ of 3.0.
14. Compliance Acknowledgement Letter indicating if the building meets or does not meet the applicable testing requirements of 95 percent in general areas and 99 percent in critical areas (passes or fails).

1.8 DETERMINATION IF AN ERCES WILL BE REQUIRED IN A BUILDING TO BE CONSTRUCTED BY USE OF A SOFTWARE PROGRAM TO PREDICT RADIO SIGNAL LEVELS

- A. Where a simulation is performed utilizing software to predict radio signal coverage in the building, the contractor performing the simulation shall provide a report documenting the results of the simulation to UT FPS for review. The report shall include the following:
 1. Name of the Building.
 2. Address of the Building.
 3. Drawing version (CD's 50%, CD's 100%, etc. with date) used to perform the simulation.
 4. Name of the company performing the simulation.
 5. Name of personnel performing the simulation and their qualifications. (copies of Factory Training certificates, NICET certification, etc.)
 6. Copy of the General Radiotelephone Operator License.
 7. Date the simulation is performed.

8. Name of software program and version used to perform the simulation.
9. A plan showing predicted signal output/signal strength (propagation) map of the building (wave or heat map type, similar to iBwave or Ranplan), in color, with a matching legend.
10. A letter stating the results of the simulation and if the building is predicted to pass or fail. If the building is predicted to fail, the letter shall list all areas of concern.

NEW SYSTEMS

1.9 CONCEPTS

- A. Where a system is required, it shall be compliant with the following:
 1. Applicable paragraphs of NFPA 101, Life Safety Code.
 2. Applicable paragraphs of NFPA 72, National Fire Alarm and Signaling Code.
 3. Requirements of NFPA 1225, Standard for Emergency Services Communications.
 4. Requirements of the International Fire Code with City of Austin Amendments.

1.10 SYSTEM FEATURES

- A. All system product lines shall be comprised of components capable of providing the following features when appropriate and specified by the project documents or the University:
 1. Firefighter's two-way radio communications compatible with CoA/Travis County System.
 2. Class A or Class B, BDA's
 3. Interface with the FACP for monitoring.

1.11 SUBMITTALS AND SHOP DRAWINGS APPROVAL AND ACCEPTANCE

- A. Prior to system installation the contractor shall prepare documentation (submittal) and forward it to UT FPS, the AHJ, for review and comment.
- B. Neither approval nor acceptance by the AHJ shall relieve the designer(s) or installer(s) from providing a system that is compliant with all governing laws, codes, and standards.
- C. Deviations from requirements of governing laws, codes or standards, shall be clearly identified and documented as such. Documentation of equivalencies shall be provided in accordance with NFPA 1225 requirements.

1.12 QUALITY ASSURANCE

- A. Emergency Responder Communication Enhancement System Contractor Qualifications:
 1. The Contractor shall be an authorized and designated representative of the manufacturer to sell, install and service the proposed manufacturer's equipment. The contractor shall have a minimum of two (2) factory trained and certified technicians on staff in a local office for the system proposed.
 2. The Contractor shall have been actively engaged in the business of selling, installing, and servicing Public Safety DAS for at least five (5) years with a minimum of ten (10) such installations comparable in size and scope to the system proposed, completed and operating properly.

