

NFPA 72, 2010 issue
Sections applicable to In-Building systems

Chapter 10 Fundamentals

10.1 Application.

10.1.1 The basic functions of a complete fire alarm or signaling system shall comply with the requirements of this chapter.

10.1.2 The requirements of this chapter shall apply to systems, equipment, and components addressed in Chapters 12, 14, 17, 18, 21, 23, 24, 26 and 27.

10.2 Purpose. The purpose of fire alarm and signaling systems shall be primarily to provide notification of alarm, supervisory, and trouble conditions; to alert the occupants; to summon aid; and to control emergency control functions.

10.3 Equipment.

10.3.1 Equipment constructed and installed in conformity with this Code shall be listed for the purpose for which it is used.

10.3.2 System components shall be installed, tested, and maintained in accordance with the manufacturer's published instructions and this Code.

10.4 Personnel Qualifications.

10.4.1 System Designer.

10.4.1.1 Fire alarm system and emergency communications system plans and specifications shall be developed in accordance with this Code by persons who are experienced in the proper design, application, installation, and testing of the systems.

10.4.1.2 State or local licensure regulations shall be followed to determine qualified personnel. Depending on state or local licensure regulations, qualified personnel shall include, but not be limited to, one or more of the following:

- (1) Personnel who are registered, licensed, or certified by a state or local authority
- (2) Personnel who are certified by a nationally recognized certification organization acceptable to the authority having jurisdiction
- (3) Personnel who are factory trained and certified for fire alarm system design and emergency communications system design of the specific type and brand of system and who are acceptable to the authority having jurisdiction

10.4.1.3 The system designer shall provide evidence of their qualifications and/or certifications when requested by the authority having jurisdiction.

10.4.1.4 The system designer shall be identified on the system design documents.

10.4.2 System Installer.

10.4.2.1 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 systems.

10.4.2.2 State or local licensure regulations shall be followed to determine qualified personnel. Depending on state or local licensure regulations, qualified personnel shall include, but not be limited to, one or more of the following:

- (1) Personnel who are registered, licensed, or certified by a state or local authority
- (2) Personnel who are certified by a nationally recognized certification organization acceptable to the authority having jurisdiction
- (3) Personnel who are factory trained and certified for fire alarm system installation and emergency communications system installation of the specific type and brand of system and who are acceptable to the authority having jurisdiction

10.4.2.3 The system installer shall provide evidence of their qualifications and/or certifications when requested by the authority having jurisdiction.

10.4.3 Inspection, Testing, and Maintenance Personnel. (SIGTMS)

10.4.3.1* Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of systems addressed within the scope of this Code. Qualified personnel shall include, but not be limited to, one or more of the following:

- (1)*Personnel who are factory trained and certified for the specific type and brand of system being serviced
- (2)*Personnel who are certified by a nationally recognized certification organization acceptable to the authority having jurisdiction
- (3)*Personnel who are registered, licensed, or certified by a state or local authority to perform service on systems addressed within the scope of this Code
- (4) Personnel who are employed and qualified by an organization listed by a nationally recognized testing laboratory for the servicing of systems within the scope of this Code

10.4.3.2 Evidence of qualifications shall be provided to the authority having jurisdiction upon request.

10.5.9.1.1 Batteries shall be marked with the month and year of manufacture using the month/year format.

10.5.9.1.2 Where the battery is not marked with the month/year by the manufacturer, the installer shall obtain the datecode and mark the battery with the month/year of battery manufacture.

10.5.9.2 Location. Storage batteries shall be located so that the equipment, including overcurrent devices, are not adversely affected by battery gases and shall conform to the requirements of *NFPA 70, National Electrical Code*, Article 480.

10.5.9.2.1 Cells shall be suitably insulated against grounds.

10.5.9.2.2 Cells shall be suitably insulated against crosses.

10.5.9.2.3 Cells shall be mounted in such a manner so as to be protected from physical damage.

10.5.9.2.4 Racks shall be suitably protected against deterioration.

10.5.9.2.5 If not located in or adjacent to the control unit, the batteries and their charger location shall be permanently identified at the control unit.

10.5.9.3 Battery Charging.

10.5.9.3.1 Adequate facilities shall be provided to automatically maintain the battery fully charged under all conditions of normal operation.

