



LEE COUNTY FIRE MARSHALS ASSOCIATION RECOMENDED PROCESS DOCUMENTS FOR ERCES

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General Requirements

1. Acceptance and approval of an ERCES for commercial service is at the sole discretion of the AHJ and the FCC Licensee.
2. Emergency Responder Communications Enhancement Systems (ERCES) are only to be deployed if coverage testing shows that buildings do not meet radio coverage standard, based on the thresholds specified in this document and a validation of that record by the residing district AHJ.
3. Additionally, for buildings where an ERCES is needed based on in-building coverage test data, only the floors or areas requiring coverage are to be addressed in the design.
4. Systems are intended to require only the minimum RF gain for the signal boosters to accomplish the coverage objectives.
5. ERCES shall be operated and maintained in accordance with Federal Communications Commission Part 90 rules, NFPA Standards as adopted by the current FFPC, manufacturer's instructions, and other Federal, State or Local codes as determined by the AHJ (Authority Having Jurisdiction).
6. Written authorization of FCC License Holder / Lee County Public Safety Communications is required upon initial installation and prior to activation for commercial service. (retransmission authorization / compliance)
7. Signal boosters must be FCC type accepted.
8. No Harm- The System shall not cause interference to licensed radio systems or equipment operated by Lee County or other government entities in Lee County.
9. If an ERCES does cause interference; the system owner shall promptly resolve any interference that occurs up to and including deactivation of the system, if necessary, until such time that the interference is corrected.
10. System owner shall provide access to the system for inspection upon request by the AHJ, Lee County Public Safety Communication, the FCC, and or their designees.
11. System owner must notify and coordinate with Lee County Radio System operations prior to testing, optimizing, and commissioning the in-building system.
12. The AHJ and FCC License Holder reserve the right to inspect or re-inspect the in-building system at any time.

Refer to the following documents for detail behind the Lee County ERCES requirements.

FCC Requirements

The FCC ([CFR 47, FCC Part 90.219\(c\)](#)) requires that Lee County either operate or explicitly authorize use of the distributed antennae systems used to achieve a minimum radio signal strength. When Lee County consents to operation of signal boosters by non-licensees (such as a building owner or a signal booster installation contractor) within our service contour and across

our applicable frequencies, then we must maintain a reasonable level of control over these operations in order to resolve interference problems. The FCC also requires all class “B” BDAs to be entered into a nationwide registry.

Florida Statute 633.202
Florida Fire Prevention
Code

Local Fire Districts and Fire Departments are Authorities Having Jurisdiction responsible for the enforcement of this statute and codes. Lee County Public Safety is the FCC licensee responsible for the legal requirements enforced by the FCC. Lee County Public Safety wants to ensure that the radio system offers the opportunity to provide or enhance a minimum radio signal strength in structures throughout the County.

What Lee County Radio System / FCC Licensee Requires for Retransmission Authorization to be Granted

1. Apply for Commercial Signal Booster Retransmission Authorization
 - ☐ Lee County has made available an online application that allows you to provide the necessary information to register the booster with the County.
2. Schedule Retransmission Compliance Test
 - ☐ Once registered and application fee paid, a Lee County representative will contact the installer to schedule the retransmission compliance test.
3. Receive Compliance Confirmation
 - ☐ Following the successful completion of the compliance test, Lee County Public Safety will provide a letter authorizing the structure owner to retransmit over the County's licensed frequencies.
4. Update Registration
 - ☐ In the event of ownership change of the structure, significant structure modifications or a failed signal booster, Lee County will ask that information is updated in order to continue to transmit over the licensed frequencies.

Lee County will not authorize retransmission of its licensed frequencies by a signal booster that does not meet these minimum standards. In the event of a test failure, Lee County will send a notice indicating the deficiencies identified in the test results. Applicants will be required to perform repairs or replacement of their system until satisfied that the components introducing noise interference in the system has been rectified. Applicant must then schedule for a retest of the system.