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3. The Contractor shall provide documentation verifying factory training of technicians that will be involved in the design, programming, installation and commissioning of the system for the proposed equipment to be installed.
 4. The Contractor shall provide documentation verifying NICET DESIGN LEVEL certification in In-Building Public Safety Communications (IBPSC) of technicians that will perform the design of the system.
 - a. Note – as the NICET IBPSC certification is new as of 2023, the NICET certification requirement in IBPSC shall become effective January 1, 2025.
 5. The Contractor shall provide documentation verifying NICET certification (Level II minimum) in In-Building Public Safety Communications (IBPSC) of technicians that will be involved in the installation, programming and commissioning of the system.
 - a. Note – as the NICET IBPSC certification is new as of 2023, the NICET certification requirements in IBPSC shall become effective January 1, 2025.
 6. The Contractor shall provide documentation verifying possession of a General Radiotelephone Operators License (GROL).
 7. Equipment furnished shall be of current manufacture.
- B. ERCES Shop Drawing Designer and System Programmer Qualifications:
1. Personnel shall be factory trained and certified for ERCES design and programming of the specific type and brand of system proposed and who are acceptable to the University of Texas Fire Marshal's Office.
 2. The design of the ERCES shall be performed by personnel who have NICET Design Technician certification in IBPSC.
 3. Programming of the ERCES shall be performed by personnel who have NICET LEVEL III certification in IBPSC.
 4. Programming of the fire alarm control panel shall be performed by individuals complying with the following qualifications:
 - a. NICET Level II (minimum) in Fire Protection Engineering Technology, Fire Alarm Systems.
 - b. Personnel who are factory trained and certified for programming with a minimum of three (3) years of experience for the specific type and brand of system to be provided and who are acceptable to the University of Texas Fire Marshal's Office and the Fire Safety Systems Shop.
 5. The system designer and programmer shall provide evidence of their qualifications and/or certifications to the University of Texas Fire Marshal's Office.
 6. Upon completion of installation and final testing, the installation shop drawings shall be revised to reflect as-built conditions and submitted as Record Documents. Record Documents shall include revised floor plans, riser drawings, equipment list, manufacturer's product data, program changes and calculations.
- C. System Installer:
1. Fire alarm systems and emergency communications systems installation personnel shall be qualified, or shall be supervised by persons who are qualified, in the installation, inspection and testing of the applicable systems.

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2. The installation of all ERCES shall be performed by or under the direct supervision of personnel with the required factory training and NICET certification in IBPSC (Level II minimum).
 - a. Contractors that utilize electricians or other labor forces to install wiring and system components shall provide a company employee that has the required factory training and NICET certification on site to supervise other installation personnel at all times.
 3. The installation of all fire alarm devices, signaling devices or systems, including monitoring equipment shall be performed by or under the direct supervision of a licensed fire alarm technician, minimum NICET Level II in Fire Protection Engineering Technology, Fire Alarm Systems or a fire alarm planning superintendent. The certifying licensee shall be licensed under the ACR number of the primary registered firm and shall be present for the final acceptance test prior to certification.
 4. The system installer(s) shall provide evidence of their qualifications and/or certifications to the University of Texas Fire Marshal's Office.
- D. The equipment furnished shall be listed and approved by a testing laboratory that has been approved by the State of Texas Commission on Fire Protection. This listing shall be for all functions required by this specification.
- E. Provide staff installation superintendents for the ERCES that have the required factory training and that are NICET certified in IBPSC Level II minimum.
- F. Provide staff installation superintendents for modification of the fire alarm system that are licensed by the State of Texas Fire Marshal's Office for such purpose and under whose supervision installation, final connections and testing will be performed.
- G. All system installations shall comply with the requirements of the applicable paragraphs of the National Electric Code.

1.13 CONSTRUCTION SUBMITTALS

- A. Prior to installation of a new ERCES, the following documents shall be provided by the Contractor to the University of Texas at Austin for review and comment:
1. Shop Drawings: Drawings shall be 1/8" = 1' minimum scale and shall include manufacturer's name, model numbers, ratings, power requirements, equipment layout, conduit, device arrangement, and complete point to point wiring diagrams along with other required information including but not limited to:
 - a. Cover sheet stating the building name and address, building type/use, applicable codes (with edition) used for the system design.
 - b. General Drawing Notes
 - c. Frequencies required by the City of Austin for Public Safety radio coverage and tower locations shall be obtained from the CoA - WCSD. The Contractor shall provide written notification to UT FPS indicating their intent to contact the CoA.
 - 1) Contact UT FPS at:
fpsengineering@austin.utexas.edu
 - 2) Contact the CoA – WCSD at:
wcsdgatewaysignalboosterrequest@austintexas.gov
 - d. Retransmission Authorization Approval letter from the CoA - WCSD.

