



Boston Fire Department

In-Building Radio Specification

The Boston Fire Department requires that, in accordance with the state building code, high-rise buildings, and certain other structures, provide reliable radio communications for fire fighters.

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 conditional 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 for buildings not covered by 780 CMR, 403.6 (state building code), must comply with all requirements of this specification.

Prior to the construction of an in-building radio system, a permit must be submitted to the Boston Fire Department Radio Supervisor, 59 Fenway, Boston, MA 02115. Fax # 617-343-3060.

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1. AUTHORITY

- 1.1 Massachusetts Building Code, 780 CMR 403.6 Section 1, requires a fire department communication system. It states that a two-way fire department communication system shall be provided for fire department use. The communication system shall operate between the fire command station and every elevator, elevator lobby and enclosed exit stairway. Acceptable types of fire department communications shall include:
 - 1. Telephone or fire department radio in lieu of a dedicated system, where approved by the fire department; and
 - 2. Intercom or two-way public address system complying with NFPA 72.
- 1.2 Local Option
 - 1.2.1 The State Building Code specifies "Acceptable types of fire department communications system shall include "Telephone or fire department radio in lieu of a dedicated system, where approved by the fire department". As an item where an option is provided, the Boston Fire Department is exercising its authority under 780CMR (State Building Code) to guide the use of the fire department communication system.
 - 1.2.2 The Boston Fire Department takes the opinion that the fire department radio in lieu of a dedicated system should be strictly utilized as the fire department communications system.
 - 1.2.3 The Boston Fire Department takes the opinion that the fire department communications system shall be a bi-directional amplification system that meets the current Boston Fire Department In-Building Radio Specification.
- 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.

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.
 - 2.1.1 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.
 - 2.1.2 General building areas shall be provided with 95% radio coverage.
- 2.2 In-building radio systems required by this ordinance must provide a signal strength that includes all of the following:
 - 2.2.1 Downlink. A minimum signal strength of -95 dBm shall be provided throughout the coverage area.
 - 2.2.2 Uplink. A minimum signal strength of -95 dBm received at the BFD Radio System from the coverage area.



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- 2.3 A donor antenna must maintain isolation from the distributed antenna system. The donor antenna signal level shall be a minimum of 15db above the distributed antenna system under all operating conditions

3. Permissible In-Building Radio Systems

- 3.1 Buildings and structures shall be equipped with an FCC Certificated Class B Bi-Directional UHF Amplifier(s) as needed.
- 3.2 The distributed antenna system may utilize a radiating cable, fixed antennas or a combination of both.
- 3.3 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.
- 3.4 The system as installed must comply with all applicable sections of FCC Rules Part 22, Part 90 and Part 101.
- 3.5 All in-building radio systems shall be compatible with both analog and digital communications simultaneously at the time of installation.
- 3.6 Permanent external filters or attachments shall not be permitted.

4. RF Plotting

- 4.1 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%.
- 4.2 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.
- 4.2.1 RF plots indicating the initial assessment of radio coverage and the enhanced coverage shall be submitted at the time of acceptance testing.
- 4.3 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)
- 4.4 Unattended operation of the in-building radio system is not permitted until the completion of acceptance testing.

5. Component Installation

- 5.1 Assembly and installation of all components of the BDA System shall comply with all applicable sections of the National Electrical Code.



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- 5.2 Survivability from attack by fire shall meet NFPA 72, National Fire Alarm Code, Section 6.9.4.3, 2002 edition.
- 5.3 The bi-directional amplifier will be installed in a NEMA 4 painted steel cabinet with a locking mechanism.
 - 5.3.1 The color will be fire engine red and bear the lettering (in bright yellow):
BOSTON FIRE DEPT. RADIO
 - 5.3.2 The maintenance vendor and telephone number will be marked on the cabinet.
 - 5.3.3 The BDA Permit # shall be marked on the cabinet

6. System Monitoring

- 6.1 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.
- 6.2 The integrity of the circuit monitoring the signal booster(s) and power supply (ies) shall comply with 4.4.7.1 of NFPA 72.
- 6.3 System and Signal booster supervisory signals shall include the following:
 - (A) Antenna Malfunction *(if available)*
 - (B) Signal booster failure
- 6.4 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% of battery capacity
- 6.5 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 *(if available)*
 - (3) Loss of normal AC power
 - (4) Failure of battery charger
 - (5) Low battery capacity *(if available)*

** 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.*

- 6.2 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.
- 6.3 The Boston Fire Department must be notified of any failures that extend past the two (2) hour time limit.



7. Distributed Antenna System

- 7.1 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.
- 7.2 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: $IM=Q \cdot F$, $IM=F1+F2+F3$, $IM=F1+F2-F3$, $IM=Q1 \cdot F1+Q2 \cdot F2$, and $IM=Q1 \cdot F1-Q2 \cdot F2$ for all frequencies up-link and down-link. These calculations will be done to the 5th order.

8. POWER SUPPLY

- 8.1 At least 2 independent and reliable power supplies shall be provided, one primary and one secondary.
- 8.2 The primary power source shall be supplied from a dedicated twenty (20) ampere branch circuit and comply with 4.4.1.4 of NFPA 72.
- 8.3 The secondary power source shall be a dedicated battery, capable of operating the in-building radio system for at least 12 hours of 100% system operation.
- 8.4 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.
- 8.5 Monitoring the integrity of power supplies shall be in accordance with 4.4.7.3 of NFPA 72.

