

DISTRIBUTED ANTENNA SYSTEMS “DAS” / BI-DIRECTIONAL AMPLIFIER "BDA" (7)

NFPA 72: National Fire Alarm and Signaling Code, 2013 Edition requires that for buildings with zero to poor public safety radio, signals have a radio enhancement system installed to boost signals to ensure emergency radio communications. This system should ensure coverage for both Fire and Police.

Palm Beach Gardens Fire Rescue and Police Departments require that prior to a building being given its Certificate of Occupancy (CO) that a communications study be completed to determined radio signal strength throughout the structure. If the study indicates no or limited coverage, then a radio enhancement system will be required.

Below are the requirements pulled directly out of NFPA 72. If you have any questions or concerns, please contact the Palm Beach Gardens Fire Rescue Community Risk Reduction Division.

NFPA 72, Chapter 24, Paragraph 24.5.2 *

Two-Way Radio Communications Enhancement Systems.

A.24.5.2 - The use of radio communication enhancement systems has become prevalent throughout the country.

Safety features and flexibilities of radio systems include:

1. Allowing full building coverage to facilitate communications from any point within the building, in case access to the telephone jack is compromised.
2. Allowing communications to be conducted between emergency responders in the field to allow quicker dissemination of safety and emergency information.
3. Each emergency responder typically will carry an individual radio, allowing for everyone to provide information or request assistance

individually, which can be important if members of crews separate from each other during an incident.

4. Radio systems allow for “fire fighter down” emergency calls in case of injury, where, by pushing a single button, a call is placed to a central location to initiate a roll call to determine the emergency responder who has been injured and requires assistance.
5. Radio systems can employ an emergency call where, by pushing a single button, an emergency responder call jump to the next radio given system access to allow wide-range communication of a superseding emergency, such as building structure failure, failure of a fire pump or standpipe system, or other emergency that could cause a change in operational strategies.

24.5.2.1 General

24.5.2.1.1 Non-Interference.

No amplification system capable of operating on frequencies or causing interference on frequencies assigned to the jurisdiction by the FCC shall be installed without prior coordination and approval of the authority having jurisdiction. The building manager/owner shall suspend and correct other equipment installations that degrade the performance of the public safety radio system or public safety radio enhancement system.

24.5.2.1.2 Approval and Permit.

Plans shall be submitted for approval prior to installation. At the end of successful acceptance testing, a renewable permit shall be issued for the public safety radio enhancement system where required by the authority having jurisdiction.

24.5.2.2 Radio Coverage.

Radio coverage shall be provided throughout the building as a percentage of floor area as specified in 24.5.2.2.1 through 24.5.2.2.3.

24.5.2.2.1 Critical Areas.

Critical areas, such as the fire command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets,

sprinkler sectional valve locations, and other areas deemed critical by the authority having jurisdiction, shall be provided with 99 percent floor area radio coverage.

24.5.2.2.2 General Building Areas.

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

24.5.2.2.3 Amplification Components.

Buildings and structures that cannot support the required level of radio coverage shall be equipped with a radiating cable system or a distributed antenna system (DAS) with FCC-certified signal boosters, or both, or with a system that is otherwise approved, to achieve the required adequate radio coverage.

24.5.2.3 Signal Strength.

24.5.2.3.1 Inbound.

A minimum inbound signal strength of -95 dBm, or other signal strength as required by the authority having jurisdiction, shall be provided throughout the coverage area.

24.5.2.3.2 Outbound.

A minimum outbound signal strength of -95 dBm at the donor site, or other signal strength as required by the authority having jurisdiction, shall be provided from the coverage area.

24.5.2.3.3 Isolation.

If a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas and shall be a minimum of 15 dB above the signal booster gain under all operating conditions.

24.5.2.4 * System Radio Frequencies.

The public safety radio enhancement system shall be capable of transmitting all public safety radio frequencies assigned to the jurisdiction and be capable of using any modulation technology.

A.24.5.2.4 - Modulation technologies include analog and digital modulation.

It is important that interoperability be developed and maintained when implementing analog and digital two-way radio systems. The simplest means to gaining a measure of interoperability with analog two-way radio systems is programming into a radio existing, operational channels from agencies that are adjacent to each other geographically and that operate in the same public safety frequency band. To gain interoperability with digital two-way radio systems, systems and devices that are (APCO) Project 25 (P25) compatible can be used. Project 25 is a standard for the manufacturing of interpretable digital two-way wireless communications systems and devices. A P25 radio system provides interoperability, because it incorporates a common air interface and a multi-band excitation vocoder that converts speech into a digital bit stream. P25 defines standard modes of radio operation to enable multi-vendor interoperability such as trunking, encryption, over-the-air rekeying, and so forth. Formally, P25 specifications are defined in the ANSI/TIA/EIA 102 suite of standards. All homeland security funding promotes interoperable communications and recommends adherence to open architecture technologies and P25 standards.

24.5.2.4.1 List of Assigned Frequencies.

The authority having jurisdiction shall maintain a list of all inbound/outbound frequency pairs for distribution to system designers.

24.5.2.4.2 * Frequency Changes.