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- e. Floor plans shall clearly indicate room names/description of all rooms and locations of all ERCES equipment and cabling. Include all required rated pathways (and type, hour rating) and where electrical conduit raceways are used for ERCES cabling.
- f. Floor plans shall indicate all areas determined to be critical areas as indicated in NFPA 1225 and the IFC – International Fire Code with City of Austin Amendments as applicable on each floor including but not limited to:
 - 1) Fire Command Centers or Fire Alarm Panel locations
 - 2) Fire Pump Rooms
 - 3) Exit stairs
 - 4) Exit Passageways
 - 5) Elevators
 - 6) Elevator lobbies
 - 7) Standpipe cabinets
 - 8) Sprinkler sectional valve locations
 - 9) Emergency generator rooms as required by AFD
- g. Floor plans shall indicate the location of the coder required ERCES remote annunciator.
- h. Electrical back-box requirements.
- i. Control Equipment Schedules.
- j. Panel Schematics identifying all cards with addresses and indicating all internal panel wiring, wiring between panels and field wiring termination points with circuits labeled/identified.
- k. Riser Diagrams indicating circuits, type of devices, number of devices, number of conductors, conduit size, junction boxes, terminal cans and etc. Riser diagrams shall also indicate all panels, including but not limited to, the BDA, power supply(s), remote annunciator, FACU, etc.
- l. Scaled floor plans shall indicate the layout of all devices with wiring connections, zoning, wire gauges and routing indicated.
- m. Donor antenna mounting sled or wall mount detail with required grounding cable and protection of coaxial cable to a height of seven (7) feet above finished floor (AFF). Detail shall indicate how the requirements will be met. (Note – Antenna shall not be moved or repositioned without written approval from the AHJ.)
- n. A plan showing predicted signal output/signal strength (propagation) map of the building (wave or heat map type, similar to iBwave or Ranplan), in color with a matching legend.
- o. Typical room elevations showing how equipment and cables are to be mounted, including height and junction boxes, dedicated power junctions, surge protection, and battery backup. Call out NEMA 4, 4X and 3R enclosures. TR (telecommunication room) mounting backboards shall be indicated as fire-retardant or fire rated. Where there are typical rooms where no electronic equipment is required, only riser and junctions, show on a separate elevation detail.
- p. Battery backup system – Show on plans how all ERCES equipment will meet the stand-by power requirements of not less than 12 hours (IFC 510.4.2.3). Two-hour standby batteries and connected to the facility generator power system that can support the complete system load for 12 hours can be utilized.
- q. Indicate on the plans where the fire alarm system will interface with the ERCES for the required supervisory points list indicated in NFPA 1225.
- r. Indicate on the plans where the dedicated ERCES monitoring (annunciator) panel will be located. For high-rise buildings, this will be in the fire command room.
- s. Indicate on the plans where all lightning protection and 120VAC Surge Protection Devices will be installed.
- t. Indicate on the plans grounding bus bar and grounding points for all equipment.

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2. A detailed Symbol Legend shall be provided that indicates all symbols that are utilized on the floor plans or riser drawings. A description shall be included for each symbol. Symbols that are not utilized **SHALL NOT** be included on the symbol legend.
3. A cable legend indicating the following:
 - a. Wire gauge
 - b. Wire type (solid or stranded)
 - c. Wire rating
 - d. Fiber cable and connector types
 - e. Line type or letter designation (or both, if required) that differentiates it from other wire/circuits shown on the plans
- B. Product Data: Provide electrical and RF characteristics, connection requirements and compatibility listings indicating that components are compatible with each other including but not limited to:
 1. A complete equipment list including model and/or part numbers, part name/description and quantities for all equipment and wire, etc. to be used on the project. All DAS/BDA equipment shall have FCC certification prior to installation.
 2. A complete system operation narrative.
 3. Manufacturer's Product Data Sheets for all Devices and Products (with applicable part numbers identified by highlight, arrow, circled, etc.) including but not limited to:
 - a. BDA's shall be either of the following:
 - 1) Class A
 - 2) Class B
 - b. Battery Cabinet and Batteries
 - c. Antennas
 - d. Antenna mounts
 - e. Annunciator
 - f. Lightning Protection
 - g. Power supply(s)
 - h. Splitters
 - i. Couplers
 - j. Wire – Feeder and riser cables shall be rated as plenum cables. Riser (backbone) cables shall have a fire-resistance rating that meets the requirements of NFPA 1225.
 - k. Applicable fire alarm devices.
 4. Wiring diagrams for all equipment
 5. Installation instructions for all equipment
 6. Proposed equipment testing procedures. Include a manufacturers' product data sheet for the calibrated equipment that will be used for the test.
 7. Equipment maintenance manuals
- C. System Calculations substantiating that the batteries to be provided meet the power requirements of the system.
- D. Link Budget Document.
- E. Copies of valid FCC General Radio Operator's License for applicable employees.