9. Acceptance Testing

- 9.1 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:
 - 9.1.1 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.
 - 9.1.2 A radio service company shall certify that a maintenance contract is in effect that provide 24 hour by 7 day response within 2 hours of notification of a system problem. This contract must be for a period of at least 1 year.
 - 9.1.3 RF plotting (grid tests) results, gain values of all amplifiers, as built drawings (with BDA Manufacturer, Model #, FCC Certification #), and a link budget must be submitted
- 9.2 The minimum acceptable delivered audio quality (DAQ) is 3

1 - Unusable. Speech present but not understandable.

2 - Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion.



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- 3 - Speech understandable with slight effort. Requires occasional repetition due to noise or distortion.*
- 3.4 - Speech understandable without repetition. Some noise or distortion present.*
- 4 - Speech easily understandable. Little noise or distortion.*

10. Annual Test

- 10.1 All active components of the in-building radio system, including but not limited to amplifier, power supplies, and back-up batteries, shall be tested a minimum of once every twelve (12) months.
- 10.2 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.
- 10.3 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.
- 10.4 Active components shall be checked to determine that they are operating within the manufacturer's specifications for their intended purpose.
- 10.5 Documentation of the test shall be maintained on site and a copy forwarded to the Boston Fire Department Radio Supervisor upon completion of the test.

11. Five Year Test

- 11.1 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.

12. Radio Service Provider

- 12.1 All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radiotelephone Operator License, or a technician certification issued by the Association of Public-Safety Communications Officials International (APCO) or equivalent as determined by the Boston Fire Department.
- 12.2 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.
- 12.3 Must submit reports of annual test and 5-year tests.
- 12.4 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 #.
- 12.5 The BFD Radio Supervisor shall be notified in writing upon the procurement of contractual agreements relating to in-building radios covered by this specification.



13. Modifications

- 13.1 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.
- 13.2 After completion of any modification to a BDA a full acceptance test as required in this specification will be conducted and submitted for review.

14. Fire Department Inspections

- 14.1 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.

15. Property Owner Responsibilities

- 15.1 Upgrades to system as directed by the Boston Fire Department.
- 15.2 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

16. Disclaimer

- 16.1 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.



**CITY OF BOSTON
FIRE DEPARTMENT**
Permit to Install and Operate an In-Building Radio System



The Boston Fire Department, Superintendent of Fire Alarms and the Fire Marshall have mandated that the "Fire Department communication system requirement" under **780 CMR, 403.6 Sec. 1 (State Building Code)**, shall be complied with by the installation of a radio based communication system.

In accordance with the provisions of 780 CMR, 403.6 (State Building Code), application is hereby made by:

Property Owner	Name: _____	Phone: _____
	Address: _____	Email: _____
Applicant	Company Name: _____	
	Email: _____	Phone _____ Fax _____
	Name _____ (Print)	Signature _____ (Sign) Date: _____

For permission to install and operate a radio based communication system. I certify that the property owner understands and will comply with the current Boston Fire Department In-Building Radio Specification. If a conflict should result with any of these specifications it will be my responsibility to resolve it.

The property owner has acknowledged that upon final system acceptance, permission will be granted to operate a bi-directional amplifier on frequencies licensed to the Boston Fire Department, by the Federal Communications Commission (FCC). Failure to maintain compliance with the Boston Fire Department In-Building radio specifications will result in the withdrawal of this permission.

Installation Address: _____ **City Section:** _____

Building Name: _____

Description of Work:		Antenna Distribution Network <input type="checkbox"/> Shared (IM study required with permit) <input type="checkbox"/> Not Shared
Radio System Installer	Name: _____	Electrician's License # _____
	Address: _____	
	Email: _____	Phone _____ Fax _____
Radio Service Provider	Name: _____	FCC License # _____
	Address: _____	
	Email: _____	Phone _____ Fax _____

Permit Number : _____ For office use only **In-Building Specification Version:** _____

Signature of Official Granting Permit: _____



**CITY OF BOSTON
FIRE DEPARTMENT**
In-Building Radio Compliance Certification



Installation Address: _____

Date: _____

Building Name: _____

Permit #: _____

***** RADIO TECHNICIAN CERTIFICATION *****

I hereby certify that the In-Building Radio System at the above address was installed and tested in accordance with the requirements of the current BFD In-Building Radio Specification and is in compliance with same.

Name: _____

FCC License #: _____

Employer: _____

Expiration Date: _____

Signature: _____

Date _____

***** MAINTENANCE CONTRACT CERTIFICATION *****

Contract Expiration Date: _____

I hereby certify that a maintenance contract is in place for the In-Building Radio System at the above address. This agreement provides 24 hour by 7 day emergency response within two (2) hours after notification. The BFD Radio Supervisor will be notified within 24 hours if this contract is cancelled. Such notice shall contain the date and time such cancellation is to take effect.

Service Provider: _____

Emergency Contact #: _____

Name: _____ Title: _____

Signature: _____

Date _____

For office use only

	Acceptable	Comments
Monitoring System		
Cabinet Label		
Equipment specifications		
Radio system drawings		
Sample test		
Uplink Gain:		
Downlink Gain:		

The Sample Testing indicates an acceptable level of radio signal to provide effective firefighter communications.

Signature: _____

Date: _____

Title: _____