Additional Compliance and Test Process & Requirements

1. During the project life cycle, ERCES system integrators will be working with and communicating with both
 - a. The AHJ (Fire District, Fire Department, and or County Plans Review)
The local AHJ will require a “FIR” permit for any installation of ERCES
 - b. The FCC License Holder (Lee County Public Safety Radio Communications).
Lee County Public Safety Communications requires a separate “DAS” permit for any installations of ERCES in order to facilitate commission and retransmission agreements.
2. These items below need to be submitted to AHJ / Fire District / Fire department Permit Review.
 - a. **System Integrator Qualifications Narrative-** if not already approved by Lee County or the residing AHJ, the following needs to be submitted
 - General Qualifications and experience of system integrator providing and installing the system
 - Copies of FCC GROL (General Radiotelephone Operators License) for system installers and technicians
 - Copies of OEM certifications completed by the employees associated with the project
 - Capabilities to provide on-going warranty, break-fix, maintenance, and periodic testing for at least five years
 - b. **Initial Determination Coverage Test Report “GRID TEST”** – (must be submitted prior to submission for an ERCES permit.)
 - This is an “as-is” coverage test report that shows the existing, native radio coverage throughout the building as a percentage of floor area
 - This report must be reviewed and validated by the residing AHJ before any coverage enhancement system is contemplated and submitted for building permit
 - The final determination of a buildings “Pass or Fail” per F.S. 633.202(18)(a), minimum radio signal strength for fire department communications in all new and existing buildings shall be the sole discretion of the residing AHJ based on coverage results and or any other factors within his or her authority.
 - See Technical Requirements below for the coverage test thresholds.

- c. **ERCES Design package**- to be submitted to the residing AHJ plans permitting department upon acknowledgement of a failing or insufficient in-building native radio coverage.
- This is typically already required for the building permit submission
 - Overall design plan drawing
 - Floor plans showing locations of equipment locations, donor antenna, and serving antennas
 - iBwave or other predictive modeling software “Heat map” showing predicted coverage for each floor
 - Initial determination coverage test report (from above) showing native coverage
 - ERCES link budget
 - Manufacturer’s data sheets
 - See further detail – plans submittal check list
3. **Retransmission Authorization letter**, once issued by the Lee County Public Safety Communication (Lee County FCC license holder)
- a. The letter must be posted conspicuously with the headend equipment (location of Bi- directional amplifier and associated alarm panel)
 - b. Commercial properties that have multiple signal boosters shall require a separate retransmission authorization letter for each signal booster.

Maintenance and Periodic Testing NFPA 1221 11.3.9.2.3

1. Annual Operational Tests
 - a. Inspect the building for any physical changes that impact ERCES coverage.
 - b. Review frequency plan of the radio system(s) being retransmitted and make any required configuration changes to the BDA. Any changes to gain settings shall require retesting with Lee County Public Safety Communications and must be documented.
 - c. Apply any firmware or software updates to the BDA recommended by the OEM.
 - d. Expected signal levels shall be verified at every serving antenna. No deviation more than 5% from initial installation documentation.

- e. Test backup batteries and power supplies under load for one (1) hour
 - f. Verify supervisory monitoring to FACP
 - g. Verify donor antenna azimuth to initial installation.
2. Tests to be Performed Every Five Years- should include all annual operational test stated above in addition to a full "GRID TEST".

Technical Requirements for RF coverage Survey, "GRID TEST".

1. The AHJ may require a grid test and evaluation of in-building radio communications for any building under their jurisdictional authority, new construction or existing, within the scope of F.S. 633.202 and the Florida Fire Prevention Code.
2. Indoor coverage "grid" tests shall be performed so that the percentage of coverage for both general building areas and critical areas can be recorded and displayed in an easy-to-read format acceptable to the AHJ.
3. **Initial Determination of Coverage** refers to the "as-is" coverage test report that shows the existing, native radio coverage. It is recommended every new construction building receive an early "Baseline" evaluation. (at dry-in) Baseline evaluations should not be considered as a final pass of a new construction project for **Initial Determination of Coverage** but may be used to demonstrate a significant deficit of signal coverage for a ERCES permit; as validated by the AHJ.
4. New buildings will require a final grid test for "Initial Determination of Coverage" (no ERCES present) when the project buildout has been substantially completed (at punchout / TCO).
5. GRID TEST format and standards should follow NFPA 1221 (2019) A11.3.9. Exceptions for unique structural designs or features may be submitted with AHJ approval.
6. Metrics for testing shall include:
 - a. Analysis of downlink BER. - FBER / standard **<= 2.5 %**
 - b. Analysis of downlink Signal to Noise Ratio – SINR / standard **>= 20 dB**
 - c. Analysis of downlink Signal Strength – RSSI stated in dBm / standard **>= -102 dBm**
 - d. Analysis of a reference level of each metric measured at least once outside the building structure in free space.
7. Final determining factor for all evaluations of Initial Determination of Coverage will be a on site two radio test "DAQ" performed by the AHJ (Grid Test Validation). Where radios have been/are provided by the AHJ to a testing party, submitted test results may be accepted.
8. DAQ threshold for acceptable in-building radio communications shall be **3.0 or greater**. Correct execution of this test confirms both UL and DL evaluation of signal quality.

Deliver Audio Quality - NFPA 1221 A11.3.9

DAQ – Is a measurement of Delivered Audio Quality, two radios in communication one to another.

DAQ 1: Unusable, speech present but unreadable.

DAQ 2: Understandable with considerable effort. Frequent repetition due to noise/distortion.

