General Guidelines for the Deployment of an Emergency Responder Communication Enhancement Systems (ERCES) City of Coral Gables Communications Division, City of Coral Gables Fire Prevention Bureau

2024

The following document shall be presented to the AHJ to confirm that there are no discrepancies with any local ordinance or code. In case of discrepancies, the local ordinance or code will prevail unless the AHJ decides differently.

The Florida Fire Prevention Code 8th edition requires new and existing buildings to meet minimum radio signal strength for fire department communications. Buildings not meeting the minimum radio signal strength requirements shall be equipped with a two-way radio communication enhancement system in accordance with NFPA 1221.

Extensions and exceptions to two-way radio communication enhancement systems. F.S 633.202

> **Extension:** Existing High-Rise buildings (Commercial and Residential) have an exemption until Jan 1, 2025, but if a system is needed must apply for permits by Jan 1, 2024. (No exemption for new buildings).
>
> **Exempt:** Apartment buildings 75 feet or less in height that are constructed using wood framing, provided that the building

has less than 150 dwelling units and that all dwelling units discharge to the exterior or to a corridor that leads directly to an exit.

Exempt: Apartments and transient public lodging establishments that are less than three stories and that have direct access from the apartment or guest area to an exterior means of egress.

Exempt: One and two-family dwellings and townhouses.

Exempt: Buildings of less than 12,000 total gross square feet with no underground areas

If signal strength or DAQ is inadequate at the exterior of the building, an enhancement system is not required.

Where a two-way radio communications enhancement system is used, the design of the system shall be approved by the AHJ and the frequency license holder. NFPA 1221 9.6.2

Important notice

1. Many Municipalities in the region make use of the City of Coral Gables' 800 MHz radio system. Even if the Municipality has its own Building and Zoning Department, it may still be using the 800 MHz City radio system. The Designer/Installer of the new BDA should find out what Police/ Fire Agency responds to the specific location where the new BDA will be deployed. With that information, the Designer/Installer should contact City of Coral Gables ERCES Group, Attn: bda@coralgables.com to confirm the frequency band to be used.

2. In-building emergency responder communication enhancement systems capable of operating on frequencies licensed to any public safety agency by the Federal Communications Commission (FCC) or other radio licensing

authority shall not be installed without prior coordination and approval of the AHJ. NFPA 1 11.10.3.2

3. To establish if a building requires a radio coverage solution, the Building Owner/Association is responsible for hiring a qualified contractor to produce a preliminary assessment or baseline report of the indoor radio signal. The report should include floor plans showing the radio signal levels throughout the facility, as well as recommendations of the areas (if any) where radio signal improvement is required. The preliminary/baseline should be conducted when the building has all doors and windows installed as this can affect the RF signal penetration. A hard copy of the signal survey (heat map) shall be kept on site. This document shall include all recommendations in compliance with NFPA standards.

4. No amplification system capable of operating on frequencies or causing interference to frequencies assigned to the jurisdiction by the licensing authority of the country of jurisdiction shall be installed without prior coordination and approval of the AHJ and the frequency license holder. NFPA 1221 9.6.5.1

5. The building manager/owner shall suspend and correct equipment installations that degrade the performance of the public safety radio system or public safety radio enhancement system. NFPA 1221 9.6.5.2

6. Systems that share infrastructure with non-public safety services shall ensure that the coverage and performance of the public safety communications channels are not degraded below the level of performance identified in 9.6.7and 9.6.8, regardless of the amount of traffic carried by the non-public safety services. NFPA 1221 9.6.5.3

Objective

The purpose of this document is to provide general guidance for the deployment of an Emergency Responder Communication Enhancement System.

The in-building solution shall allow the Public Safety Agencies to properly communicate inside a given facility.

This document **does not** constitute a Design or Construction Plan and **does not** substitute or supersede partially or entirely any guidelines, codes or specifications coming from the AHJ where the in-building solution is being deployed.

Designer/Installer Qualifications

System installation personnel shall be qualified or shall be supervised by persons who are qualified in the installation, testing and maintenance of the systems. The system installer shall provide evidence of their qualifications and/or certifications when requested by the authority having jurisdiction.

