

# **Sterling Fire Department**

## ***Specification and Requirements for Emergency Responder Radio Coverage in Buildings***

*10/1/2020*

The Sterling Fire Department has developed this specification in conjunction with the requirements of the Massachusetts Comprehensive Fire Code 527 CMR 1 and Massachusetts State Building Code 780 CMR.

The installation and operation of emergency responder radio communication systems must comply with this document.

Property owners who maintain compliance with this specification are granted permission to operate the signal boosters on frequencies licensed to the Town of Sterling Fire and Police Departments by the Federal Communications Commission.

Failure to maintain compliance with this specification will result in the automatic withdrawal of said permissions.

Prior to the construction of an Emergency Responder Communication System, a permit must be applied for and submitted to:

**Sterling Fire Department  
Attn: Fire Prevention Office  
5 Main Street – P.O. Box 21  
Sterling, Ma 01564**

The following documents are required for permit application:

- Plans containing the riser diagram, cable paths, antenna and equipment locations.
- Equipment technical specifications.
- Product certifications (FCC ID, UL Listing and File Number).
- Battery Calculations.
- Plans shall be signed by a person holding a valid FCC GROL License.
- Contact information and license number of the installing electrical contractor.

# **Fire and Police Radio Coverage and Signal Booster System Requirements**

## **1. General**

All new buildings, as well as all existing buildings undergoing substantial renovation, a change of occupancy, or the installation of a new fire alarm system shall have approved radio coverage for Firefighters and Police Officers within the building based upon the existing signal levels of the Sterling Fire and Police communication systems at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

### ***Exceptions:***

**A.** Buildings that have sufficient levels of radio coverage to satisfy the requirements of this specification may request a waiver with the following constraints:

- 1.** A radio survey as described in this specification must be submitted and signed by a qualified FCC GROL licensed technician. *(Building must be substantially completed with all walls, windows, roof, interior partitions completed prior to the survey)*
- 2.** The survey shall be submitted with the waiver request.
- 3.** If approved, the waiver will only be valid for a 5-year period at which time a new radio survey must be submitted.
- 4.** If at any time it is determined that radio coverage does not meet this specification, the waiver will be withdrawn, and the property owner is then required to provide radio coverage as required by this specification.

**B.** One- and Two-family dwellings

**1.1** Buildings and structures that cannot support the required level of radio coverage shall be equipped with a distributed antenna system and FCC-certified, UL 2524 listed signal boosters, or systems otherwise approved to achieve the required adequate levels of radio coverage.

## **2. Signal Strength:**

**2.1** The in-building radio system is an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable firefighter communications at the required signal strength within the specified areas.

**2.2** Critical Areas such as emergency command center, fire pump room, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations and similar critical areas shall be provided with 100% floor area radio coverage.

**2.3** General building areas shall be provided with 95% radio coverage.

**2.4** In-building radio systems required by this ordinance must provide the following signal strengths:

Downlink - Minimum signal strength of -95 dBm throughout the coverage area.

Uplink - Minimum signal strength of -95 dBm received at the public safety Radio System.

## **3. Radio Signal Strength Survey:**

**3.1** The building owner shall have the in-building radio system tested to ensure that two-way radio coverage on each floor of the building meets or exceeds the required levels. Building must be completed with all walls, windows, roof, interior partitions completed prior to the survey.

3.2 Each floor of the building shall be divided into a grid of a minimum of twenty (20) equal areas of no larger than 2,500 SF each. Each critical area shall contain at least one test reading. Maximum of one (1) test point of general area will be allowed to fail the test per floor. A 100% of all critical areas must pass. A spot located approximately in the center of a grid area will be selected for the test. Once the spot has been selected, prospecting for a better spot within the grid area will not be permitted. Field strength testing instruments are to be recently calibrated (1 year) and of the frequency selective type incorporating a flexible antenna similar to the ones used on the hand-held transceivers.

3.3 RF plots indicating the enhanced coverage shall be submitted at the time of acceptance testing.

3.4 The FD is to be notified prior to any testing.

3.5 Unattended operation of the in-building radio system is not permitted until the completion of acceptance testing.

**4. Technical Specifications and Component Installation:**

4.1 Assembly and installation of all components of the Fire Fighter Communication System shall comply with all applicable sections of the National Electrical Code.