DAQ 3: Speech understandable with slight effort. Occasional repetition required.

DAQ 3.5: Speech understandable. Repetition rarely required. Some noise distortion.

DAQ 4: Speech easily understood. Occasional noise or distortion.

DAQ 4.5: Speech easily understood. Infrequent noise or distortion.

DAQ 5: Speech easily understood.

“The DAQ scale comes from the TIA TSB-88, Wireless Communications Systems Performance in Noise and Interference-Limited Situations. A DAQ test is preferred to absolute RF signal levels for two reasons: the DAQ test is easier to administer than RF levels, and DAQ is useful regardless of the type of modulation or system technology used (analog or digital). It measures what really matters – how the signal sounds to the user – regardless of manufacturer specifications.”

Commissioning Tests

1. Lee County Public Safety will send a technician on-site of the booster. The on-site technician will not be able to touch the equipment at the site so when testing is scheduled be certain that someone is on-site to turn on and off the booster as well as make minor adjustments, if necessary.

A. Site Testing

The on-site technician will ensure that the booster is powered off. A second technician at the radio (RF) site most likely affected (in case an omnidirectional donor antenna, the nearest Public Safety site or with non-omnidirectional donor antenna, nearest site and in line with the directional azimuth of the antenna) will then monitor and capture an averaged ambient noise floor reading.

B. System On

The on-site technician will ensure that the booster is powered on. The technician at the RF site will then monitor and capture an averaged and ambient noise floor reading.

C. System Transmitting

The technician on-site will key their portable with a 0db gain antenna held at head level while directly underneath the closest inside antenna. The technician at the RF site will then monitor and capture an averaged and ambient noise floor reading.

Minimum Standards

- a. Booster cannot introduce any measurable (by average) and reproducible noise floor level above the Baseline ambient noise reading.
- b. Booster cannot generate any measurable and reproducible power level higher than -75dBm recorded at the RF site.
- c. Booster must be Phase II capable
- d. Maximum acceptable propagation delay – 15 microseconds (Phase II compatible)

2. Outdoor Signal Leakage from ERCES (LEAK TEST)

- a. Identify the operating control channel for voice communication – Lee County P25
- b. Disconnect the coax feed from the site donor antenna at the BDA input port. Connect a spectrum analyzer to the donor coax feed from the donor antenna. Measure the RF channel power of the incoming control channel signal from the antenna; **note dBm value.**
- c. With the spectrum analyzer connected search and identify a clean test frequency (guard band) within the Public Safety Bandwidth sufficiently isolated by at least 50 KHz from any active channels. A clean test frequency is one with no other RF traffic that may cause variant test readings.
- d. Tune a frequency transmitter / signal generator to the identified clean test frequency. **Set the RF power level to a value equal to the measured signal from step b.** Verify the BDA UL HPA is disabled. Connect and generate the clean test frequency into the BDA donor input port.
- e. Using a spectrum analyzer or scanning receiver capable of seeing both the control channel and the test channel power proceed to test a minimum of 8 locations around the exterior perimeter of the building. Minimum 4 corners and 4 sides. A distance of 3 to 5 feet from exterior wall of the building.
- f. Record the separate signal power readings for comparison. Test frequency power level (the RF leak from the building) **shall be at least 15dB lower** than the measured signal of the control channel at any test point.

3. Isolation Test

- A. Isolation between the donor antenna and all serving antennas must be tested to be at least 20 dB above system gain.
- B. ERCES passive design systems (typical amplifier and coax systems) may demonstrate isolation by a record of the device Guided Unit Interface (GUI) report if allowed by the AHJ.
- C. Manual isolation testing steps
 - a. Disconnect the coax feed from the site donor antenna at the BDA input port. Connect a spectrum analyzer to the donor coax feed from the donor antenna.
 - b. Disconnect the output coax (DAS antenna feed) from the BDA and connect a frequency transmitter / signal generator.
 - c. Tune the FG to an identified clean test frequency. Generate the clean test frequency into the DAS or antenna system of the ERCES. Minimum power to transmit (assuming a passive DAS) should be 0 to 10 dB.
 - d. Measure and record the levels of the test frequency levels received at the spectrum analyzer.
 - e. Subtract the measured level at the SA from the RF level transmitted/generated. Note this value as the Isolation reference.
 - f. Ensure the calculated isolation reference is more than system gain of the BDA plus 20 dB.
- D. Active ERCES/DAS systems (Fiber DAS w/remote amplifier) will require a manual isolation test. (refer to manufacturer's instructions to manual test active DAS)

