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| **Revision History** | |
| **Revision Date** | **Section/Nature of Revision** |
| **9/18/24** | Document Issued |

**PART 1 GENERAL**

* 1. GENERAL

1. Provide an In-building Two-way Emergency Responder Communication Enhancement System (ERCES) with signal amplification system to provide complete coverage in the building for the public safety agencies as required by the local Authority Having Jurisdiction (AHJ). System users shall receive and transmit radio signals from their portable radio units within the building. This shall be accomplished utilizing the following components:
2. Bi-directional amplifiers (signal boosters)/fiber DAS master/remote.
3. Coaxial cable/fiber cable.
4. Antennas.
5. Couplers.
6. Connectors.
7. Power splitters.
8. Other components and interconnecting circuitry as required.
9. The system shall comply with the requirements of UL2524 2nd edition Standard for In-building Two-way Emergency Radio Communication Enhancement Systems, NFPA 72 2013 edition, NFPA 1225 2022 edition and Florida Fire Prevention Code 8th edition (FFPC) or later, as referenced.
10. The entire system shall meet all the requirements of the Pinellas County Schools Fire Marshal, the Pinellas County Schools Building Department and all other agencies and AHJ.
11. The work in this section shall include the responsibility for all permit requirements with the AHJ. Where filings require the Engineer’s signature, documents shall be submitted for their review and signature. This responsibility shall include furnishing of required quantities of floor plans, descriptive notes and/or specifications, wiring diagrams, shop drawings and amendment forms.
12. Early completion of the In-building Two-way Emergency Responder Communication Enhancement System will be required as to permit a Certificate of Occupancy to be obtained in a timely manner.
13. Any permits necessary for the installation of the work shall be obtained prior to the commencement of the work. All permit costs and inspection fees shall be included.
14. The In-building Two-way Emergency Responder Communication System shall use a signal booster with UL2524 2nd edition listing from an Occupational Safety and Health Administration (OSHA) approved Nationally Recognized Testing Laboratory (NRTL), NFPA 72, NFPA 1225 and or later FFPC.

**PART 2 PRODUCTS**

2.1 DISTRIBUTED ANTENNA SYSTEM

1. The system specified shall be based upon Advanced RF Technologies (ADRF) or Comba Telecom line of Public Safety UL2524 2nd edition, NFPA 72, NFPA 1225, FFPC compliant signal boosters/fiber DAS master/remote.
2. The system shall be Public Safety type with Class A or Class B signal booster or fiber DAS master/remote, as designated by the FCC or as required by the AHJ.
3. The secondary power supplies, battery chargers and system monitoring shall be fully compliant with UL2524 2nd edition, NFPA 72, NFPA 1225 and FFPC. The signal booster shall have both the primary and the secondary power supplies within a waterproof, Type-4 approved enclosure.
4. All signal boosters and other active system components must have FCC certification prior to installation. The equipment FCC ID must be displayed on the product as required by the FCC.
5. The digital signal booster shall be capable of field configuration via programmable software for the frequency channels with adjustable bandwidths as specified by the AHJ.
6. 700MHz and 800MHz plus FirstNet Band 14, VHF, UHF signal boosters shall support both Class A and Class B operation. Signal boosters shall be channeling selective type with 150KHz, 100KHz, 75KHz, 50KHz, 37.5KHz, 25KHz and 12.5KHz channel bandwidth options. Nonselective wide band signal boosters shall not be accepted, unless required to cover multiple channels within the same band.
7. Signal boosters shall have oscillation suppression circuitry to protect the public safety radio system in case of system malfunction or other causes. This signal booster circuitry shall allow real time automated oscillation correction and immediate detection capable of generating an oscillation alarm, combined with programmable limited operation or auto-shutdown if performance migration fails.
8. Signal boosters must have an uplink noise suppression function to eliminate uplink noise while in standby (i.e. no radio transmission from within a building). Systems that produce any measurable level of uplink noise while in standby shall not be acceptable.
9. Signal booster must have an uplink and downlink squelch per channel per timeslot.
10. The signal booster gain shall be rated at a minimum of 85dB +/- 2.0dB and the gain shall be adjustable in a minimum of 28dB range. System gain shall be set and documented at the time of the final system test.
11. Maximum propagation delay of the signal booster system shall be adjustable in the signal booster to comply with system requirement or as specified by the AHJ. The signal booster shall offer filter delay operations. Maximum propagation delay shall be within the minimum range of 3.5μS (microseconds) to a maximum of 61.5μS (microseconds).
12. Signal booster shall produce no more than a maximum of 9dB noise throughout its published operable uplink gain range.
13. The signal booster system shall include built-in automatic supervision of malfunctions of the signal booster and battery systems as per NFPA 1221, NFPA 72 and the FFPC. Non-OEM equipment add-ons and modifications to comply with this specification shall not be acceptable.
14. A dedicated supervised monitoring/annunciator panel shall be provided within the emergency command center next to the fire alarm panel/annunciator or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:
15. Normal AC power.
16. Signal booster trouble.
17. Antenna failure.
18. Loss of normal AC power.
19. Failure of battery charger.
20. Low battery capacity.
21. Active system component failure.
22. The signal booster is to be supervised by the local FACP and shall include universal normally open relays for connections to external monitoring modules.
23. External filters, duplexers, power supplies or other non-OEM additions or modifications of the original equipment shall not be acceptable with the exception where technically required so long as it does not violate the UL2524 2nd edition certification. If required, the external filters should be manufactured or certified by the manufacturer.
24. All signal booster components shall be contained in a Type-4 approved waterproof enclosure. All enclosures shall be painted red with external labeling as required by the AHJ.
25. All coaxial RF surge suppressors shall meet or exceed all requirements of UL 497C and shall be listed.