4.2 Survivability from attack by fire shall meet NFPA 72, National Fire Alarm Code, 2010 edition and NFPA 1221 2016 edition.

4.3 The system must comply with all applicable sections of FCC rules. Signal booster shall have FCC certification prior to installation.

4.4 The signal booster and all other active components shall be listed for the intended purpose. The acceptable standard is UL 2524 - Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems.

4.5 External filters or attachments or aftermarket modifications of the original equipment shall not be permitted.

4.6 All signal booster components shall be contained in a type-4 approved waterproof cabinet. All enclosures shall be painted red with a locking mechanism.

4.7 The signal booster system shall include built-in automatic alarming of malfunctions of the signal booster and battery system as per NFPA 1221 2016 Edition Section 9.6 and NFPA 72, 2013 Edition, 24.5.2.6.1-24.5.2.6.2. Aftermarket equipment add-ons and modifications to comply with this specification will not be accepted.

4.8 Maximum Propagation delay of the signal booster system shall be 14us (microseconds) or as otherwise approved by the AHJ.

4.9 Antenna isolation shall be maintained between the donor antenna and all inside antennas (D.A.S.) to a minimum of 20dB under all operating conditions.

**4.10 Frequencies:**

AGENCY	REPETAER OUTPUT		REPEATER INPUT	
STERLING FIRE	460.0625	PL 100.0	465.0625	PL 100.0
STERLING POLICE	453.4000	PL 100.0	458.4000	PL 100.0

#### 4.11 Radio Repeater Locations:

<b>FIRE TRANSCIEVER LOCATIONS</b>	<b>LAT</b>	<b>LON</b>
Legate Hill Rd	42.475828°	-71.743632°
Kendall Hill Rd	42.425836°	-71.749448°
Justice Hill Rd	42.479885°	-71.816650°
Merrill Rd	42.408531°	-71.806616°
<b>POLICE REPEATER/RECIEVER LOCATIONS</b>		
<b>REPEATER LOCATION</b>	<b>LAT</b>	<b>LON</b>
Pinewoods Ln	42.442192°	-71.767330°
<b>RECIEVER LOCATIONS</b>	<b>LAT</b>	<b>LON</b>
Legate Hill Rd	42.475828°	-71.743632°
Justice Hill Rd	42.479885°	-71.816650°
Kendall Hill Rd	42.425836°	-71.749448°

4.12 To reduce the possibility of unwanted interference affecting the operation of the system, all UHF and VHF signal boosters shall be band or channel selective type. Wide-band signal boosters shall not be accepted without approval of the AHJ.

4.13 Signal Boosters shall have oscillation prevention circuitry to protect the public safety radio system in case of signal booster malfunction.

4.14 To prevent radio interference and degradation of public safety radio systems, signal boosters shall not emit any measurable uplink noise while idle. The signal booster shall contain an automatic uplink noise suppression function.

4.15 The cabinet shall be painted red and labeled as follows with contrasting white letters and a lock and key provided to the AHJ:

***STERLING FIRE & POLICE RADIO SIGNAL BOOSTER***

*Serviced by: (vendor name and telephone number)*

#### 5. System Monitoring:

5.1 The In-Building Radio system shall include automatic supervisory and trouble signals for malfunctions of the signal booster(s) and power supplies that are annunciated by the fire alarm system. Building owner shall immediately report all troubles to the signal booster provider.

5.2 The integrity of the circuit monitoring the signal boosters and power supplies shall comply with NFPA 72, National Fire Alarm Code, 2013 edition and NFPA 1221 2016 edition.

5.3 System and Signal booster supervisory signals shall include Antenna Malfunction and Signal booster failure

5.4 Power supply supervisory signals shall include loss of normal AC power, Failure of battery charger, and low battery capacity (alarming at 70% of battery capacity and 30% of the charge remaining).

5.5 A dedicated supervised monitoring panel shall be provided at a location approved by the AHJ 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) Antenna Failure
- (4) Loss of normal AC power
- (5) Failure of battery charger
- (6) Low battery capacity

5.6 A sign will be located at the dedicated monitoring panel with the name and telephone number of the contracted system service provider.

## **6. Distributed Antenna System:**

6.1 The distributed antenna system may utilize a radiating cable, conventional cable, fixed antennas or a Combination of all three.