10.5.9.3.2 Adequate facilities shall be provided to recharge batteries within 48 hours after fully charged batteries have been subject to a single discharge cycle as specified in 10.5.6.3.

10.5.9.3.3 Upon attaining a fully charged condition, the charge rate shall not be so excessive as to result in battery damage.

10.5.9.3.4* Batteries shall be either trickle- or float-charged.

Chapter 24 Emergency Communications Systems (ECS)

24.1 Application.

24.1.1 The application, installation, and performance of emergency communications systems and their components shall comply with the requirements of this chapter.

24.1.2* The requirements of this chapter shall apply to emergency communications systems within buildings and outdoor areas.

24.1.3 The requirements of Chapters 10, 12, 17, 18, 21, 23, 26 and 27 shall also apply, unless they are in conflict with this chapter.

24.1.4 The requirements of Chapter 14 shall apply.

24.3.5.8 Two-way radio communications enhancement systems shall comply with 24.3.5.8.1 and 24.3.5.8.2.

24.3.5.8.1 Where a two-way radio communications enhancement system, exclusive of the antennae, is used in lieu of a two-way in-building wired emergency communications system, it shall have a pathway survivability of Level 2 or Level 3.

24.3.5.1 Pathway survivability levels shall be as described in Section 12.4.

12.2.4* The installation of all pathway wiring, cable, and equipment shall be in accordance with *NFPA 70, National Electrical Code*, and the applicable requirements of 12.2.4.1 through 12.2.4.5. (SIG-FUN)

12.2.4.5* Wiring methods permitted by other sections of this Code to resist attack by fire shall be installed in accordance with manufacturer's published instructions and the requirements of *NFPA 70, Article 760*. (SIG-FUN)

12.4.3 Pathway Survivability Level 2. Pathway survivability Level 2 shall consist of one or more of the following:

- (1) 2-hour fire-rated circuit integrity (CI) cable
- (2) 2-hour fire-rated cable system [electrical circuit protective system(s)]
- (3) 2-hour fire-rated enclosure or protected area
- (4) 2-hour performance alternatives approved by the authority having jurisdiction

12.4.4 Pathway Survivability Level 3. Pathway survivability Level 3 shall consist of pathways in buildings that are fully protected by an automatic sprinkler system in accordance with *NFPA 13, Standard for the Installation of Sprinkler Systems*, and one or more of the following:

- (1) 2-hour fire rated circuit integrity (CI) cable
- (2) 2-hour fire rated cable system (electrical circuit protective system(s))
- (3) 2-hour fire rated enclosure or protected area
- (4) 2-hour performance alternatives approved by the authority having jurisdiction

24.3.5.8.2 Where a two-way radio communications enhancement system is used in lieu of a two-way in-building wired emergency communications system, the design of the system shall be approved by the authority having jurisdiction.

24.5.2* Two-Way Radio Communications Enhancement Systems.

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 conclusion 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 emergency 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, in order 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.

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, in order to maintain radio system coverage as originally designed.

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, and signal booster 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:

(1)*Signal boosters shall have FCC certification prior to installation.

(2) 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.

24.5.2.6 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 10.17.1. *[see page 4]*

(2) System and signal booster supervisory signals shall include the following:

- (a) Antenna malfunction
- (b) Signal booster failure

(3) Power supply supervisory signals shall include the following for each signal booster:

- (a) Loss of normal ac power
- (b) Failure of battery charger
- (c) Low-battery capacity, alarming at 70 percent of battery capacity

24.5.2.6.2* Dedicated Panel. A dedicated monitoring panel shall be provided within the emergency 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. This document 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

24.5.2.8 Inspection and Testing. Inspection and testing shall be performed in accordance with testing frequencies and methods in Chapter 14. [see page 5]

(end of this section)

10.17 Monitoring Integrity.

10.17.1* Monitoring Integrity of Installation Conductors and Other Signaling Channels.

10.17.1.1 Unless otherwise permitted or required by 10.17.1.3 through 10.17.1.14, all means of interconnecting equipment, devices, and appliances and wiring connections shall be monitored for the integrity of the interconnecting conductors or equivalent path so that the occurrence of a single open or a single ground fault condition in the installation conductors or other signaling channels is automatically indicated within 200 seconds.

