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# In-Building Fire Department Auxiliary Radio Communication System

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## Biography

- Appointed as New York City firefighter in 1979 and assigned to Engine 290 - Ladder 103 in Brooklyn's East New York section.
- Promoted to Lieutenant in 1997, Mike worked in various firehouses in Battalion 54 in southeastern Queens for one year. From there he worked with the Field Communications Unit and assisted with the Incident Command System at fires throughout the city. He supervised and organized staff chief and commissioner notifications for the Department's Emergency Operations Center. Mike was a first responder on location at the base of the World Trade Center collapse and was instrumental in establishing a remote command post on the east side of what came to be known as Ground Zero.
- Promoted to Captain in 2001, Mike was assigned to the FDNY Research & Development Unit. While assigned there he developed the Command Post Radio, a radio unit designed to improve radio communications in high-rise buildings. He trained firefighters to effectively use the self-contained Command Post Radio and was a direct liaison *between department chiefs and manufacturers in the development of new products. Upon retiring in 2003, Mike became a consultant for the FDNY Research and Development Unit where he continued to be a liaison between FDNY brass and manufacturers working on new products and updates to existing equipment. Mike worked closely with the NYPD, OEM and the Secret Service to coordinate communications for the 2003 New Years Eve celebration in Times Square and the 2004 Republican National Convention at Madison Square Garden.*
- Holds multiple patents on safety equipment for firefighters.
- Licensed Electrician and a Licensed Plumber.
- Currently a Communications Consultant and Instructor for Fire Command Consultants.

### **Abstract**

The most evident shortcoming for firefighters on that fatal day of September 11, 2001 was the inability to communicate with the Fire Command Center in the lobby of the Twin Towers in New York City. Ten years have passed and NYC has specified a code for a system that enables firefighters to communicate with the Fire Command Center. The system allows the Incident Commander at the Fire Command Center to issue an evacuation order that all firefighters will be able to receive.

**Hi-rise, In-Building, Auxiliary Radio Communication System, Fire Departments**



November 10, 2011

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## **FDNY Hi-Rise In-Building Firefighters Communications**

### **The Road to a Solution:**

The inability of the FDNY to communicate in high-rise buildings was never more evident or critical than on September 11, 2001. Books have been written (Radio Silence of the FDNY), and studies completed (McKinsey Report, NIST Investigation, 911 Commission Report, APCO Study and the FDNY A.R.C.S. Committee) that definitively conclude that existing building code must include a requirement for a thoroughly effective communication system for the firefighters and first responders.

The Command Post Radio was a quick fix for the FDNY. The Command Post Radio consisted of a hi-powered radio that included a battery and antenna developed by the FDNY Research and Development Unit. All firefighters in the New York City Fire Department (FDNY) are required to carry or "wear" portable radios. This radio finally and effectively gave firefighters the ability to communicate within the concrete and steel of hi-rise buildings. It met the challenges of creating a system which was transparent to an operation, while eliminating the need for firefighters to change radio channels. No additional firefighter communication training was necessary.

In 1987, building code provided for the option of slotted coaxial communication systems for firefighter use in hi-rise hotels. These systems were never pursued. The 2003 International Building Code section 907.2.12.3 required that all hi-rise buildings have a communications system for firefighter use. This system consisted of hardwired telephones placed in elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside enclosed exit stairways at each level. The system is required to operate between the above locations and the Fire Command Center. This section of the code included an exception, which states that an approved fire department radio system could be provided to replace the hardwired phones. This section of the code was adopted by the City of New York in 2008 with a second exception that did not require these systems in hi-rise residential buildings classified R-2.