6.1 The distributed antenna system shall not be shared with commercial cellular systems. Sharing of the passive DAS with other commercial in-building radio systems is allowed only if approved by the AHJ. Intermodulation study and the list of commercial frequencies shall be submitted with the permit application.

6.2 A secondary user of the distributed antenna system (DAS) must comply with all requirements of the Sterling Fire Department so as not to degrade the operational standards of the system. Notice will be made to the Sterling Fire Department as part of the permit application if the DAS will have non-fire department frequencies included.

## **7. Power Supply:**

7.1 At least 2 independent and reliable power supplies shall be provided.

7.2 The primary power source shall be supplied from a dedicated twenty (20) ampere branch circuit and comply with NFPA 72, National Fire Alarm Code, 2013 edition and NFPA 1221 2016 edition.

7.3 The emergency responder radio coverage system shall be equipped with a secondary source of power. The secondary source of power shall be a battery system with a dedicated battery charger powered by a separate, dedicated and independent electrical circuit of sufficient size. The secondary power supply shall supply power automatically when the primary power source is lost. The secondary source of power shall be capable of operating the emergency responder radio coverage system for a period of at least 24 hours. The battery system shall automatically charge in the presence of external power input. Battery charger and all other electronic components must be fully enclosed in a non-vented type-4 approved enclosure. Batteries shall be enclosed in a separate, vented NEMA 3R type approved enclosure.

## **8. Acceptance Testing:**

8.1 Delivered audio quality (DAQ) testing will be conducted by FD radio personnel to ensure that two-way radio coverage, on each floor of the building, meets the minimum coverage requirements of Section 2.

8.2 The signal booster vendor shall certify that the in-building radio system was installed and tested in accordance with the requirements of the current AHJ In-Building Radio Specification.

8.3 A signal booster service company shall certify that a maintenance contract is in effect that provides 24-hour by 7-day response within 2 hours of notification of a problem. This contract must be for a period of at least 1 year.

8.4 RF plotting (grid tests) results, gain values of all amplifiers, as built drawings which include BDA Manufacturer, Model #, Serial #, FCC Certification #, and a link budget must be submitted

## **9. Annual Test:**

9.1 The owner shall check all active components of the in-building radio system, including but not limited to amplifier, power supplies, and back-up batteries, a minimum of once every twelve (12) months.

9.2 Amplifiers shall be tested to ensure that the gain is the same as it was upon initial installation and acceptance. The original gain shall be noted and any change in gain shall be documented.

**9.3** Back-up batteries and power supplies shall be tested under load to verify that they will operate during an actual power outage.

**9.4** Active components shall be checked to determine that they are operating within the manufacturer's specifications for their intended purpose.

**9.5** Documentation of the test shall be maintained on site and a copy forwarded by the signal booster service company to the Sterling Fire Department upon completion of the test.

**10. Five Year Test:**

**10.1** In addition to the annual test, a radio coverage test shall be conducted a minimum of once every five (5) years to ensure that the radio system continues to meet the requirements of this ordinance. The procedure set forth in Section 3 shall apply to such tests.

**11. Signal Booster Service Provider Responsibilities:**

**11.1** All tests shall be conducted, documented, and signed by a person in possession of FCC General Radio Telephone Operators License.

**11.2** All testing personnel shall be certified and authorized by the BDA manufacturer in the installation and operation of their equipment.

**11.3** Must submit reports of annual test and 5-year tests.

**11.4** FD shall be notified in writing at least thirty (30) days prior to cancellation of a maintenance contract.

**11.5** FD shall be notified in writing upon the procurement of contractual agreements relating to in-building radios covered by this specification.

**12. Modifications:**

**12.1** Any modification of an existing BDA System will require a written request to FD.

**12.2** After completion of any modification to a BDA a full acceptance test as required in this specification will be conducted and submitted for review.

**13. Fire Department Inspections:**

**13.1** The Fire Department, after providing reasonable notice to the owner or their representative, shall have the right to enter onto the property to conduct field testing to be certain that the required level of radio coverage is present.

**14. Property Owner Responsibilities:**

**14.1** Upgrades to system as directed by the Sterling Fire Department.

**14.2** Maintenance contract maintained with a qualified radio service contractor, who will provide a 24 hour by 7-day emergency response within two (2) hours after notification