10.17.1.2 Unless otherwise permitted or required by 10.17.1.3 through 10.17.1.14, all means of interconnecting equipment, devices, and appliances and wiring connections shall be monitored for the integrity of the interconnecting conductors or equivalent path so that the restoration to normal of a single open or a single ground-fault condition in the installation conductors or other signaling channels is automatically indicated within 200 seconds.

Comment: If compliant with 10.17.1.1 and 10.17.1.2, there is no need to use any exception listed between 10.17.1.3 and 10.17.1.14.

10.17.1.3 Shorts between conductors shall not be required to be monitored for integrity, unless required by 10.17.1.18, 10.17.1.19 and 10.17.2.2.

10.17.1.4 Monitoring for integrity shall not be required for a noninterfering shunt circuit, provided that a fault circuit condition on the shunt circuit wiring results only in the loss of the noninterfering feature of operation.

10.17.1.5 Monitoring for integrity shall not be required for connections to and between supplementary system components, provided that single open, ground, or short-circuit conditions of the supplementary equipment or interconnecting means, or both, do not affect the required operation of the fire alarm system.

10.17.1.6 Monitoring for integrity shall not be required for the circuit of an alarm notification appliance installed in the same room with the central control

equipment, provided that the notification appliance circuit conductors are installed in conduit or are equivalently protected against mechanical injury.

10.17.1.7 Monitoring for integrity shall not be required for a trouble signal circuit.

10.17.1.8* Monitoring for integrity shall not be required for the interconnection between listed equipment within a common enclosure.

10.17.1.9 Monitoring for integrity shall not be required for the interconnection between enclosures containing control equipment located within 20 ft (6 m) of each other where the conductors are installed in conduit or equivalently protected against mechanical injury.

10.17.1.10 Monitoring for integrity shall not be required for the conductors for ground detection where a single ground does not prevent the required normal operation of the system.

10.17.1.11 Monitoring for integrity shall not be required for central station circuits serving notification appliances within a central station.

10.17.1.12 Monitoring for integrity shall not be required for pneumatic rate-of-rise systems of the continuous line type in which the wiring terminals of such devices are connected in multiple across electrically supervised circuits.

10.17.1.13 Monitoring for integrity shall not be required for the interconnecting wiring of a stationary computer and the computer's keyboard, video monitor, mouse-type device, or touch screen, as long as the interconnecting wiring does not exceed 8 ft (2.4 m) in length; is a listed computer/data processing cable as permitted by *NFPA70, National Electrical Code*; and failure of cable does not cause the failure of the required system functions not initiated from the keyboard, mouse, or touch screen.

10.17.1.14 Monitoring for integrity of the installation conductors for a ground-fault condition shall not be required for the communications and transmission channels extending from a supervising station to a subsidiary station(s) or protected premises, or both, that comply with the requirements of Chapter 26 and are electrically isolated from the fire alarm system (or circuits) by a transmitter(s), provided that a single ground condition does not affect the required operation of the fire alarm system.

Chapter 14 Inspection, Testing, and Maintenance

Note: Due to the length of this section, only items that are required for emergency radio systems are listed here.

14.1 Application.

14.1.1 The inspection, testing, and maintenance of systems, their initiating devices, and notification appliances shall comply with the requirements of this chapter.

14.1.3 Procedures that are required by other parties and that exceed the requirements of this chapter shall be permitted.

14.1.4 The requirements of this chapter shall apply to both new and existing systems.

14.2 General.

14.2.1 Performance.

14.2.1.1 Performance Verification. To ensure operational integrity, the system shall have an inspection, testing, and maintenance program.

14.2.1.1.1 Inspection, testing, and maintenance programs shall satisfy the requirements of this Code and conform to the equipment manufacturer’s published instructions.

14.2.1.1.2 Inspection, testing, and maintenance programs shall verify correct operation of the system.

14.2.1.2 Impairments.

14.2.1.2.1 The requirements of Section 10.19 shall be applicable when a system is impaired. [See below]

10.19* Impairments.

10.19.1 *The system owner or their designated representative shall be notified when a fire alarm system or part thereof is impaired. Impairments to systems shall include out-of-service events.*

10.19.2 *A record shall be maintained by the system owner or designated representative for a period of 1 year from the date the impairment is corrected.*

10.19.3* *Where required, mitigating measures acceptable to the authority having jurisdiction shall be implemented for the period that the system is impaired.*

10.19.4 *The system owner or owner’s designated representative shall be notified when an impairment period is completed or discontinued.*

14.2.1.2.2 System defects and malfunctions shall be corrected.

14.2.1.2.3 If a defect or malfunction is not corrected at the conclusion of system inspection, testing, or maintenance, the system owner or the owner's designated representative shall be informed of the impairment in writing within 24 hours.