- F. Copies of NICET Certification for system Designer and Installation personnel.
- G. The submittal package shall be signed and dated by the person that prepared the submittal.
 - 1. All code deficiencies and/or variances shall be noted on the submittals and/or drawings.
 - 2. Submittals shall be complete and include all required information. Partial submittals will be returned NOT REVIEWED and marked REVISE AND RESUBMIT.

1.1 TECHNICAL ASSISTANCE

- A. The authority having jurisdiction shall be permitted to require a review by an approved independent third party with expertise in the matter to be reviewed at the submitter's expense.
- B. The independent reviewer shall provide an evaluation and recommend necessary changes to the proposed design, operation, process, or new technology to the authority having jurisdiction.

1.2 UNIT PRICES

- A. The Contractor shall include as part of the submittal the unit prices that are required to be provided with the bid.
- B. The unit prices for the devices shall include the device, installation, thirty (30) feet of conduit, wire, programming, profit, supervision, and any other required work (the unit price shall be all inclusive). The unit prices shall be used for device additions and device deducts.
 - 1. Antennas with splitters/couplers.
 - 2. Thirty feet (30') of ¾" EMT conduit.

PART 2 - PRODUCTS

2.1 EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEMS (ERCES)

- A. Acceptable Manufacturer's models for new system installations include (or equal):
 - 1. Advanced RF Technologies (ADRF)
 - 2. Comba Telecom
 - 3. Westell Technologies
- B. At each installed field device (antenna, splitter, coupler, etc.) affix a label that corresponds to the device number on the design documentation.
- C. Identify each cable or wire at its' designated terminal with a permanent label.
- D. All BDA's shall provide expansion capability to accommodate any future requirements for additions to/expansion of the system.
- E. All BDA's shall be connected to a Primary and Secondary Power source. The primary power source shall be a one hundred twenty-volt AC (120VAC) power circuit (emergency circuit where available). The circuit shall be a dedicated circuit meeting the requirements of NFPA 72. The secondary power supply shall be capable of operating the in-building two-way ERCES at 100-percent system capacity for a duration of not less than 12 hours.
 - 1. Primary Power source circuit breakers shall be provided with a Space Age Breaker Lock, Model #ELOCK-FA (or equal).

- 2. Primary Power circuits shall be protected by Surge Protection Devices, Space Age model E120V-GT (or equal).
- F. All programming shall be permanent and non-volatile to reduce outage time due to failure.
- G. All ERCES cabling shall be installed in accordance with the requirements of NFPA 70. Fire alarm and ERCES cabling shall not be supported by hangers utilized to support other material or ceiling grid support wires.

2.2 SYSTEM MONITORING

- A. The system shall include automatic supervisory signals for malfunction of the ERCES that are annunciated by the fire alarm system. System supervisory signals shall include the following:
 - 1. Signal source malfunction
 - 2. Active RF-emitting device failure
 - 3. Low battery capacity indication
 - 4. Active system component failure
- B. Power supply supervisory signals shall include the following for each RF-emitting device and active system component:
 - 1. Loss of normal AC power
 - 2. Failure of battery charger
- C. The communications link between the fire alarm system and the ERCES shall be monitored for integrity.

