



Technical Bulletin #18-003
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Emergency Responder Radio Coverage

Referenced Codes and Standards: OAC § 1301:7-7-05(J); OFC § 510 *et. seq.*
OAC § 1301:7-7-11(C)(2); OFC § 1103.2
OAC § 1301:7-7-01(E)(7)(a); OFC § 105.7.1
OAC § 1301:7-7-01(E)(7)(e); OFC § 105.7.5
OAC § 1301:7-7-06(D); OFC § 604
FCC 47 CFR Part 90.219 (2007)

Although the 2011 Ohio Fire Code contained some basic provisions regarding emergency responder radio coverage, the provisions have been extensively amended in the 2017 Ohio Fire Code (OFC). The new provisions add additional language to the previously existing provisions and affect both new and existing buildings that are required to have emergency responder radio coverage. Provisions regarding radio coverage for new buildings is still contained in OFC § 510. Language regarding existing buildings has also been amended and is located at OFC § 1103.2. These provisions became effective on December 15, 2017. This bulletin is intended to provide general guidance regarding the new requirements and to help educate those affected by these new provisions.

I. Emergency Responder Radio Coverage in Existing Buildings

New language in OFC § 510 states that existing buildings must be provided with coverage as set forth in Rule 11. New language in Rule 11 (now “Construction Requirements for Existing Buildings”) was added to require that existing buildings that do not have approved radio coverage be equipped with coverage in one of two ways. (See OFC § 1103.2.) However, as is always the case with new provisions of the OFC, these new provisions are subject to Rule 1 of the OFC and will not apply retroactively to already existing buildings unless the building or system is altered after the effective date of the new provisions (December 15, 2017) or unless specific language is added to say that the new provisions are retroactive. Here, no such language was added. Therefore, the new provisions in Rule 11 requiring emergency responder radio coverage in existing buildings will not apply to an existing building unless the building or system is altered or unless the fire code official determines that the system is inadequate and as a result of that inadequacy a distinct hazard exists.

If the coverage system in an existing building is altered or if the fire code official does determine – by a preponderance of the evidence – that a distinct hazard exists, then adequate coverage may be required by the fire code official. If coverage is required, OFC § 1103.2 states that coverage for existing buildings must happen in one of two ways:

- 1) If an existing wired communication system is being replaced or cannot be repaired, or where the system is not approved, coverage must be provided in accordance with OFC § 510.1, Exception 1. OFC § 510.1, Exception 1 allows for a wired communication system in lieu of an approved radio coverage system.
- 2) If an existing building does not have adequate radio coverage it must be equipped with coverage within a timeframe established by the adopting authority.

When an emergency responder radio coverage system is required in an existing building, the system must meet the new requirements for coverage as discussed below.

II. Emergency Responder Radio Coverage in New Buildings

As in the 2011 OFC, the 2017 OFC retains language that requires new buildings to have approved radio coverage for emergency responders within buildings based on the existing coverage levels of the public safety communication system of the jurisdiction at the exterior of the building. The two prior exceptions are the same as well: Exception 1 allows for a wired communication system in lieu of an approved radio coverage system; and Exception 2 authorizes no system when the fire code official determines that the system is not needed. However, in the 2017 OFC, a third exception has been added to the requirement for approved radio coverage. New Exception 3 gives the local fire code official the authority to accept an automatically activated emergency responder radio coverage system in cases where the otherwise required system or its components or equipment could have a negative impact on the normal operations of the facility.

Absent one of these three exceptions, all new buildings are required to have approved radio coverage for emergency responders within the building based on the existing coverage levels of the public safety communication system of the jurisdiction at the exterior of the building. When making a determination regarding what will be required, the local fire code official should keep in mind that the ultimate goal is to provide a mechanism for first responders to communicate when on scene. Sometimes the solution will be for building owners to work with local fire code officials to help improve performance of the emergency radio system to achieve required coverage. Fire code officials should look at all available options and technology when determining what coverage and equipment will be required in any particular situation.

III. Permits

OFC § 510.3 now provides for a permit for the installation and modification to any emergency responder radio coverage system and its related equipment as set forth in OFC Rule 1. Rule 1 authorizes the local fire code official to require a construction permit for emergency responder radio systems. See OFC § 105.7.5. Therefore, if local fire code officials opt to have a permitting program and require a construction permit for radio systems, no one can install or modify an emergency responder radio coverage system or its related equipment without first obtaining a permit from the local fire code official.