14.2.2 Responsibilities.

4.2.2.1* The property or building or system owner or the owner's designated representative shall be responsible for inspection, testing, and maintenance of the system and for alterations or additions to this system.

14.2.2.2 The delegation of responsibility shall be in writing, with a copy of such delegation provided to the authority having jurisdiction upon request.

14.2.2.3 Inspection, testing, or maintenance shall be permitted to be done by the building or system owner or a person or organization other than the building or system owner if conducted under a written contract.

14.2.2.5* Service Personnel Qualifications and Experience.

Service personnel shall be qualified and experienced in accordance with the requirements of 10.4.3. [See below]

10.14.3 Initiating Devices.

10.14.3.1 *Initiating devices of the manual or automatic type shall be selected and installed so as to minimize nuisance alarms.*

End of this section.

Table 14.3.1 Visual Inspection Frequencies

3. Batteries

(d) Sealed lead-acid: Initial/Reacceptance and Annually

Table 14.4.2.2 Test Methods

5. Batteries—general tests Prior to conducting any battery testing, the person conducting the test shall ensure that all system software stored in volatile memory is protected from loss.

(a) Visual inspection: Batteries shall be inspected for corrosion or leakage. Tightness of connections shall be checked and ensured. If necessary, battery terminals or connections shall be cleaned and coated. Electrolyte level in lead-acid batteries shall be visually inspected.

(b) Battery replacement: Batteries shall be replaced in accordance with the recommendations of the alarm equipment manufacturer or when the recharged battery voltage or current falls below the manufacturer's recommendations.

(c) Charger test: Operation of battery charger shall be checked in accordance with charger test for the specific type of battery.

(d) Discharge test: With the battery charger disconnected, the batteries shall be load tested following the manufacturer's recommendations. The voltage level shall not fall below the levels specified.

Exception: An artificial load equal to the full fire alarm load connected to the battery shall be permitted to be used in conducting this test.

(e) Load voltage test: With the battery charger disconnected, the terminal voltage shall be measured while supplying the maximum load required by its application. The voltage level shall not fall below the levels specified for the specific type of battery. If the voltage falls below the level specified, corrective action shall be taken and the batteries shall be retested.

Exception: An artificial load equal to the full fire alarm load connected to the battery shall be permitted to be used in conducting this test.

6. Battery tests (specific types)

(d) Sealed lead-acid type

(1) Charger test With the batteries fully charged and connected to the charger, the voltage across the batteries shall be measured with a voltmeter. The voltage shall be 2.30 volts per cell ± 0.02 volts at 77°C `` (25°C) or as specified by the equipment manufacturer.

(2) Load voltage test Under load, the battery shall perform in accordance with the battery manufacturer's specifications.

14.4.5* Testing Frequency. Unless otherwise permitted by other sections of this Code, testing shall be performed in accordance with the schedules in Table 14.4.5, or more often if required by the authority having jurisdiction.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs

A.14.4.12 In-building emergency radio communication systems where the ac power source is monitored for integrity should be tested annually. Systems where the ac power source is not monitored for integrity should be tested quarterly.

A.14.4.12.1.3 Testing procedures typically are done on a grid system. A grid is overlaid onto a floor area to provide 20 grid cells. Grid cells are provided with definite minimum and maximum dimensions. For most buildings, using a minimum grid dimension of 20 ft (6.1 m) and a maximum grid dimension of 80 ft (24.4 m) will suffice to encompass the entire floor area. Where a floor exceeds 128,000 ft² (11,890 m²), which is the floor area that can be covered by the maximum grid dimension of 80 ft (24.4 m), it is recommended that the floor be subdivided into sectors, each having an area of less than or equal to 128,000 ft² (11,890 m²), and that each sector be tested individually with 20 grid cells in each sector. Signal strength measurements should be taken at the center of each grid and should be performed using standardized parameters as specified in A.14.4.12.1.4. Signal strength typically is recorded on the delivered audio quality (DAQ) scale. This scale is a universal standard often cited in system designs and specifications, using the following measures:

- (1) DAQ 1: Unusable speech present but unreadable.
- (2) DAQ 2: Understandable with considerable effort. Frequent repetition due to noise/distortion.
- (3) DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
- (4) DAQ 3.5: Speech understandable with repetition only rarely required. Some noise/distortion.
- (5) DAQ 4: Speech easily understood. Occasional noise/distortion.
- (6) DAQ 4.5: Speech easily understood. Infrequent noise/distortion.
- (7) DAQ 5: Speech easily understood.