2.3 DEDICATED ANNUNCIATION

- A. A dedicated ERCES annunciator shall be provided in the Fire Command Center near the FACU or, when there is not a Fire Command Center, near the FACU as applicable to annunciate the status of all RF-emitting devices and active system components.
- B. The annunciator shall provide visual and labeled indications for each system component and RF-emitting device including:
 - 1. Normal AC power
 - 2. Loss of normal AC power
 - 3. Battery charger failure
 - 4. Low-battery capacity
 - 5. Signal source malfunction
 - 6. Active RF-emitting device malfunction
 - 7. Active system component malfunction
- C. The communications link between the annunciator and the ERCES shall be monitored for integrity.

2.4 WIRING

- A. Basic wiring material and installation shall comply with the requirements of NFPA 70.
- B. Conductors shall be sized in accordance with the requirements of the system manufacturer to provide the minimum required voltage drop.
- C. All wiring shall be installed in accordance with the requirements of NFPA 70 (Chapters 7 and 8) and NFPA 1225.
- D. Install wiring in conduit or raceway in compliance with the requirements NFPA 70, Article 820.
- E. Junction boxes containing ERCES wiring shall be provided with red covers labeled with "ERCES".
 - 1. ERCES junction boxes size and construction shall be as determined by the installing contractor.
- F. All ERCES cabling shall be independently supported by the building structure. ERCES cabling shall not be attached to supports for other systems such as ceiling grid, sprinkler piping, conduit, etc.

PART 3 - SPECIAL CONDITIONS

3.1 GENERAL

- A. It shall be the responsibility of the Contractor to assure that there is no disruption of the University's normal day-to-day operations such as studying, testing, class, research, or administration during construction.

3.2 CONNECTION TO OR MODIFICATION OF EXISTING SYSTEMS

- A. Operating, reprogramming, modifying and/or connecting to existing fire alarm systems shall be supervised and/or coordinated with the University of Texas at Austin's Fire Safety Systems Shop (FSSS) staff. Documentation indicating all changes shall be provided at the FACU at the time any changes are made to the systems.
- B. Existing systems shall remain operational during modifications or additions to the systems throughout the duration of the project.

PART 4 - TESTING

4.1 GENERAL

- A. Upon completion of the system installation, the ERCES Contractor shall perform a complete and comprehensive pre-test of the entire system in accordance with the requirements of NFPA 72, NFPA 1225, IFC and the contract documents.
- B. Downlink Test – Test equipment shall provide values based on -dB power, Signal to Interference Plus Noise Ratio (SINR) and Bit Error Rate (BER) readings to verify downlink meets the requirements of NPFA 1225. All deficiencies shall be documented, corrected and re-tested.
 - 1. Test equipment shall have been calibrated annually. The Contractor shall provide documentation to substantiate the test equipment used for testing meets the calibration requirements.

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2. Test results / readings shall be provided in tabular form and shall also be documented on floor plans with “grid” overlay and shall identify all critical areas. Test results shall include the following.
 - a. -dBm, SINR and BER value in each “grid”.
 - b. -dBm, SINR and BER value at each critical area within a “grid”. Recordings at critical areas shall be made with the door to the critical area closed (where applicable). Test report shall include a description of each critical area measured (i.e. room number, stair number, FACP location, etc.).
 - c. dBm readings shall be -95 dBm minimum.
 - d. SINR readings shall be 18dB minimum to meet DAQ 3.0 for P25 Phase 1.
 - e. BER readings shall be 2.0% maximum to meet DAQ 3.0 for P25 Phase 1.
- C. Uplink Test – Uplink shall be verified utilizing radios. Standard Harvard sentences, or similar, shall be utilized to verify voice transmission meets DAQ 3.0.
 1. Radios are available from the University of Texas Department of Emergency Management. The rental rate is \$25.00/day per radio.
 2. The uplink test shall be witnessed by a third party.
- D. Prior to commencement of the pre-test, the Contractor shall notify the CoA-WCSD that they will be conducting a pre-test. The notification shall include the date, time, and location where the pre-test will be conducted.
 1. Contact CoA at wcsdgatrressignalboosterrequest@austintexas.gov
- E. The Contractor shall notify UT FPS of the date, time and location of the pre-test.
 1. Contact UT FPS at fpsengineering@austin.utexas.edu
- F. The Contractor shall have the Fire Alarm Contractor available to verify required monitoring by the Fire Alarm System.
- G. The Contractor shall document and correct all deficiencies identified during the pre-test.
- H. Upon completion of the pre-test, the system shall be turned off. The system shall not be left in service until testing by the CoA – WCSD has been completed.