To ensure personnel safety, all construction tasks shall be conducted in accordance with OSHA safety and/or local safety regulations (whichever is more stringent).

Contractors must have a DBPR license and comply with applicable Federal, State and Local Codes and requirements, including the Florida Building Code.

All site development and equipment installation work shall comply with all applicable codes in use by the Authority Having Jurisdiction. Government and local codes shall take precedence over the requirements of this document provided they offer added safety.

The Contractor must be knowledgeable of the following industry standards and codes that have been adopted by the City of Coral Gables Fire Department:

- NFPA 1, National Fire Protection Association Fire Code as adopted in the current Florida Fire Prevention Code.
- NFPA 70, National Fire Protection Code or "National Electrical Code" as adopted by the current Florida Fire Prevention Code.
- NFPA 72, National Fire Alarm and Signaling Code as adopted by the current Florida Fire Prevention Code.
- NFPA 780, "Standard for the Installation of Lightning Protection Systems"
- NFPA 1221 Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems,.
- Motorola R-56, "Standards and Guidelines for Communication Sites"
- TIA Bulletin TSB-88.1-C, Wireless Communications Systems Performance in Noise-Limited Situations, Part 1: Recommended Methods for Technology-Independent Performance Modeling
- Current adoption of the Florida Building Code
- ANSI/TIA-222-G, Structural Standard for Antenna Supporting Structures and Antennas
- IEEE STD 142 "Green Book", "Recommended Practice for Grounding of Industrial and Commercial Power Systems"
- ANSI/TIA/EIA-568-B, "Commercial Building Telecommunications Cabling Standard
- ANSI/TIA/EIA-569-B, "Commercial Building Standards for Telecommunications Pathways and Spaces"
- ANSI/TIA/EIA-606, "The Administration Standard for the Telecommunications Infrastructure of Commercial Building"
- ANSI/TIA/EIA-607, "Commercial Building Grounding and Bonding Requirements for Telecommunications"
- All other applicable Federal, State and Local Building Codes and Requirements

General Scope of Work

The Designer/Installer shall provide a "turn-key" solution for the design, installation, and testing maintenance of an in-building RF coverage system capable of meeting the requirements detailed below.

All system components shall be designed, installed, tested, inspected, and maintained in accordance with the manufacturers' published instructions and the requirements of NFPA 1221 9.6.1

Radio Coverage

Radio coverage shall be provided throughout the building as a percentage of floor area as specified in 9.6.7.3 and 9.6.7.4. NFPA 1221 9.6.7.1

The system shall adhere to the maximum acceptable propagation delay standard provided by the AHJ. NFPA 1221 9.6.7.2

Critical areas, including fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage. NFPA 1221 9.6.7.3

Coral Gables Fire Department has determined the elevator cars shall be considered a critical area.

General building areas shall be provided with 90 percent floor area radio coverage. NFPA 1221 9.6.7.4

Buildings and structures that cannot support the required level of radio coverage shall be equipped with a system that includes RF-emitting devices that are certified by the radio licensing authority (FCC) to achieve the required adequate radio coverage. NFPA 1221 9.6.7.5

Radio enhancement systems shall be designed to support two portable radios simultaneously transmitting on different talk paths or channels, where the AHJ has required the radio enhancement system to support more than one channel or talk path. NFPA 1221 9.6.7.6

Signal Strength

A minimum inbound signal strength sufficient to provide usable voice communications, as specified by the AHJ, shall be provided throughout the coverage area. NFPA 1221 9.6.8.1.1

The inbound signal level shall be sufficient to provide a minimum of DAQ 3.0 for either analog or digital signals. NFPA 1221 9.6.8.1.2

In addition to the requirements in 9.6.8.1 of NFPA 1221, the inbound signal strength shall be a minimum of -95 dBm throughout the coverage area and sufficient to provide not less than a delivered audio quality (DAQ) of 3.0 or an equivalent signal-to-interference-plus-noise ratio (SINR) applicable to the technology for either analog or digital signals.