In December of 2009, the NYC Building Department established Building Bulletin 022 of 2009 which required that all existing hi-rise buildings that are upgrading their alarm systems must bring that system up to the 2008 building code which included firefighter's communications. An interpretation of an approved radio communication system had to be developed to give design engineers the tools with which to build a system. The FDNY Fire Prevention Unit, under the direction of Assistant Chief Tom Jenson and Battalion Chief Thomas Pigott put together a team to develop that specification. The team consisted of members of FDNY Communications, FDNY Operations (Asst. Chief Ronald Spadafora and Capt. Catalanotto), the Buildings Department (James P. Colgate RA. Esq. and Donald Gottfried PE, Senior Electrical Engineer), and Technology Specialists (Sid Achonsky, PE, and retired FDNY Lt. P. Maloney). Various codes and standards were referenced in the development of this specification.

In January of 2011, FDNY Fire Prevention established Technology Management Bulletin 001 of 2011 which provided a specification of a Fire Department Radio Communication System. This specification is the current guideline for the design and installation of a Fire Department Auxiliary Radio Communication Systems in NYC today. An auxiliary radio communication system is preferred over hardwired phones and code revision will seek to eliminate these phones.

## **FDNY In-Building Auxiliary Radio Communication System**

### **1. Background:**

Currently an initial response to a hi-rise incident would consist of 3 ladder companies and 3 engine companies along with 2 Battalion Chiefs. Upon arrival all units will report to the Fire Command Center to ascertain the status of alarms, elevators and ventilation systems. The first arriving units will ascend to the floor below the fire via the elevator. After exiting the elevator they will proceed via the stairs to the fire floor. In most hi-rise buildings successful communications with portable radios can be achieved up to about the 10<sup>th</sup> floor. Above that either a relay has to be set up or a Command Post Radio must be used. The FDNY procedures call for the deployment of the Command Post Radio to the floor below the fire and a link to the lobby established via a Battalion Car Repeater. This can only be achieved when the first assigned chief arrives on location. Many times the chief is delayed and the companies proceed to the fire floor to start operations. It is at this critical time they can not communicate with the Fire Command Center. Often to overcome this, the companies will set up relays using any combination of portable radios, warden phones, office phones or PA system. Any one of which requires the use of manpower that could be used for other vital operations.

### **2. Overview of FDNY Auxiliary Radio Communication System:**

A hybrid system has been developed from the patented Command Post Radio. It was installed and tested in the Chrysler Building and has proven to overcome the communication problems in hi-rise buildings. The system consists of a base radio/console handset display attached to a radiating coax antenna cable that is powered from building power or a backup battery. The system gives the firefighter the ability to communicate from any location in the building to the Fire Command Center Console Radio. Firefighter's radios communicate point to point on the fire ground which does not require any infrastructure. The advantage of this system over a "standard repeater system" is the fact that no firefighter has to switch his portable radio off of the primary tactical channel, and also in the event of system failure all firefighters can still communicate with the members that are within range of their portable radios.

