



## **Boston Fire Department Communications Section**

### **Specification for Fire Fighter Communication Systems**



The Boston Fire Department has developed this specification in conjunction with the requirements of the International Building Code (2009) and the Commonwealth of Massachusetts Building Code, 8<sup>th</sup> Edition (eff. 1/7/2011).

The installation and operation of radio based fire department communication systems must comply with this document which contains the Boston Fire Department In-Building Radio Specifications.

Property owners who maintain compliance with this specification are granted permission to operate these radio amplifiers on frequencies licensed to the Boston Fire Department by the Federal Communications Commission. The failure to maintain compliance with this specification will result in the automatic withdrawal of said permissions.

The voluntary adoption of this specification must comply with all of the requirements of this specification.

Prior to the construction of a Fire Fighter Communication System, a permit must be submitted to:

Boston Fire Department  
Communications Section  
59 Fenway  
Boston, MA 02115

Fax # 617-343-3060.

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Joseph F. Brooks  
Radio Supervisor  
Boston Fire Department



**Boston Fire Department  
Fire Fighter Communication System Specification**

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**1. General**

All new buildings shall have approved radio coverage for Fire Fighters within the building based upon the existing coverage levels of the Boston Fire Department communication systems at the exterior of the building. This section shall not require improvement of the existing public safety communication systems. (780CMR, 915.2)

*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 radio technician. *(All interior partitions must be completed prior to the survey)*
- 2.** A permit must be submitted with proper signatures
- 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- 4.** At any time it is determined that radio coverage does not meet this specification, the waiver will be withdrawn and the property owner is then required to provide radio coverage as required by this specification.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 2 family dwellings

**1.2** The Fire Marshall for the City of Boston has exercised a local option and determined that a wired communication system shall not be permitted in *lieu* of a radio communication system

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

**1.4** Existing buildings undergoing substantial renovation, a change of occupancy, or the installation of a new fire alarm system are required to provide radio coverage for fire fighters.

**1.5** The system as installed must comply with all applicable sections of FCC Rules. (Parts 22, 90, and 101).

**1.6** The downlink (from BFD) pass band of the BDA shall have a center frequency of 483.2 +/- 75Khz. The uplink (to BFD) pass band of the BDA shall have a center frequency of 486.2 +/- 75Khz.

**1.7** All in-building radio systems shall be compatible with both analog and digital communications simultaneously at the time of installation.

**1.8** Permanent external filters or attachments shall not be permitted.

**1.9** A donor antenna must maintain isolation from the distributed antenna system and shall be a minimum of 15db above the signal booster gain under all operating conditions

**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 99% floor area radio coverage.



## **Boston Fire Department Fire Fighter Communication System Specification**

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- 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 -100 dBm received at the BFD Radio System.

### **3. Radio Survey**

- 3.1 The building owner shall have the in-building radio system tested to insure that two-way radio coverage on each floor of the building meets or exceeds the required 95%.
- 3.2 Each floor of the building shall be divided into a grid of approximately twenty (20) equal areas. A maximum of one (1) area will be allowed to fail the test per floor. 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 initial assessment of radio coverage and the enhanced coverage shall be submitted at the time of acceptance testing.
- 3.4 All compliance testing to be done with 50 ohm loads in place of the donor antenna to avoid interference to the BFD radio system. The BFD Communications Section is to be notified prior to any testing. (617-343-2875)
- 3.5 Unattended operation of the in-building radio system is not permitted until the completion of acceptance testing.