A minimum outbound strength sufficient to provide usable voice communications, as specified by the AHJ, shall be provided throughout the coverage area. NFPA 1221 9.6.8.2.1

The outbound signal level shall be sufficient to provide a minimum of DAQ 3.0 for either analog or digital signals. NFPA1221 9.6.8.2.2

Frequencies Communications

The public safety radio enhancement system shall be capable of transmitting all radio frequencies in Class A or B mode of

operation as determined by the AHJ assigned to the jurisdiction. This system shall be capable of using any modulation technology in current use by the public safety agencies in the jurisdiction.

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

In the specific case of City of Coral Gables, The "base" frequencies are transmitted on by the City's radio system. "Mobile" frequencies are transmitted on by user radios, such as mobile and, portable radios.

Base	Mobile	Call sign
851.0125	806.0125	WPCJ297
851.2000	806.2000	WPCJ404
851.2250	806.2250	WPCJ404
851.5125	806.5125	WPCJ297
851.6750	806.6750	WPCJ404
851.7000	806.7000	WPCJ404
852.0125	807.0125	WPCJ297
852.5125	807.5125	WPCJ297
852.6250	807.6250	WPCJ297
853.0125	808.0125	WPCJ297
853.0500	808.0500	WPCJ404
853.0750	808.0750	WPCJ404
853.5500	808.5500	WPCJ404
853.7750	808.7750	WPCJ404
853.8000	808.8000	WPCJ404
854.4875	809.4875	WYQ412
857.4375	812.4375	WPCT408

Set BDA to Class B Operation for Simulcast System and enable anti-oscillating features in the BDA equipment programming.

Point donor antennas to the closest radio site with the best signal not to overlap over any donor antennas on adjacent buildings with BDA systems.

Radio Site 1	2800 Ponce De Leon
Radio Site 2	10 Edgewater Drive
Radio Site 3	11911 Old Cutler Rd

To obtain information about the active control channel benchmarking/monitoring frequency for the City of Coral Gables 800 MHz bands and other questions about in-building solutions for 800 MHz, please contact us at City of Coral Gables BDA Group, **bda@coralgables.com**.

Systems shall be upgradeable to allow for instances where the jurisdiction changes or adds system frequencies to maintain radio system coverage as it was originally designed. NFPA 1221 9.6.10.2

Electrical power requirements Electrical

All signal boosters shall be compatible with analog and digital communication simultaneously at the time of installation. All active components of the BDA shall be powered via dedicated ("home run") and generator protected electrical circuits. The location of the dedicated branch circuit disconnecting means shall be permanently identified at the control unit. For the communication system the circuit disconnecting means shall be identified in red and permanently labeled "BDA". It will be permissible to use fire alarm lockouts on the circuit breaker that are labeled as "Fire Alarm Circuit" but on the tin of the circuit breaker panel immediately adjacent to the circuit breaker it shall be labeled "BDA" in red.

Surge protection device(s) shall be used to protect active components of the BDA from electrical transients.

System Components

Component Approval

In-building emergency responder communication enhancement systems installed within buildings shall be listed and labeled in accordance with UL 2524, In-building 2-Way Emergency Radio Communication Enhancement Systems. NFPA 1 11.10.3.1

RF-emitting devices and cabling used in the installation of the public safety two-way radio communications enhancement systems shall be approved by the AHJ and the frequency license holder. NFPA 1221 9.6.11.1.1

All RF-emitting devices shall have the certification of the radio licensing authority (FCC) of that country and be suitable for public safety use prior to installation. NFPA 1221 9.6.11.1.2

Component Enclosures

All repeater, transmitter, receiver, signal booster components, optical-to-RF and RF-to-optical converters, external filters, batteries, and battery system components shall be contained in a NEMA4- or NEMA4X-type enclosure(s). NFPA 1221 9.6.11.2.1

Batteries that require venting shall be stored in NEMA3R-type enclosures. NFPA 1221 9.6.11.2.2

Bi-directional amplifiers (BDAs) used in in-building emergency responder communication enhancement systems shall have oscillation detection and control circuitry. NFPA 1 11.10.6

RF-Emitting Devices. RF-emitting devices shall meet the following requirements in addition to any other requirements determined by the AHJ:

(1) RF-emitting devices shall have the certification of the radio licensing authority prior to installation.