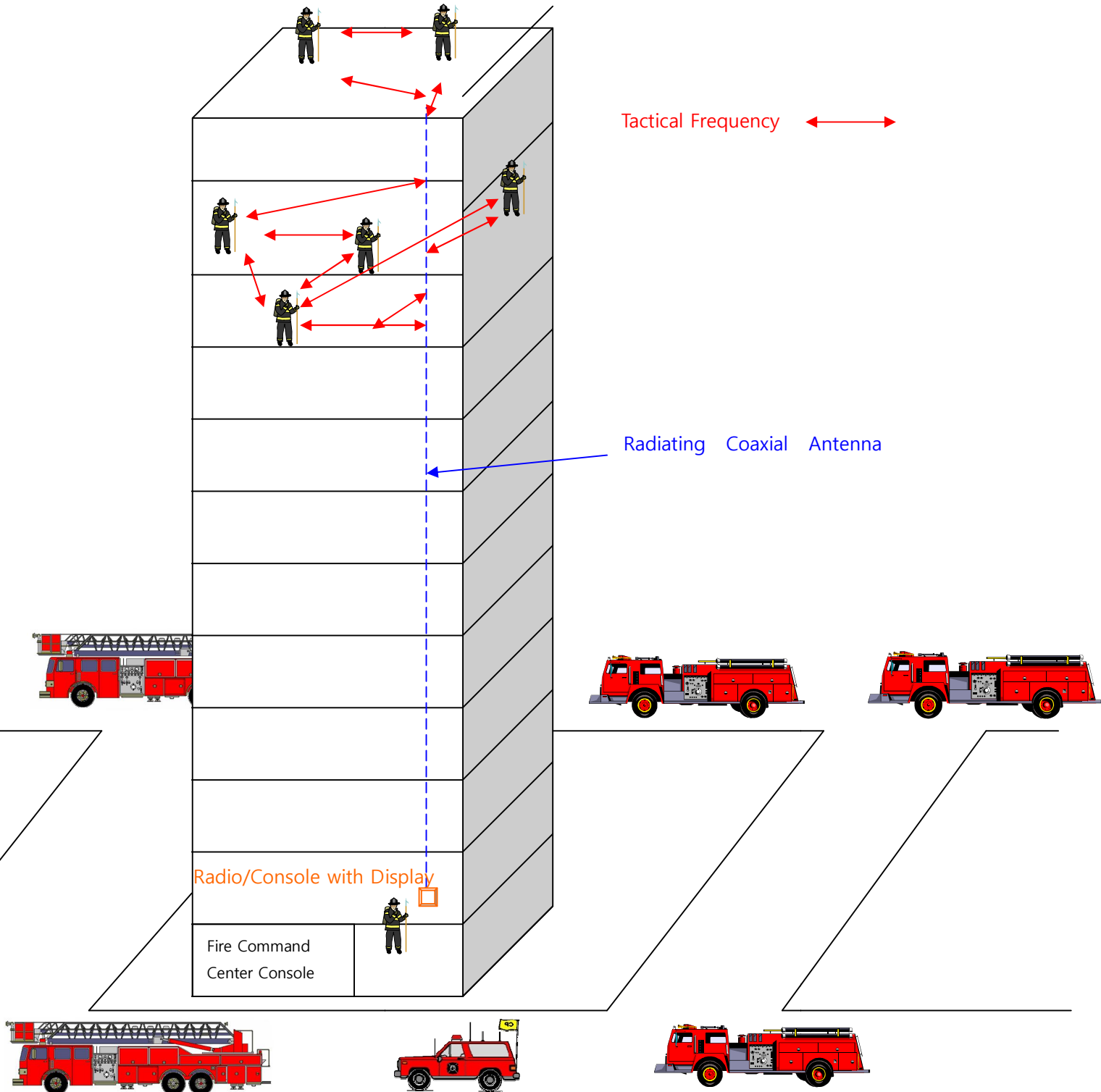
### **3. Description of System Operations:**

Upon arrival of first due companies at a hi-rise incident the system will be activated by turning a 1620 FDNY key switch at the Fire Command Center Console and units will confirm that system is working. The member remaining at this location (Usually the first arriving ladder company chauffeur) will maintain communications with all members operating in the building by use of the handset at the Fire Command Center Console. All other members will remain on the primary tactical channel. As members move throughout the building all of their tactical transmissions will go into the radiating coax antenna cable and be sent to the member at the Fire Command Center Console.

### **4. System Components:**

The system will consist of a number of feet of radiating coax antenna cable currently being used for FDNY communications in various buildings. It will be connected to a custom designed base radio unit which will have the ability to read the ID and emergency signaling system currently used by the FDNY. Currently if there is no chiefs Model III display radio on location the firefighter cannot read any IDs on his Model I radio. The system will have a building power source that will power the radios as well as charge the lead acid backup battery. The battery will be able to run the system for approximately 12 hours without electricity. Installation cost of the system will be determined by the length of cable needed as well as the labor cost to install it. This system is designed to meet the FDNY Technology Management Specification for Auxiliary Radio Communication Systems. In the future the system will support wireless public address in hi-rise residential buildings.