ERCES Recommended Plans Submittal Check List

PLANS SUBMITAL AND REVIEW

- 1 TYPICAL DESIGNS REQUIRE 3 TO 5 SETS OF DRAWINGS MINIMUM ALONG WITH THE REQUIRED SPECIFICATIONS, CALCULATIONS. PLANS SHALL BE SUBMITTED IN ACCORDANCE WITH APPROPRIATE PLANS CHECKLIST IF PROVIDED BY AHJ.
- 2 PROJECT NAME, ADDRESS, CITY AND STATE SHALL BE SHOWN ON EACH DRAWING. BUILDING OCCUPANCY TYPE, TOTAL SQFT, NUMBER OF FLOORS, HEIGHT OF BUILDING ETC. (NFPA 1-1.7.12) (NFPA 72-7.4)
- 3 CONTRACTOR NAME, ADDRESS, CITY, STATE AND LICENSE NUMBER SHOULD BE SHOWN ON EACH DRAWING. SIGNATURE AND SEAL OF ERCES ENGINEER OF RECORD PE NUMBER, CONTACT INFORMATION (NFPA 72-10.5)
- 4 SCOPE OF WORK & NOTES TO INCLUDE CODE REFERENCES FOR DESIGN AND DETAIL ADDED WHERE APPLICABLE. INCLUDE WRITTEN SEQUENCE OF OPERATION.
- 5 SCALE / SHOULD PROVIDE A GRAPHIC REPRESENTATION OF THE SCALE USED ON ALL PLANS.
- 6 COMPASS ROSE / NORTH ARROW- SHOULD APPEAR ON EVERY SHEET SHOWING A PORTION OF THE INSTALLATION. Include PS tower location where donor antenna is identified.
- 7 A SYMBOL KEY PLAN SHOULD BE PROVIDED AS NEEDED.
- 8 THE DRAWINGS SHALL IDENTIFY ALL ROOMS & SPACES BY NAME AND THEIR USE. FLOOR PLANS SHOWING DEVICE LOCATIONS, FIRE RATED ENCLOSURES, CONDUIT / CABLE RUNS, AND APPROPRIATE HEAT MAP MODELING. DESIGN PLANS WILL INCLUDE A COMPLETE LINK BUDGET (NFPA 1-1.7.12) (NFPA 72-7.4)
- 9 THE DATE OF THE PLANS ALONG WITH ANY SUBSEQUENT REVISIONS MUST BE NOTED.
- 10 SHEET NUMBER- EACH SHEET MUST SHOW THE SHEET NUMBER AND THE TOTAL NUMBER OF SHEETS INCLUDED, AS WELL AS CLEARLY LABELED MATCH LINES TO SHOW WHERE OTHER SHEETS MATCH OR ADJOIN TO EACH OTHER.
- 11 COMPLETE CUT SHEETS - CURRENT MANUFACTURER'S SPECIFICATION AND INSTALLATION SHEETS ARE ATTACHED FOR ALL CONTROL UNITS, COMPONENTS, APPUANCES, DEVICES, MODULES AND RELAYS LISTED ON LEGEND.
- 12 A PRELIMINARY BASELINE GRID TEST, SHOULD BE PROVIDED TO AHJ TO IDENTIFY THE NEED FOR AN ERCES.

- 13 □ PLANS MUST BE CLEARLY IDENTIFY THE FLORIDA FIRE PREVENTION CODE, NFPA 1221, NFPA 72, NEC 70, AND ALL OTHER REFERENCED CODES ADDITIONS AND DATES EMPLOYED BY THE DESIGN. (FOR DESIGNS APPLYING NEWER CODES AHJ APPROVAL SHALL BE OBTAINED.)

□ DESIGN

- 14 □ ALL SYSTEMS MUST BE CAPABLE OF UPGRADE, TO ALLOW FOR INSTANCES WHERE THE JURISDICTION CHANGES OR ADDS SYSTEM FREQUENCIES, IN ORDER TO MAINTAIN RADIO SYSTEM COVERAGE AS ORIGINALLY DESIGNED, IN ACCORDANCE WITH NFPA 1221 – 9.6.10.2
- 15 □ A DEDICATED MONITORING PANEL PROVIDED IN THE FIRE COMMAND CENTER TO ANNUNCIATE THE STATUS OF ALL SIGNAL BOOSTER LOCATIONS, (NFPA 1221 – 9.6.13.2.1) THE MONITORING PANEL SHALL PROVIDE VISUAL AND LABELED INDICATION OF THE FOLLOWING FOR EACH SIGNAL BOOSTER:

- (1) NORMAL AC POWER
- (2) LOSS OF NORMAL AC POWER
- (3) FAILURE OF BATTERY CHARGER
- (4) LOW-BATTERY CAPACITY @ 70 % DEPLETION
- (5), DONOR ANTENNA MALFUNCTION,

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“ACTIVE RF EMITTING DEVICE” AND OR “ACTIVE SYSTEM COMPONENT”

Any type of circuit component that requires an ac or dc power source with the ability to electrically control electron flow and/or amplification of RF signal, including but not limited to signal boosters, repeaters, bi-directional amplifiers, and fiber distributed antenna systems.