Systems shall be capable of upgrade, to allow for instances where the jurisdiction changes or adds system frequencies, to maintain radio system coverage as originally designed.

A.24.5.2.4.2 - There is currently an ongoing national effort to eliminate current interference issues between cellular carriers and public safety bands in the 800 MHz band. This effort could revise the actual frequencies for public agencies within this band. The public safety radio enhancement system design should be capable of being changed to accommodate updated frequencies to allow maintenance of the minimum system design criteria.

24.5.2.5 System Components.

24.5.2.5.1 Component Approval.

Components utilized in the installation of the public safety radio enhancement system, such as repeaters, transmitters, receivers, signal boosters, cabling, and fiber-distributed antenna systems, shall be approved and shall be compatible with the public safety radio system.

24.5.2.5.2 Component Enclosures.

All repeater, transmitter, receiver, signal booster components, and battery system components shall be contained in a NEMA 4- or 4X-type enclosure(s).

24.5.2.5.3 External Filters.

Permanent external filters and attachments shall not be permitted.

24.5.2.5.4 Signal Booster Components.

If used, signal boosters shall meet the following requirements, as well as any other requirements determined by the authority having jurisdiction:

* Signal boosters shall have FCC certification prior to installation.

A.24.5.2.5.4(1) - All repeaters, transmitters, receivers, and signal boosters should be installed and operated in a manner consistent with Title 47, CFR. Within these regulations is a mandatory requirement that repeaters, transmitters, and signal boosters have Federal Communications

Commission (FCC) “certification.” Receivers do not normally have a FCC certification requirement but must comply with other applicable FCC regulations. FCC certification is a formal procedure that verifies the equipment meets certain minimum FCC technical specifications. Each brand and model type are issued a distinct FCC certification number. Use of repeaters, transmitters, or signal boosters that do not have an existing FCC-issued certification is a violation of federal law, and users are subject to fine and/or imprisonment. A label displaying the exact FCC certification number must be placed in a visible place on the equipment itself.

All signal boosters shall be compatible with both analog and digital communications simultaneously at the time of installation. The authority having jurisdiction shall provide the maximum acceptable propagation delay standard.

24.5.2.5.5 Power Supplies.

At least two independent and reliable power supplies shall be provided for all repeater, transmitter, receiver, and signal booster components, one primary and one secondary.

24.5.2.5.5.1 Primary Power Source.

The primary power source shall be supplied from a dedicated branch circuit and comply with 10.6.5.1.

24.5.2.5.5.2 * Secondary Power Source.

A.24.5.2.5.5.2 - The battery requirement of 12 hours for the public safety radio enhancement system is purposely longer than the 5-minute performance requirement for general evacuation and the 15-minute performance requirement for emergency voice/alarm communication systems. This is due to the primary mission of these systems, where the fire alarm system's primary mission is to assist fire detection and occupant egress, and the public safety radio enhancement system's primary mission is to assist fire department operations, which might take longer than occupant egress.

The secondary power source shall consist of one of the following:

1. A storage battery dedicated to the system with at least 12 hours of 100 percent system operation capacity and arranged in accordance with 10.6.10.
2. An automatic-starting, engine-driven generator serving the dedicated branch circuit or the system with at least 12 hours of 100 percent system operation capacity and storage batteries dedicated to the system with at least 2 hours of 100 percent system operation capacity and arranged in accordance with 10.6.11.3.

24.5.2.5.5.3 Monitoring Integrity of Power Supplies.

Monitoring the integrity of power supplies shall be in accordance with 10.6.9.

24.5.2.6 System Monitoring.

24.5.2.6.1 Fire Alarm System.

The public safety radio communications enhancement system shall include automatic supervisory and trouble signals for malfunctions of the signal booster(s) and power supply(ies) that are annunciated by the fire alarm system and comply with the following:

1. The integrity of the circuit monitoring signal booster(s) and power supply(ies) shall comply with 10.6.9 and Section 12.6.
2. System and signal booster supervisory signals shall include the following:
 1. Antenna malfunction.
 2. Signal booster failure.
 3. Low-battery capacity indication when 70 percent of the 12-hour operating capacity has been depleted.
 4. Power supply signals shall include the following for each signal booster:
 1. Loss of normal ac power.
 2. Failure of battery charger.

24.5.2.6.2 * Dedicated Panel.

A.24.5.2.6.2 - Due to the longer backup battery requirement for the public safety radio communications enhancement system, it is recognized that the fire alarm system might not be available to provide monitoring of radio system signals, including low-battery signals. Therefore, redundant status annunciation is required to provide local signals to the incident commander or his/her designee at the fire command center.

A dedicated monitoring panel shall be provided within the fire command center 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:

1. Normal ac power.
2. Signal booster trouble.
3. Loss of normal ac power.
4. Failure of battery charger.
5. Low-battery capacity.

24.5.2.7 Technical Criteria.

The authority having jurisdiction shall maintain a document of technical information specific to its requirements, which shall contain, as a minimum, the following:

1. Frequencies required.
2. Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system.
3. Maximum propagation delay (in microseconds).
4. List of specifically approved system components.
5. Other supporting technical information necessary to direct system design.