### **4. Component Installation**

- 4.1 Assembly and installation of all components of the 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.
- 4.3 The bi-directional amplifier will be installed in a NEMA 4 painted (fire engine red) steel cabinet with a locking mechanism.
- 4.4 The cabinet shall be labeled (in bright yellow):

**BOSTON FIRE DEPT. RADIO**  
BDA Permit #  
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. Trouble signals must be immediately reported to the radio service provider.
- 5.2 The integrity of the circuit monitoring the signal booster(s) and power supply (ies) shall comply with NFPA 72, National Fire Alarm Code, 2010 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



## **Boston Fire Department Fire Fighter Communication System Specification**

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Low battery capacity (alarming at 70% of battery capacity)

**5.5** 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

*\* Due to the longer battery requirement for the In-Building radio system, the fire alarm system might not be available to provide monitoring of radio system signals, including low battery signals. Therefore a redundant status annunciation is required to provide local signals to the incident commander or their designee at the emergency command center.*

**5.6** A sign will be located at the dedicated monitoring panel with the name and telephone number of the radio service provider indicating that they shall be notified of any alarm.

**5.7** The Boston Fire Department must be notified of any failures that extend past the two (2) hour time limit.

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

**6.1** The distributed antenna system may utilize a radiating cable, fixed antennas or a combination of both.

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

**6.3** Secondary users must furnish a complete list of transmit and receive frequencies along with an inter-modulation (IM) study that will accompany the permit application. The IM Study will consist of the following calculations:  $IM = Q * F$ ,  $IM = F1 + F2 + F3$ ,  $IM = F1 + F2 - F3$ ,  $IM = Q1 * F1 + Q2 * F2$ , and  $IM = Q1 * F1 - Q2 * F2$  for all frequencies up-link and down-link. These calculations will be done to the 5th order.

### **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, 2010 edition.

**7.3** The in-building radio system shall be capable of operating on a battery dedicated to the system with at least 12 hours of 100% system operation capacity.

**7.4** The battery system shall automatically charge in the presence of external power input. The battery system shall be contained in 1 NEMA 4 or 4X type enclosure.

**7.5** Monitoring the integrity of power supplies shall be in accordance with NFPA 72, National Fire Alarm Code, 2010 edition.



## **Boston Fire Department Fire Fighter Communication System Specification**

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### **8. Acceptance Testing**

- 8.1** Delivered audio quality (DAQ) testing will be conducted by BFD radio personnel to ensure that two way radio coverage, on each floor of the building, meets the minimum coverage requirements of Section 2. At least five (5) business days notice is required prior to the test being conducted. At the time of this test, the following are also required:
- 8.2** The radio technician shall certify that the in-building radio system was installed and tested in accordance with the requirements of the current BFD In-Building Radio Specification.
- 8.3** A radio 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 insure 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 for a period of one (1) hour 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 radio service company to the Boston Fire Department Radio Supervisor 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 insure that the radio system continues to meet the requirements of this ordinance. The procedure set forth in Section 4 shall apply to such tests.

### **11. Radio Service Provider**

- 11.1** All tests shall be conducted, documented, and signed by a person in possession of one of the following:
  - FCC General Radiotelephone Operator License
  - APCO Radio Technician Certification
  - Certification from an industry organization acceptable to the Boston Fire Department
- 11.2** All testing personnel shall be certified by the BDA manufacturer in the installation and operation of their equipment
- 11.3** Testing personnel will be issued call signs for communicating with Boston Fire Department personnel on the Boston Fire Radio System. These call signs are to be used only by properly licensed individuals.
- 11.4** Must submit reports of annual test and 5-year tests.



## **Boston Fire Department Fire Fighter Communication System Specification**

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**11.5** The BFD Radio Supervisor shall be notified in writing at least thirty (30) days prior to cancellation of a maintenance contract. Such notice shall contain the date and time such cancellation is to take effect, BDA location, and BDA Permit #.

**11.6** The BFD Radio Supervisor 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 the BFD Radio Supervisor. This request will include; frequency list (transmit and receive), full IM study, and drawing showing intended modification. Upon written approval of the BFD Radio Supervisor, the modification can begin with the stipulation that during the construction period the BFD System will always be operational at the required specifications or better.

**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** Fire Department Radio personnel, 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 Boston 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

### **15. Disclaimer**

**15.1** The Boston Fire Department does not endorse, recommend or specify any specific product, service provider or configuration as the means to comply with this specification.