- (6) ACTIVE RF EMITTING DEVICE MALFUNCTION / SIGNAL BOOSTER TROUBLE
- (7) ACTIVE SYSTEM COMPONENT MALFUNCTION / FIBER REMOTE TROUBLE

- 16 □ A HEAT MAP MODEL SHOULD BE PROVIDED TO DEMONSTRATE DESIGN RADIO COVERAGE THROUGHOUT THE BUILDING- THE BUILDING SHALL HAVE A MINIMUM OF:

- (A) CRITICAL AREAS RADIO COVERAGE 99%:

ALL CRITICAL AREAS SUCH AS THE FIRE COMMAND CENTER(S), THE FIRE PUMP ROOM(S),

EXIT STAIRS, EXIT PASSAGEWAYS, * ELEVATOR, ELEVATOR LOBBIES, STANDPIPE CABINETS, SPRINKLER SECTIONAL VALVE LOCATIONS, AND OTHER AREAS DEEMED CRITICAL BY THE AUTHORITY HAVING JURISDICTION SHALL HAVE A MINIMUM OF 99% CRITICAL FLOOR AREA RADIO COVERAGE IN ACCORDANCE WITH NFPA 1221 – 9.6.7.3

(B) NON-CRITICAL AREAS RADIO COVERAGE 90%:

SHALL HAVE A MINIMUM OF 90% FLOOR AREA RADIO COVERAGE IN ACCORDANCE WITH NFPA 1221 – 9.6.7.4

- 17 DESIGN SHALL DEMONSTRATE/ SUPPORT MINIMUM INBOUND SIGNAL STRENGTH -
 - a. Analysis of downlink BER. - FBER / standard $\leq 2.5\%$
 - b. Analysis of downlink Signal to Noise Ratio – SINR / standard ≥ 20 dB
 - c. Analysis of downlink Signal Strength – RSSI stated in dBm / standard ≥ -102 dBm

- 18 DESIGN SHALL DEMONSTRATE / SUPPORT MINIMUM OUTBOUND SIGNAL STRENGTH –
 - a. Analysis of downlink BER. - FBER / standard $\leq 2.5\%$
 - b. Analysis of downlink Signal to Noise Ratio – SINR / standard ≥ 20 dB
 - c. Analysis of downlink Signal Strength – RSSI stated in dBm / standard ≥ -102 dBm

- 19 IDENTIFY ERCES DESIGN AS EQUIPPED WITH AN FCC COMPLIANT CLASS "B" OR CLASS "A" SIGNAL BOOSTER (BI-DIRECTIONAL AMPLIFIER/ DISTRIBUTED ANTENNA SYSTEM) OR SYSTEMS OTHERWISE APPROVED. ALL ERCES MUST BE COMPATIBLE WITH BOTH P25 PHASE I AND PHASE II SIGNALS.

- 20 ARE ALL COMPONENTS PROPERLY ENCLOSED, SUCH AS REPEATERS, TRANSMITTERS, RECEIVERS, SIGNAL BOOSTER COMPONENTS, AND BATTERY SYSTEM COMPONENTS IN A NEMA 4, NEMA 4X OR NEMA 3R-TYPE ENCLOSURE(S). (NFPA 1221 – 9.6.11.2)

- 21 ARE THE RADIO ENHANCEMENT SYSTEM AND ALL ACTIVE CONTROLS LOCATED IN A PLACE THAT MEETS ALL ENVIRONMENTAL REQUIREMENTS WITH REGARDS TO HEATING, VENTILATION, COOLING, AND HUMIDITY REQUIREMENTS OF THE MANUFACTURER SPECIFICATIONS.

- 22 ALL ACTIVE CONTROLS FOR ERCES LOCATED IN AN AREA FREE FROM HAZARDS.

- 23 FEEDER AND RISER CABLES (SEE "BACKBONE") MUST BE PLENUM RATED. (NFPA 1221-9.6.2.1.1) BACKBONE MAY BE ROUTED THROUGH AN ENCLOSURE MATCHING BUILDINGS

FIRE RATING (NFPA 1221 -9.6.2.3)