The minimum allowable DAQ for each grid cell typically is DAQ 3.

Not more than two nonadjacent grid cells should be allowed to fail the test. In the event that three of the areas fail the test, or if two adjacent areas fail the test, in order to be more statistically accurate, the testing grid resolution should be doubled. This would require decreasing the size to one-half the dimension used in the failed test to a minimum of 10 ft (3.0 m) and a maximum of 40 ft (12.2 m). Further, to cover the same floor area, the number of grids is quadrupled to 80. Not more than eight nonadjacent or five adjacent grid cells should then be allowed to fail the test. In the event that nine or more nonadjacent and/or six or more adjacent grid cells fail the test, consideration should be given to redesigning and reinstalling the public safety radio enhancement system to meet the minimum system design requirements. Failures should not be allowed in critical areas. Measurements should be made with the antenna held in a vertical position at (3 ft to 4 ft) [0.91 m to 1.22 m] above the floor. The DAQ readings should be recorded on small-scale drawings that are used for testing with the authority having jurisdiction. In addition, the gain values of all amplifiers should be measured, and the test measurement results should be kept on file with the building owner so that the measurements can be verified each year during annual tests.

A.14.4.12.1.4 Downlink measurements should be made with the following standardized parameters:

- (1) A calibrated spectrum analyzer, or a calibrated automatic signal level measurement recording system
- (2) Receiving antennas of equal gain to the agency's standard portable radio antenna, oriented vertically, with a centerline between 3 ft and 4 ft above floor
- (3) A resolution bandwidth nearest the bandwidth of the channel under test
- (4) Levels recorded while walking an "X" pattern, with the center of the pattern located approximately in the center of each grid area
- (5) The linear distance of each side of the "X" equal to at least 10 percent of the length of the grid's side, and a minimum length of 10 ft (3.0 m)
- (6) Measurement sampled in averaging mode to include a minimum of one sample per each 5 ft (1.52 m) traveled, recorded with not less than five samples per measurement recorded per side of the "X"

A.14.4.12.1.5 Typically, acceptance tests are required by the authority having jurisdiction prior to building occupancy. As built drawings should be provided along with other information required from the signal level and commissioning tests, including a full report with grid locations, DAQ measurements, and amplifier gain values should be provided at the acceptance test. The acceptance test typically entails a random test by the authority having jurisdiction of radio communication in various portions of the building, especially including the critical areas. The authority having jurisdiction can review any test documentation and ensure that the findings of the commissioning test with respect to DAQ levels and gain values are supported by the acceptance test. If amplification systems are utilized in the public safety radio enhancement system, a spectrum analyzer should be utilized to ensure spurious oscillations are not being generated or unauthorized carriers are being repeated in violation of FCC regulations. This testing should be conducted at time of installation and during subsequent inspections. Downlink and uplink spectrum should be recorded with a maximum-hold screen capture at the active system air interfaces, with the system under normal load and at least one uplink carrier active on the indoor portion of the system. Measurements should be analyzed for correct gains on both uplink and downlink paths, noise floor elevation from active components, intermodulation, and other parameters determined necessary by the authority having jurisdiction.

Gain values of all amplifiers should be measured and the results kept on file with the building owner and the authority having jurisdiction. In the event that the measurement results become lost, the building owner will need to repeat the acceptance test to reestablish the gain values.

A.14.4.12.1.6 Typically, annual tests require several items to be checked. Annual tests should include all procedures encompassed in 14.4.12.1.1 through 14.4.12.1.4. Signal boosters should be tested to ensure that the gain is the same as it was upon initial installation and acceptance. Backup batteries and power

supplies should be tested under load for a period of 1 hour to verify that they will properly operate during an actual power outage. Other active components are typically checked to determine that they are operating within the manufacturer's specifications for the intended purpose.

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 each individual 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 in order 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.

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.

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 in order to allow maintenance of the minimum system design criteria.