(2) All RF-emitting devices shall be compatible with both analog and digital communications, as required to be used by the radio licensing authority and the AHJ, simultaneously at the time of installation. NFPA 12219.6.11.3

Signal Wiring

The backbone, antenna distribution, radiating, or any fiber-optic cables shall be rated as plenum cables. NFPA 1221 9.6.2.1

The backbone cables shall be connected to the antenna distribution, radiating, or copper cables using hybrid coupler devices of a value determined by the overall design. NFPA 1221 9.6.2.2

Backbone cables shall be routed through an enclosure that matches the building's fire rating. NFPA 1221 9.6.2.3

The connection between the backbone cable and the antenna cables shall be made within an enclosure that matches the building's fire rating, and passage of the antenna distribution cable in and out of the enclosure shall be fire-stopped. NFPA 1221 9.6.2.4

All signal wiring shall be installed in accordance with NFPA 1221 Chapter 5 and adhere to all manufacturer's installation instructions.

Power Sources

At least two independent and reliable power sources shall be provided for all RF-emitting devices and any other active electronic components of the system: one primary and one secondary. NFPA 1221 9.6.12

Primary Power Source

The primary power source shall be supplied from a dedicated branch circuit and comply with NFPA 72. NFPA 1221 9.6.12.1

Secondary Power Source

9.6.12.2 Secondary Power Source. The secondary power source shall consist of one of the following:

1. A storage battery dedicated to the system with 12 hours of 100 percent system operation capacity.

2. An alternative power source of 12 hours at 100 percent system operation capacity as approved by the AHJ.

Monitoring Integrity of Power Sources. Monitoring the integrity of power sources shall be in accordance with 9.1.2.2. NFPA 1221 9.6.12.3

System Monitoring

Fire Alarm System. The system shall include automatic supervisory signals for malfunctions of the two-way radio communications enhancement systems that are annunciated

by the fire alarm system in accordance with NFPA 72and shall comply with the following:

(1) Monitoring for integrity of the system shall comply with Chapter 10 of NFPA 72.

(2) System supervisory signals shall include the following:

(a) Donor antenna malfunction

(b) Active RF-emitting device failure

(c) Low-battery capacity indication when 70 percent of the 12-hour operating capacity has been depleted.

(d) Active system component failure

(3) Power supply supervisory signals shall include the following for each RF-emitting device and active system components:

(a) Loss of normal ac power

(b) Failure of battery charger

(4) The communications link between the fire alarm system and the two-way radio communications enhancement system shall be monitored for integrity. NFPA 1221 9.6.13.1

Dedicated Annunciation

A dedicated annunciator shall be provided within the fire command center to annunciate the status of all RF-emitting devices and active system component locations. This device shall provide visual and labeled indications of the following for each system component and RF-emitting device:

(1) Normal ac power

(2) Loss of normal ac power

(3) Battery charger failure

(4) Low-battery capacity (i.e., to 70 percent depletion)

(5) Donor antenna malfunction

(6) Active RF-emitting device malfunction

(7) Active system component malfunction

NFPA 1221 9.6.13.2.1

The communications link between this device and the two-way radio communications enhancement system shall be monitored for integrity. NFPA 1221 9.6.13.2.2

Propagation Delay

The maximum radio signal propagation delay introduced by the in-building coverage solution shall not exceed 12 μs. If a delay greater than 12 μs is expected by design, then further analysis should be conducted in conjunction with the AHJ to evaluate potential signal degradation in areas where the direct signal coming from a radio site coincides with the BDA output signal.

Exterior Antenna System

If a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to a minimum of 20 dB above system gain. NFPA 1221 9.6.9

Mounting of the Donor Antenna(s).

To maintain proper alignment with the system designed donor site, donor antennas shall meet one of the following:

(1) Antennas shall be permanently affixed on the building.

(2) Where approved, antennas shall be mounted on a movable sled with a visible sign stating "Movement or repositioning of this antenna is prohibited without approval from the AHJ." NFPA 1 11.10.8.1

The antenna installation shall also be in accordance with the applicable requirements of the building code for weather protection of the building envelope. NFPA 1 11.10.8.2

Lightning Protection

All lightning protection systems on a building or structure shall be interconnected in accordance with NFPA 780. NFPA 1221 9.6.3

The antenna, antenna mast, and antenna discharge unit(s) shall be grounded in accordance with Article 810 of NFPA 70.