- 24 □ ALL WIRING SHALL BE INSTALLED AT THE SAME OR GREATER LEVEL OF SURVIVABILITY, PATHWAY AND CLASS AS THE FIRE ALARM SYSTEM. (NFPA 1221 - 9.6 & 5.10) (NFPA 72 - 24.3.13.8) WHERE RISER CABLE IS NOT IN 2-HOUR RATED ENCLOSURE SPECIFY PERFORMANCE ALTERNATIVE USED WITH CODE AND EDITIONS REFERENCES.
- 25 □ DBPR DIVISION OF ELEVATOR SAFETY: WHERE ANY DESIGN EMPLOYS ANTENNA OR WIRE INSIDE AN ELEVATOR SHAFT THE INSTALLING CONTRACTOR SHALL SUBMIT A LETTER TO DBPR FOR APPROVAL ALLOWING FOR PENETRATIONS INTO THE ELEVATOR SHAFT. APPROVAL LETTER SHALL BE PROVIDED TO THE FIRE MARSHAL FOR LOCAL APPROVAL.
- 26 □ ERCES REQUIRES ISOLATION BETWEEN THE DONOR ANTENNA AND ALL INSIDE ANTENNAS AT A MINIMUM OF 20 DB ABOVE THE SIGNAL BOOSTER GAIN UNDER ALL OPERATING \ CONDITIONS. (NFPA 1221 – 9.6.9)
- 27 □ ERCES REQUIRES TWO INDEPENDENT AND RELIABLE POWER SUPPLIES PROVIDED FOR ALL REPEATER, TRANSMITTER, RECEIVER, AND SIGNAL BOOSTER COMPONENTS; ONE PRIMARY AND ONE SECONDARY (NFPA 1221 – 9.6.12)
- PRIMARY SOURCE REQUIRES DEDICATED 20 AMP CIRCUIT; BREAKER MARKED AT PANEL; BREAKER LOCKED. CONNECTIONS WILL BE HARD WIRE OR TWISTLOCK.
 - SECONDARY SOURCE MAY BE; BATTERY WITH AT LEAST 12 HR OPERATION @ 100%; OR AN ALTERNATIVE POWER SOURCE OF 12 HRS @ 100% AS APPROVED BY THE AHJ (NFPA 1221-9.6.12.1)
- 28 □ DONOR / ERCES PROTECTION FROM LIGHTNING COMPLIES WITH NFPA 780 (NFPA 1221 – 9.6.3) AHJ CAN APPROVE ALTERNATE MEANS IF BUILDING INFRASTRUCTURE DOES NOT SUPPORT NFPA 780.
- 29 □ ALL WIRING MUST BE IN ACCORDANCE WITH MANUFACTURER SPECS FOR INSTALLATION AND GROUNDING (COMPLIANT WITH NFPA 70) DONOR, MAST, AND COAX BONDED AND GROUNDED.
- 29 □ AN IDENTIFIER PLACARD OR LABEL INCLUDING DATE OF ACCEPTANCE SHALL BE POSTED AT BDA / DAS UPON FINAL SYSTEM TEST; INITIALED OR VERIFIED BY THE AHJ.

MONITORING OF SIGNALS

- 30 DOES THE INTEGRITY OF THE CIRCUIT MONITORING THE ERCES AND POWWER SUPPLY COMPLY WITH NFPA 72-10.6.9 .(NFPA 1221-9.6.13.1)
- 31 VERIFY COMPLIANCE WITH NFPA 72 – 14; NFPA 1221 – 11.3.9 / A METHOD IN PLACE FOR INSPECTION, TESTING, AND MAINTENANCE ON AN ANNUAL BASIS; APPROVED BY AHJ
- 32 BINDER STORED NEXT TO ERCES / BDA (NFPA 72-7.5) AS BUILT DRAWNIGS, MANUFACTURERS DATA SHEETS AND MANUAL; FINAL GRID MAP DOCUMENT WITH SIGNAL STRENGTH RESULTS. MAINTENACE CONTRACT WITH VENDOR INFORMATION; MAINTENANCE REPAIR LOG

ADDITIONAL REFERENCE NOTES

NFPA 1221, 2019:

Backbone Cable:

Similar to a "Riser Cable"

NFPA 1221-3.3.10 Backbone. A communication cable in an in-building radio enhancement system that carries wideband signals important to the entire building, from the donor antenna, through the amplifiers, and to distribution antenna lines.

NFPA 1221-a.3.3.10 Backbone. Damage to a backbone cable will disable the radio enhancement system through much or all of the building, and as a result it should be identified and protected. The backbone could be fiber-optic, copper, or coaxial cable, but it does not radiate RF energy along its path.

Distribution Antenna Cable:

Similar to a "Feeder Cable"

NFPA 1221-3.3.46 Distribution Antenna Cable. A communication cable that carries RF energy in both directions along its length to distribution antennas in one or more places in the building.

NFPA 1221-A.3.3.46 Distribution Antenna Cable. It is typically a coax cable or radiating cable, and it is outside of the heat and fire protection provided by any firewalls or other means.

All rechargeable batteries manufactured today, including "sealed" batteries, require ventilation. The 2019 Code and the UL 2524 Standard addresses this issue and requires a NEMA 3R type enclosure for batteries requiring ventilation.