**PART 3 EXECUTION**

3.1 DESIGN REQUIREMENTS

1. In-building Two-way Emergency Responder Communication Enhancement Systems for emergency responders are an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable emergency responder communications at the required signal strength within the specified areas.
2. Critical areas such as emergency command center, fire pump room, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations and similar critical areas as specified by AHJ shall be provided with 99% floor area radio coverage.
3. General building areas shall be provided with 95% radio coverage, or as specified by the AHJ.
4. The In-building Two-way Emergency Responder Communication Enhancement System must provide the following signal strengths:
5. A minimum DAQ of 3.0 or better and equivalent signal to interference noise ratio (SINR) applicable to the technology for either analog or digital.
6. Downlink: minimum signal strength of -102 DBm throughout the coverage area.
7. Uplink: minimum signal strength of -102 dBm received at the AHJ radio system.
8. As otherwise required by the AHJ.
9. The system shall be complete with all components and wiring required for compliance with all applicable codes and regulations and for its operations described hereinafter.
10. An approved manufacturer or a qualified and approved vendor shall supply, test and determine locations of components which are required for proper operation as well as to supply, install, test and certify the performance of the complete system. Vendor qualifications must be acceptable to the AHJ.
11. Design shall include iBwave software simulated radio propagation modeling with heat maps showing predicted signal coverage levels within the building. iBwave level 2 or higher certified personnel shall do the iBwave design.
12. All tests shall be conducted, documented and signed by a person in possession of an FCC General Radio Telephone Operators License. All testing personnel shall be certified and authorized by the signal booster manufacturer in the installation and operation of their equipment. Personnel qualifications must be acceptable to the AHJ.
13. The system design shall be based on the ADRF line of Public Safety signal boosters/fiber DAS or equivalent UL2524 2nd edition, NFPA 72, NFPA 1225, FFPC and FCC certified to establish standards of quality for materials and performance. The naming of a specific manufacturer or a catalog number does not waiver any requirement or performance of individual components described in the specification.
14. Assembly and installation of all components of the In-building Two-way Emergency Responder Communication Enhancement System shall comply with all applicable sections of the National Electrical Code (NEC).
15. Survivability from attack by fire shall meet requirements of NFPA 72, NFPA 1225, FFPC or as required by the local jurisdiction.
16. The system must comply with all applicable sections of the FCC rules. Signal booster/fiber DAS master/remote shall have FCC certification prior to installation.
17. Antenna isolation shall be maintained between the donor antenna and all inside antennas (DAS) to a minimum of 20dB under all operating conditions.
18. Donor antenna mast installation shall be designed by a professional Structural Engineer licensed in the State of Florida and shall meet a minimum of 160 m.p.h. wind load. The design shall be signed and sealed.
19. All designs shall be submitted to the Pinellas County Schools Fire Marshal for review and approval. All designs shall include all information required on the Pinellas County School Board Emergency Responder Communications Enhancement System (ERCES) plan review checklist sheet (Appendix A).

3.2 INSTALLATION REQUIREMENTS

1. Installation of all components of the In-building Two-way Emergency responder Communication Enhancement System shall comply with all applicable sections of the NEC, NFPA 70 NFPA 72, NFPA 1225, FFPC or as required by the local AHJ.
2. At least two (2) independent and reliable power supplies shall be provided as specified in NFPA 72, NFPA 1225 and FFPC.
3. The primary power source shall be supplied from a dedicated twenty ampere branch circuit and comply with NFPA 70, NEC, NFPA 72 and NFPA 1225 (2022 edition). Power source shall be hardwired to the unit.
4. The signal booster shall be equipped with a secondary source of power. The secondary source of power shall be a battery system with a dedicated battery charger. The secondary power supply shall power on automatically when the primary power source is lost. The secondary source of power shall be capable of operating the In-building Two-way Emergency Responder Communication Enhancement System for a period of at least 24 hours. The battery system shall automatically charge in the presence of external power input. Battery charger and all other electronic components must be fully enclosed in a waterproof Type-4 approved enclosure. Batteries shall be enclosed in a NEMA-4 rated enclosure. External Uninterruptable Power Supplies (UPS) are not acceptable.
5. RF coaxial cable shall be listed, CMP plenum or armored plenum coaxial cable or two-hour fire rated plenum coaxial cable. Non-plenum cable can be used when installed in a metallic raceway. The cable classification shall be clearly marked on the outer surface of the cable regular intervals.
6. All installed systems will need prior written approval from the FCC license holder of the systems be reamplified and must meet their established criteria for installation prior to the system installation.
7. Installed systems shall be registered with the FCC signal booster registry where required.

3.3 ACCEPTANCE AND TEST PROCEDURES

1. Acceptance testing for an In-building Two-way Emergency Responder Communication Enhancement System is required upon completion of installation.
2. The coverage testing shall be done in accordance with NFPA 72, NFPA 1225, FFPC and as required by the local AHJ.
3. All tests shall be conducted, documented and signed by a person in possession of a current FCC General Radio Operator License.
4. All test records along with system diagrams, iBwave design, equipment specifications, user manuals, RF link budget calculations, battery backup calculation and other design data shall be submitted upon completion of the project and as required by the AHJ.

**\*\*\*End of Section\*\*\***