Please note: Maintenance is not considered a modification of the system and no permit is required under the OFC for maintenance performed on the system in accordance with the OFC. See OFC § 105.7.1. Likewise, local fire code officials are not authorized under the OFC to require a permit for routine maintenance on radio systems.

IV. Technical Requirements

OFC § 510.5 sets forth the technical requirements that all emergency responder radio coverage systems must meet. These include all of the following.

A. Signal Strength

Language regarding signal strength was not extensively changed. Other than the minimum signal strength received when transmitted from within the building changing from -100 dBm to -95 dBm, signal strength levels remain the same. Therefore, the minimum signal strength into and out of the building are now both -95 dBm. Coverage is considered acceptable if 95 percent of the signal strength measurements in all areas on each floor of the building meet the -95 dBm signal strength requirement.

B. System Design

New 2017 OFC provisions require all emergency responder radio coverage systems to meet certain basic requirements.

First, any building or structure that cannot support the required level of radio coverage must have an amplification system to meet the required adequate radio coverage. The amplification system can be either a radiating cable system, a distributed antenna system with Federal Communications Commission (FCC)-certified signal boosters, or another system approved by the fire code official.

Second, emergency responder radio coverage systems must have standby power. (See OFC § 604 for standby power system requirements.) The standby power supply must be capable of operating the radio coverage system for at least 24-hours.

Third, if signal boosters are used with a radio coverage system, all signal booster components and all battery systems used for the emergency power source must be contained in a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet. In addition, the signal booster system and the battery system must either be electrically supervised and monitored or must sound an audible signal at a constantly monitored location. However, the fire code official must approve the use of an audible signal at a constantly monitored location. If the fire code official does not approve this option, the signal booster and battery systems must be electrically supervised and monitored. All signal booster equipment must also have FCC certification prior to installation.

Finally, all emergency responder radio coverage systems must be capable of modification or expansion. This requirement will enable the system to adapt to frequency changes or additions required or made by the FCC.

In addition to the above technical requirements for the system, new OFC provisions also require fire code officials to maintain specific technical information and requirements for radio coverage systems. The fire code official must maintain documentation that includes the various frequencies required, the location of radio sites, effective radiated power of radio sites, and other supporting technical information.

V. Installation Requirements

New installation requirements for radio coverage systems are set forth in OFC § 510.5.

A. Approval Prior to Install

If an amplification system is capable of operating on a frequency that is licensed to a public service agency by the FCC, it cannot be installed without prior coordination and approval of the fire code official.

B. Minimum Qualifications for systems designers / lead install personnel

New code provisions set forth the qualifications that all radio coverage system designers and lead installation personnel must have. First, the individual must have a valid FCC-issued radio operators license. Second, the individual must have certification of in-building system training issued by a nationally recognized organization or school or have a certificate issued by the equipment manufacturer. Unless the individual demonstrates adequate skill and experience that is satisfactory to the fire code official they must meet both of the above qualifications. If they do demonstrate adequate skill and experience to the satisfaction of the fire code official they will not have to meet the requirements.

C. Acceptance Testing Procedures

New provisions in the OFC (as section 510.5.3) set forth procedures that must be followed for **acceptance testing**. When an acceptance test is performed, each floor will be divided into a grid of 20 test squares. The squares must all be approximately the same size. A 'test location' within each square or area shall be selected and the test shall be conducted from that selected location. The test location must be in the approximate center of the test area. A calibrated portable radio of the latest brand and model used by the agency talking through the system must be used and the radio shall be enabled to verify two-way communication to and from the outside of the building through the public agency's radio communication system. If more than two non-adjacent test squares fail this test, it will result in failure of the test.

However, if three test squares fail, the floor can be divided into 40 approximately equal test squares and the test reconducted. The squares must all be approximately the same size. A 'test location' within each square or area shall be selected and the test shall be conducted from that selected location. The test location must be in the approximate center of the test area. A calibrated portable radio of the latest brand and model used by the agency talking through the system must be used and the radio shall be enabled to verify two-way communication to and from the outside of the building through the public agency's radio communication system. If, under the 40-grid test, more than four non-adjacent test areas fail it shall result in a failure of the system and the system must be altered to meet the 90 percent coverage requirements.

In either the 20 or 40 square grid test, once the squares or test areas have been established and a test location selected within that square or area the location represents that entire test area. Failure from that test location will result in a failure of that test area; additional testing locations cannot be selected

A spectrum analyzer or other suitable test equipment must be used for the acceptance test and the test must be conducted as a part of the installation. When the test is performed, the gain values of all amplifiers shall be measured. The measurement results must be kept on file with the building owner for later verification during annual testing. If the results are lost, the building owner must have the acceptance test rerun to reestablish the gain values.