4.2 SPECIFIC TESTS

- A. City of Austin Test and Acceptance
 1. Upon completion of successful pre-testing, the Contractor shall contact the CoA – WCSD to request a system test. The CoA – WCSD will provide a form to the Contractor to complete prior to scheduling a system test (near-far and other tests as applicable).
 - a. Contact CoA at wcsdgatrressignalboosterrequest@austintexas.gov
 2. The Contractor shall notify UT FPS of the date and time the CoA test will be performed. UT personnel shall witness the CoA test.
 - a. Contact UT FPS at fpsengineering@austin.utexas.edu
 3. Floor plans with documented results from the pre-test shall be provided at the test with the CoA.

4. Upon successful completion of testing with the CoA – WCSD, the system shall be placed in service.
5. The Contractor shall provide UT FPS a copy of the CoA – WCSD “Acceptance Document”. This document shall also be included in the project record documentation.

4.3 BDA REGISTRATION

- A. Upon completion of system installation and testing, the following information shall be provided such that the BDA can be registered with the Federal Communications Commission as required by Part 90 Private Land Mobile Radio Signal Boosters as applicable for Class B boosters.
 1. The call sign and frequency(s) of the station to be re-transmitted.
 2. The operating range of the Class B signal booster.
 3. The physical location of the booster including:
 - a. Address (including city, state)
 - b. Location of equipment in the building (floor and room number)
- B. The above information shall be provided to the University of Texas at Austin via the following links:
 1. rf-registration@austin.utexas.edu
 2. fpsengineering@austin.utexas.edu

PART 5 - DOCUMENTATION

5.1 WARRANTY AND MAINTENANCE

- A. The contractor shall warranty all materials, installation and workmanship for a period of one (1) year from the date of acceptance by the University of Texas unless otherwise specified. A copy of the manufacturer’s warranty shall be provided with the closeout documentation and included with the operation and maintenance manuals (O&M’s).
- B. Materials, installation or workmanship found to be defective during the warranty period shall be corrected/replaced without cost to the University of Texas. The Contractor shall initiate repair of any warranty defects within eight (8) hours of notification of such defects and shall be repaired within twenty-four (24) hours.
- C. The warranty or any part of the warranty shall not be made void by any required operation or inspection of the system after acceptance during the warranty period. Modifications to any part of the system shall not void the warranty as related to the overall system, only the portion of the system that is modified.
- D. The ERCES contractor shall maintain a service organization with adequate spare parts stock and service technicians trained in service of the type systems installed within seventy-five (75) miles of the installation location.

5.2 QUANTITY OF DEVICES

- A. Keys – A minimum of three (3) sets of keys shall be provided. Keys shall be labeled appropriately, identifying the equipment/locks they pertain to.

5.3 TRAINING

- A. The certifying ERCES technician shall instruct the Owner's personnel in the operation and maintenance of the system installed for a minimum of two (2), four (4) hour sessions.
- B. One (1) hard copy of the operation and maintenance manuals (O&M's) and one (1) hard copy of the Record Drawings (As-Built Drawing) shall be provided on site at the time of the training. In addition to the copies provided for the site, one (1) additional hard copy of each document shall be provided for the Fire Safety Systems Shop.

5.4 FINAL CLOSEOUT DOCUMENTATION

- A. Provide a copy of all final closeout documentation on a flash drive. Drawings shall be in CAD and PDF format. All other documents shall be in PDF format.
- B. Record documents shall include all information provided in the original submittal that has been modified to reflect as-built conditions.

END OF SECTION 27 51 29.17