When a project is permitted under NFPA 72 (2013) or NFPA 1221 (2016), approval from the Fire AHJ is required to use the NEMA 3R type enclosure. The Fire AHJ may approve the NEMA 3R type enclosure when the BDA equipment is listed per UL 2524 and batteries requiring ventilation are used, based on NFPA 1-1.4, Equivalencies, Alternatives, and Modifications.

Lightning Protection Systems are NOT grounding systems.

A Lightning Protection System protects the building structure from a lightning strike. Typically, 3/0 wire is used. A grounding system with surge protection protects the communication system electronics from a lightning strike. Typically, a small #8-#6 awg wire is used.

1. Riser and donor antenna conduits are recommended to be a minimum of 2" with large 24" radius bends for all riser and donor antenna coaxial cables.
2. Conduits are recommended to be a minimum of 1-1/2" with large 24" radius bends for all feeder coaxial cables (metal raceways).
3. Junction or pull boxes are recommended to be a minimum of 16" x 16" x 4".
4. The AHJ may require sweep testing at any time. Small conduits, long runs, small junction boxes, or multiple bends could be strong indicators that there might be problems with the installation. Resolutions of these problems are an expensive process and may cause delays on the project.

The Telecommunications Industry Association Standard, TIA/ANSI-569-C, recommends the following guidelines:

9.8.2.1 Length

No section of conduit shall be longer than 100ft. between pull points.

9.8.2.1 Bends

No section of conduit shall contain more than two 90° bends, or equivalent, between pull points.

9.8.2.3 Pull Tension

The pull tension of the cable being installed shall not be exceeded.

9.8.2.4 Pull Boxes

9.8.3.2 Pull Strings

Pull strings shall be placed in installed conduit.

9.9.4 Pathway Fill Factor (Conduits)

For future pathways, the maximum pathway fill shall be 40%.

Lee County Radio Frequencies

- NFPA 1221 9.6.10.1
The AHJ shall maintain a list of all inbound / outbound frequency pairs for distribution to system designers.

Lee County P25 Phase II – new frequencies online

Mainland EOC

Repeater RX/TX

- 1- 813.7125/858.7125 (Current control)
- 2- 813.0875/858.0875
- 3- 813.4625/858.4625 (Future available control)
- 4- 812.7125/857.7125 (Available control)
- 5- 813.0625/858.0625
- 6- 812.0125/857.0125
- 7- 812.4625/857.4625
- 8- 811.7125/856.7125
- 9- 811.4625/856.4625
- 10- 811.0875/856.0875
- 11- 810.9625/855.9625
- 12- 809.5875/854.5875

Sanibel

Repeater RX/TX

- 1- 814.3125/859.3125 (Control)
- 2- 812.5125/857.5125 (Available control)
- 3- 812.0375/857.0375 (Available control)
- 4- 811.3875/856.3875 (Available control)
- 5- 811.0625/856.0625
- 6- 809.8125/854.8125

Boca Grande

Repeater RX/TX

- 1- 813.5875/858.5875 (Future primary control)
- 2- 813.0375/858.0375 (Current Control)
- 3- 812.5875/857.5875 (Available control)
- 4- 812.0625/857.0625 (Available control)
- 5- 811.7625/856.7625
- 6- 810.7375/855.7375

Guidelines for in-building ERCES / AHJ inspection check list

1. Donor Antenna Installation
 - a. Is the donor securely mounted – 160ph wind load (no sled)
 - b. Are the roof location and azimuth correct per plans
 - c. Is this the correct antenna on the plans/permit set
 - d. Is the connector properly weatherproofed
 - e. Is the mast and j-boxes bonded/grounded (mast to lightning suppression)
 - f. Is the antenna bonded to lightning suppression or back to BDA
 - g. Is coax the correct outdoor rated (match plans)
 - h. Is the weather head / roof penetration properly sealed
2. Lightning Protection
 - a. Is there a lightning protector installed on the coax – bonded to building ground
 - b. Is it grounded properly – wire, connections, all to building ground
3. Donor and Backbone Cable Runs
 - a. Is this cable run in conduit. (mechanical protection as approved)
 - b. Or is the cable in a rated / protected enclosures (per plans / permitted)
 - c. Is the cable riser/plenum rated
 - d. Are there jumper connections to the BDA (preferred for service and access)
4. BDA
 - a. Is the BDA properly mounted; rack or rated plywood
 - b. Is the room rated as required per plans / as permitted
 - c. Is there power to the BDA; dedicated circuit required
 - d. Does the BDA power have surge protection (recommended)
 - e. Twist lock plug or direct wire if required
 - f. If power is hard wire is there an EPO switch (recommended)
 - g. Have all code required fire alarm connections been done
 - h. Dedicated monitoring panel at BDA ; and at fire command room if applicable
 - i. Is the BDA cabinet bonded/grounded
 - j. Is there proper clearance side, above, and below (air flow / access)
 - k. Are there cabinet keys and any accessories with the unit
5. BBU
 - a. Is the BBU properly mounted (NEMA 4 or NEMA 3 as approved)
 - b. Have batteries been installed correctly; labeled with date of installation
 - c. Is room rated per plans / as permitted
 - d. Is there power to the BBU charger (dedicated circuit ?)
 - e. Have fire alarm circuits been connected