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 is 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. FCC certification verification can be obtained from any FCC office or online (<https://fjallfoss.fcc.gov/oetcf/eas/reports/genericsearch.cfm>).

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 emergency command center.

A.24.5.3 “Areas of refuge” or “areas of rescue assistance” are areas that have direct access to an exit, where people who are unable to use stairs can remain temporarily in safety to await further instructions or assistance during emergency evacuation or other emergency situation. It is, therefore, important that a method to communicate between that location and a central control point where appropriate action for assistance be initiated.

A.24.5.3.1 Generally, the building code or engineer specification will provide the specifics on the required locations of the remote area of refuge (area of rescue assistance) stations, as well as the central control point.

=====
=====

Annex F Sample Ordinance Adopting *NFPA 72*

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

F.1 The following sample ordinance is provided to assist a jurisdiction in the adoption of this Code and is not part of this Code.

ORDINANCE NO. _____

An ordinance of the *[jurisdiction]* adopting the 2010 edition of *NFPA 72®*, *National Fire Alarm and Signaling Code*, and documents listed in Chapter 2 of that Code; prescribing regulations governing conditions hazardous to life and property from fire or explosion; providing for the issuance of permits and collection of fees; repealing Ordinance No. _____ of the *[jurisdiction]* and all other ordinances and parts of ordinances in conflict therewith; providing a penalty; providing a severability clause; and providing for publication; and providing an effective date.

BE IT ORDAINED BY THE *[governing body]* OF THE *[jurisdiction]*:

SECTION 1 That the *NFPA 72, National Fire Alarm and Signaling Code*, and documents adopted by Chapter 2, three (3) copies of which are on file and are open to inspection by the public in the office of the *[jurisdiction's keeper of records]* of the *[jurisdiction]*, are hereby adopted and incorporated into this ordinance as fully as if set out at length herein, and from the date on which this ordinance shall take effect, the provisions thereof shall be controlling within the limits of the *[jurisdiction]*.

The same are hereby adopted as the Code of the *[jurisdiction]* for the purpose of prescribing regulations governing conditions hazardous to life and property from fire or explosion and providing for issuance of permits and collection of fees.

SECTION 2 Any person who shall violate any provision of this code or standard hereby adopted or fail to comply therewith; or who shall violate or fail to comply with any order made thereunder; or who shall build in violation of any detailed statement of specifications or plans submitted and approved thereunder; or fail to operate in accordance with any certificate or permit issued thereunder; and from which no appeal has been taken; or who shall fail to comply with such an order as affirmed or modified by a court of competent jurisdiction, within the time fixed herein, shall severally for each and every such violation and noncompliance, respectively, be guilty of a misdemeanor, punishable by a fine of not less than \$ _____ nor more than \$ _____ or by imprisonment for not less than _____ days nor more than _____ days or by both such fine and imprisonment. The imposition of one penalty for any violation shall not excuse the violation or permit it to continue; and all such persons shall be required to correct or remedy such violations or defects within a reasonable time; and when not otherwise specified the application of the above penalty shall not be held to prevent the enforced removal of prohibited conditions. Each day that prohibited conditions are maintained shall constitute a separate offense.

SECTION 3 Additions, insertions, and changes — that the 2010 edition of *NFPA 72, National Fire Alarm and Signaling Code* is amended and changed in the following respects:

List Amendments

SECTION 4 That ordinance No. _____ of *[jurisdiction]* entitled *[fill in the title of the ordinance or ordinances in effect at the present time]* and all other ordinances or parts of ordinances in conflict herewith are hereby repealed.

SECTION 5 That if any section, subsection, sentence, clause, or phrase of this ordinance is, for any reason, held to be invalid or unconstitutional, such decision shall not affect the validity or constitutionality of the remaining portions of this ordinance. The *[governing body]* hereby declares that it would have passed this ordinance, and each section, subsection, clause, or phrase hereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, and phrases be declared unconstitutional.

SECTION 6 That the *[jurisdiction's keeper of records]* is hereby ordered and directed to cause this ordinance to be published.

[NOTE: An additional provision may be required to direct the number of times the ordinance is to be published and to specify that it is to be in a newspaper in general circulation. Posting may also be required.]

SECTION 7 That this ordinance and the rules, regulations, provisions, requirements, orders, and matters established and adopted hereby shall take effect and be in full force and effect *[time period]* from and after the date of its final passage and adoption.