D. FCC Compliance

In addition to the requirements set forth in the OFC, all emergency responder radio coverage system installations and components must also comply with applicable federal regulations. This includes, but is not limited to, compliance with FCC 47 CFR Part 90.219 (2007).

VI. **Maintenance**

Maintenance and testing requirements are set forth in OFC § 510.6.

A. Annual Testing

All emergency responder radio coverage systems must be inspected and tested annually. They must also be inspected and tested when structural changes occur, including additions or remodels that could materially change the original field performance tests. This annual testing (or testing subsequent to a building alteration) must include all of the following:

- In-building coverage tests (i.e., the 20/40 grid tests discussed above in Section IV, C) must be performed.
- Signal boosters must be tested to verify that the gain is the same as it was upon initial installation and acceptance.

- Backup batteries and power supplies must be tested under load for a period of one hour to verify that they will properly operate during an actual power outage. If within the one-hour test period the battery exhibits symptoms of failure, the test must be extended for additional one-hour periods until the integrity of the battery can be determined.
- All other active components of the system must be checked to verify operation within the manufacturer's specifications.

A report must be generated at the end of the testing and must verify compliance with the 20/40 grid testing procedures outlined above. The report must be submitted to the fire code official.

B. Additional Frequencies

If the FCC requires frequency changes or makes additional frequencies available, the building owner must modify or expand the emergency responder radio coverage system (at their expense) as necessary to ensure coverage. Prior approval of the system on a previous frequency is irrelevant.

C. Field Testing

Agency personnel may conduct field testing of a radio coverage system to verify the required level of coverage. The OFC gives personnel the authority to enter onto property for this purpose; however, the field testing must be done at a reasonable time.

This Technical Bulletin is intended only as an informational tool. Affected individuals and code enforcement officials should consult their legal advisor to determine specific requirements, their applicability, and courses of action that should be taken to ensure compliance with all applicable requirements and standards.

1301:7-7-05 Fire Service Features

(J) Section 510 Emergency responder radio coverage

510.1 Emergency responder radio coverage in new buildings. All new buildings shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building. This *paragraph* shall not require improvement of the existing public safety communication systems.

Exceptions:

1. Where approved by the building official and the fire code official, a wired communication system in accordance with *paragraph* (G)(2)(m)(ii)(907.2.13.2) of rule 1301:7-7-09 of the Administrative Code shall be permitted to be installed or maintained in lieu of an approved radio coverage system.
2. Where it is determined by the fire code official that the radio coverage system is not needed.
3. In facilities where emergency responder radio coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the fire code official shall have the authority to accept an automatically activated emergency responder radio coverage system.

510.2 Emergency responder radio coverage in existing buildings. Existing buildings shall be provided with approved radio coverage for emergency responders as required in rule 1301:7-7-11 of the Administrative Code.

510.3 Permit required. A construction permit for the installation of or modification to emergency responder radio coverage systems and related equipment is required as specified in *paragraph* (E)(7)(e)(105.7.5) of rule 1301:7-7-01 of the Administrative Code. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.

510.4 Technical requirements. Systems, components and equipment required to provide emergency responder radio coverage system shall comply with *paragraphs* (J)(4)(a)(510.4.1) to (J)(4)(b)(v)(510.4.2.5) of this rule.

510.4.1 Radio signal strength. The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95 per cent of all areas on each floor of the building meet the signal strength requirements in *paragraphs* (J)(4)(a)(i)(510.4.1.1) and (J)(4)(a)(ii)(510.4.1.2) of this rule.

510.4.1.1 Minimum signal strength into the building. A minimum signal strength of -95 dBm shall be receivable within the building.

510.4.1.2 Minimum signal strength out of the building. A minimum signal strength of -95 dBm shall be received by the agency's radio system when transmitted from within the building.

510.4.2 System design. The emergency responder radio coverage system shall be designed in accordance with *paragraphs* (J)(4)(b)(i)(510.4.2.1) to (J)(4)(b)(v)(510.4.2.5) of this rule.

510.4.2.1 Amplification systems allowed. Buildings and structures that cannot support the required level of radio coverage shall be equipped with a radiating cable system, a distributed antenna system with "Federal Communications Commission" ("FCC")-certified signal boosters, or other system approved by the fire code official in order to achieve the required adequate radio coverage.