- f. Is BBU properly bonded/grounded
 - g. Is there proper clearance side, top, bottom (air flow / access)
 - h. Is the BBU properly tied to EPO switch (if required)
6. Service antennas and wire infrastructure
- a. Are all cables, junction devices, and antennas installed per plans / permits
 - b. Components, junctions, connections clean and connected properly (have installers “tug test” or demonstrate secure connections)
 - c. Wire installation bends 90 deg or more; sweep 20 x cable diameter
 - d. No other wire installed in conduit where utilized
 - e. No leaky coax
 - f. “J-boxes” properly marked, color coded and labeled per AHJ requirements
 - g. All coax connections within junction box / approved mechanical protection
 - h. All penetrations properly finished per UL or plans / permits
 - i. Survivability pathways completed per plans / permits
 - j. All conduit utilized must be bonded to building grounds
 - k. Proper required NEMA 4 / NEMA 3 enclosures per plans / permits

Fire Final guidelines for AHJ / ERCES Final Inspection Check List

Verify before beginning site inspection...

- Verify Final drawings on site and Installation of components match “as built”
- BDA room or enclosure approved marked by placard.
- Electrical panel marked; breaker(s) locked on.
- Access to J-boxes, antennas, components; open upon request for inspection
- BBU batteries have a full charge
- Dedicated monitoring panel in fire control room; minimum dedicated panel at BDA head unit and addressable FACP notes specific alarm issues
- Fire Alarm monitoring and Fire dispatch notified and or on TEST
- BDA Manual / Binder in BDA room: final as-built installation plans , manufacturers data/specs sheets , grid map of final signal strength measurements (dBm) with documentation of donor antenna azimuth/coordinates , maintenance repair log.

Note: first 5 of the following elements may be demonstrated by documentation as allowed by AHJ

1. Integrator technician to check / establish off air values of inbound signal strength
2. BDA gain @ selected test frequency or guard band frequency
3. Isolation test: Manual or GUI report – confirm isolation UL/DL 20dB minimum above BDA gain settings. (Attenuation acceptable to ensure correct isolation value)
4. Integrator technician may then set up BDA on PS frequency UL and DL gain.
 - a. (Optional) building signal leak test – see commission testing
5. RADIO SHOP NO HARM COMPLETED - TESTING FOR RETRANSMISSION

When the system has passed and is permitted to be on to the Public Safety system AHJ may require additional grid test documentation

6. Witness installer tech test proper alarm / indicator(s) and transmitted alarm to FACP
 - a. Normal AC power indicator
 - b. BDA loss of normal AC / power failure
 - i. Test = turn off AC power
 - c. BDA donor antenna “signal source” malfunction
 - i. Test = disconnect donor coax to BDA
 - d. BDA / and or each active system components failure /fiber (see Note)
 - i. Test = switch off BDA / each remote amplifier setup
 - e. BBU charger failure
 - i. Test = switch off charger and or disconnect batteries
 - f. BBU low-battery capacity (70% depletion level)
 - i. Test = disconnect batteries

7. Verify all alarms reported to monitoring; all alarms show on addressable alarm panel; all alarms indicated on remote signal panel(s)

8. AHJ walk test (action for validating final grid results provided by installer/test tech)
 - a. Spot check DAQ 3 or better - general floor areas throughout building
 - b. Specifically verify DAQ critical areas
 - i. Fire command room
 - ii. Fire pump room
 - iii. Exit Stairwells / passageways.
 - iv. Elevator lobbies or *Elevator cabs as required by AHJ*
 - v. Standpipe connection locations (common in egress stairwells)
 - vi. Sprinkler valve locations (common in egress stairwells)

NOTE # 6 testing alarm notification to FACP for an active emitting device or active system device:

“ACTIVE RF EMITTING DEVICE” AND OR “ACTIVE SYSTEM COMPONENT”

*Any type of circuit component that requires an ac or dc power source with the ability to electrically control electron flow and/or amplification of RF signal, including but not limited to signal boosters, repeaters, bi-directional amplifiers, and fiber distributed antenna systems. **In a typical system (BDA and COAX) need only test BDA failure.** Only larger hybrid / fiber DAS systems require separate testing of remote amps.*