# FDNY In-Building Auxiliary Radio Communication System





NYC Buildings Department  
280 Broadway, New York, NY 10007

Robert D. LiMandri, Commissioner



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## BUILDINGS BULLETIN 2009-022

Technical

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**Supersedes:** None

**Issuer:** James P. Colgate, RA, Esq.   
Assistant Commissioner for Technical Affairs and Code Development

**Issuance Date:** November 19, 2009

**Purpose:** This document clarifies the types of work involving an existing fire alarm system, designed and approved under the 1968 building code or prior codes, which are subject to the 2008 NYC Construction Codes.

**Related Code** AC 28-101.4.3  
**Section(s):** BC 907  
BC Q105.1

**Subject(s):** Fire alarm, ordinary repair; Fire alarm, existing buildings; Fire alarm, alterations

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Work involving fire alarm systems installed pursuant to the 1968 Building Code or prior codes in existing buildings shall comply with the following:

**1. Work constituting an ordinary repair.** Any work performed on a fire alarm system, installed pursuant to the 1968 Building Code or prior codes, to maintain it in working order, involving in-kind replacement of devices, including initiating appliance devices (smoke detector, water flow, manual pull station, etc.) or notification appliance devices (audible and visible devices) may be considered an ordinary repair and shall not require a permit. However, all such work shall only be performed by a licensed electrician.

Repair of a control panel or distributed control units (RCU, TTB, DGP, etc.), which was installed under the 1968 Building Code or prior codes, may be considered an ordinary repair and shall not require a permit. In such case, the system's functionality shall be programmed in accordance with the existing approval.

**Exception:**

Replacement of a fire command center, fire alarm control panel or distributed control units (RCU, TTB, DGP, etc.), which was installed under the 1968 Building Code or prior codes, is **not** considered an ordinary repair and therefore shall be subject to item 2 or 3 of this document, as applicable.

**2. Alterations requiring a work permit.** All work described below in 2(a), (b), and (c) shall require alteration applications and shall only be performed upon the issuance of a permit.

a. For an alteration application that does not involve a change of use or occupancy and that does not involve an enlargement of the building requiring an addition of a sub-system(s) to an existing system approved under the 1968 Building Code or prior codes, the fire alarm system's functionality may be programmed in accordance with the existing approval. However, the portion of the system affected by such alteration shall comply with the 2008 NYC Construction Codes and the following, as applicable:

Buildings Bulletin 2009-022

1 of 2

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- i. Newly installed devices, including initiating appliance devices (smoke detector, flow, manual pull station, etc.) or notification appliance devices (audible and visible devices), shall comply with the 2008 NYC Construction Codes and supervision of such devices is required. Existing functional devices not affected by the scope of work may remain.
- ii. All new electrical work shall comply with Rules of the Department of Buildings, 1 RCNY 4000-06 (Fire Alarm wiring and power sources). Existing functional wiring not affected by the scope of work shall be permitted to remain. (see <http://www.nyc.gov/html/dob/html/reference/rules.shtml>)

b. An enlargement of an existing building constructed pursuant to the 1968 Building Code or prior codes may utilize the programming of the existing, approved system's functionality only if the enlarged portion is of the same use or occupancy as the existing building. Any portion of the existing fire alarm system affected by such enlargement shall comply with the 2008 NYC Construction Codes and Items 2(a)(i) and (ii) above, as applicable.

c. Where an alteration involves a change of use or occupancy, the programming of the existing fire alarm systems functionality shall comply with the 2008 Construction Codes, unless otherwise reviewed and approved by the Technical Affairs Division of the Department of Buildings. Any portion of the existing fire alarm system affected by such alteration shall comply with the 2008 NYC Construction Codes and Items 2(a)(i) and (ii) above, as applicable.