The donor antenna coaxial cable(s) shall be protected by antenna discharge units in accordance with Article 810 of NFPA 70.

Radio Communication Antenna Density

In-building emergency responder communication enhancement systems shall be engineered to minimize the near-far effect. NFPA 1 11.10.9.1

In-building emergency responder communication enhancement system designs shall include sufficient antenna density to address reduced gain conditions. NFPA 1 11.10.9.2

Where an in-building emergency responder communication enhancement system is required and such system, components, or equipment has a negative impact on the normal operations of the facility at which it is installed, the AHJ shall have the authority to accept an automatically activated responder system. NFPA 1 11.10.10

Acceptance Test Procedure

Where an in-building emergency responder communication enhancement system is required, the building owner shall have the system tested on completion of installation to verify that two-way coverage on each floor of the building is not less than the coverage specified in 9.6.7.3 or 9.6.7.4 of NFPA 1221 as applicable.

Test Procedure

The test procedure, as required by 11.10.11, shall be conducted as follows:

(1) Each floor of the building shall be divided into a grid of 20 approximately equal test areas.

(2) The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio

communications system or equipment approved by the AHJ.

(3) Failure of more than one test area shall result in failure of the test.

(4) A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system, as follows:

(a) Once the test location has been selected, that location shall represent the entire test area.

(b) Failure in the selected test location shall be considered to be a failure of that test area and additional test locations shall not be permitted.

(5) All signal boosters or amplifiers shall be tested to verify that the gain is the same as it was upon initial installation and acceptance or set to optimize the performance of the system under all operating conditions.

(6) At the time of installation and at subsequent annual inspections, a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster.

(7) Systems shall be tested using two portable radios simultaneously conducting subjective voice quality checks, as follows:

(a) One portable radio shall be positioned not more than 10 ft (3048 mm) from the indoor antenna.

(b) The second portable radio shall be positioned at a distance that represents the farthest distance from any indoor antenna.

(c) With both portable radios simultaneously keyed up on different frequencies within the same band, subjective audio testing shall be conducted and comply with DAQ levels as specified in 9.6.8.1 or 9.6.8.2 of NFPA 1221 as applicable.

At the conclusion of successful acceptance testing, a renewable permit shall be issued by the AHJ and the frequency license holder for the public safety radio enhancement system. NFPA 1221 9.6.2

Designer/Contractor Responsibilities

At no time shall work commence without an approved set of plans and issued permits.

Survey the facility to ensure compliance with current adopted version of NFPA 1221

Design, commissioning, testing, and maintenance of an in-building RF coverage solution that guarantees a minimum RF signal level of -95 dBm and 3.0 DAQ throughout the entire facility and attached structures under the conditions described in this document or as per the conditions specified by the AHJ.

Plans must be submitted through Development Services and approved prior to the installation of any equipment.

Obtain the necessary building permits.

Record all appropriate signal levels after the system implementation as previously detailed. Prepare and submit to the AHJ the "before and after" floor plans showing signal levels.

Applicant will supply results of preinstallation surveys and/or coverage forecasts used to design the system.

Address any in-building coverage issue discovered during the Acceptance Test.

Address any reported interference issue related to the new BDA installation.

Provide the Building Owner/AHJ with project documentation including but not limited to "As-built" documentation, system documents, technical manuals, Return Loss or VSWR readings of the RF lines, diagrams showing equipment placement and routing for antennas, coaxial cables, fiber optics interconnections and AC power.

Building Owner Responsibilities

At no time shall the owner allow work to commence without an approved set of plans and issued permits

Keep record of the project documentation including but not limited to;

"As-built" documentation, system documents, technical manuals, Return Loss or VSWR readings of the RF lines, diagrams showing equipment placement and routing for antennas, coaxial cables, fiber optics interconnections and AC power.

Have in place a service contract with a qualified Vendor for technical maintenance, repair (including all components of the system), operation and troubleshooting in the event of radio interference involving the inbuilding radio coverage solution.