510.4.2.2 Technical criteria. The fire code official shall maintain a document providing the specific technical information and requirements for the emergency responder radio coverage system. This document shall contain, but not be limited to, the various frequencies required, the location of radio sites, effective radiated power of radio sites, and other supporting technical information.

510.4.2.3 Standby power. Emergency responder radio coverage systems shall be provided with standby power in accordance with *paragraph* (D)(604) of rule 1301:7-7-06 of the Administrative Code. The standby power supply shall be capable of operating the emergency responder radio coverage system for a duration of not less than 24 hours.

510.4.2.4 Signal booster requirements. If used, signal boosters shall meet the following requirements:

(a) All signal booster components shall be contained in a "National Electrical Manufacturer's Association" ("NEMA") 4-type waterproof cabinet.

(b) Battery systems used for the emergency power source shall be contained in a "NEMA" 4-type waterproof cabinet.

(c) The signal booster system and battery system shall be electrically supervised and

monitored by a supervisory service, or when approved by the fire code official, shall sound an audible signal at a constantly attended location.

(d) Equipment shall have “FCC” certification prior to installation.

510.4.2.5 Additional frequencies and change of frequencies. The emergency responder radio coverage system shall be capable of modification or expansion in the event frequency changes are required by the “FCC” or additional frequencies are made available by the “FCC.”

510.5 Installation requirements. The installation of the public safety radio coverage system shall be in accordance with *paragraphs (J)(5)(a)(510.5.1) to (J)(5)(d)(510.5.4) of this rule.*

510.5.1 Approval prior to installation. Amplification systems capable of operating on frequencies licensed to any public safety agency by the “FCC” shall not be installed without prior coordination and approval of the fire code official.

510.5.2 Minimum qualifications of personnel. The minimum qualifications of the system designer and lead installation personnel shall include both of the following:

(i) A valid FCC-issued general radio operators license.

(ii) Certification of in-building system training issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.

These qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the fire code official is provided.

510.5.3 Acceptance test procedure. Where an emergency responder radio coverage system is required, and upon completion of installation, the building owner shall have the radio system tested to verify that two-way coverage on each floor of the building is not less than 90 per cent. The test procedure shall be conducted as follows:

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

(ii) 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.

(iii) Failure of more than two nonadjacent test areas shall result in failure of the test.

(iv) In the event that three of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of more than four nonadjacent test areas shall result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 90 per cent coverage requirement.

(v) 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. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.

(vi) The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.

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

510.5.4 “FCC” compliance. The emergency responder radio coverage system installation and components shall also comply with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219 as listed in rule 1301:7-7-80 of the Administrative Code.

510.6 Maintenance. The emergency responder radio coverage system shall be maintained operational at all times in accordance with *paragraphs (J)(6)(a)(510.6.1) to (J)(6)(c)(510.6.3) of this rule.*

510.6.1 Testing and proof of compliance. The emergency responder radio coverage system shall be inspected and tested annually or where structural changes occur including additions or remodels that could materially change the original field performance tests. Testing shall consist of the following:

(i) In-building coverage test as described in *paragraph (J)(5)(c)(510.5.3) of this rule.*

(ii) Signal boosters shall be tested to verify that the gain is the same as it was upon initial installation and acceptance.

(iii) Backup batteries and power supplies shall be tested under load of a period of 1 hour to verify that they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.

(iv) Other active components shall be checked to verify operation within the manufacturer's specifications.

(v) At the conclusion of the testing, a report, which shall verify compliance with *paragraph (J)(5)(c)(510.5.3) of this rule,* shall be submitted to the fire code official.

510.6.2 Additional frequencies. The building owner shall modify or expand the emergency responder radio coverage system at his or her expense in the event frequency changes are required by the "FCC" or additional frequencies are made available by the "FCC." Prior approval of the public safety radio coverage system on previous frequencies does not exempt this *paragraph.*

510.6.3 Field testing. Agency personnel shall have the right to enter onto the property at any reasonable time to conduct field testing to verify the required level of radio coverage.

1301:7-7-11 Construction Requirements for Existing Buildings

(C) Section 1103 Fire safety requirements for existing buildings

1103.2 Emergency responder radio coverage in existing buildings. Existing buildings that do not have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building, shall be equipped with such coverage according to one of the following:

(a) Where an existing wired communication system cannot be repaired or is being replaced, or where not approved in accordance with *paragraph (J)(1)(510.1), exception 1 of rule 1301:7-7-05 of the Administrative Code.*

(b) Within a time-frame established by the adopting authority.

Exception: Where it is determined by the fire code official that the radio coverage system is not needed.