3. System replacements requiring a work permit. For an existing fire alarm system designed and approved under the 1968 Building Code or prior codes that does not function properly and is not repairable within the scope of item number 1 or 2 of this document, or due to the unavailability of approved replacement parts or for any other reason, the entire system may need to be upgraded. An application for a permit must be filed for any replacements to the system. The design and installation of the system replacements shall comply with the 2008 NYC Construction Codes and the following:

- a. All new electrical work shall comply with Rules of the Department of Buildings, 1 RCNY 4000-06 (Fire Alarm wiring and power sources). Existing wiring not affected by the upgrade shall be permitted to remain.

(see: <http://www.nyc.gov/html/dob/html/reference/rules.shtml>)

- b. Newly installed replacement devices, including initiating appliance devices (smoke detector, water flow, manual pull station, etc.) or notification appliance devices (audible and visible devices), shall comply with the 2008 NYC Construction Codes and supervision of such devices is required. Existing functional devices not affected by the upgrade may remain.
- c. Smoke detectors shall be installed in all locations as required for new construction as per section BC 907. (For example: Section BC 907.2 - Item #1: area smoke detector shall be installed in each mechanical equipment, electrical, transformer, telephone equipment or similar room, in elevator machine rooms, and in elevator lobbies, irrespective of room size.)
- d. The alarm sequence shall comply with section BC 907.2.12.2 and NFPA 72 as modified by Appendix Q as applicable.
- e. Fire Department communication systems shall comply with section BC 907.2.12.3 for buildings 75 feet or greater in height.
- f. Existing ventilation systems over 2000 cfm shall be equipped with duct smoke detectors as per sections BC 907.11 and MC 606.2.
- g. Panels for smoke control systems (post-fire smoke purge, stair pressurization, etc.) shall be required only if such systems exist in the building.

Buildings Bulletin 2009-022

2 of 2

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## **2003 International Building Code Chapter 9 Fire Protection Systems**

**907.2.12.3 Fire Department communication system.** An approved two-way, fire department communication system designed and installed in accordance with NFPA 72 shall be provided for fire department use. It shall operate between a fire command center complying with Section 911 and elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside enclosed exit stairways. The Fire Department communication device shall be provided at each floor level within the enclosed stairway.

### **Exceptions:**

1. Fire Department radio systems where approved by the Fire Department



## **2008 New York City Building Code Chapter 9 Fire Alarm Systems**

**907.2.12.3 Fire Department communication system.** An approved two-way, fire department communication system designed and installed in accordance with NFPA 72 shall be provided for Fire Department use. It shall operate between a fire command center complying with Section 911 and elevators, elevator lobbies, emergency power rooms, fire pump rooms, areas of refuge and inside enclosed exit stairways. The Fire Department communication device shall be provided at each floor level within enclosed stairway.

**Exceptions:**

1. Fire Department radio systems where approved by the Fire Department may be installed in lieu of a two-way fire department communication system.
2. Group R-2 occupancy.

Battalion Chief Thomas J. Pigott – Chief of Technology Management

Office of Technology Management  
Bureau of Fire Prevention

9 METROTECH CENTER – BROOKLYN, NY 11201



## **TECHNOLOGY MANAGEMENT BULLETIN # 01/2011**

RE: This document represents the performance requirements for an in-building radio system to be installed at Hi-Rise or large footprint buildings to be provided by the Building Owner/Management. FDNY channel frequencies will be provided upon agreement to install repeater/simplex system.

### **1. Fire Department In-Building Auxiliary Radio Communication Systems**

#### **1.1 Scope**

**1.1.1 Exceptions** Exception No. 1 of BC 907.2.12.3 allows for Fire Department radio systems where approved by the Fire Department may be installed in lieu of a two-way Fire Department communication system. However, in this regard there are no guidelines for building owners, engineers, designers, installers, etc. to follow when proposing to comply with this exception.

#### **1.1.2 General**

**1.1.2.1 Non-Interference** No amplification system capable of operating on frequencies or causing interference on frequencies assigned to the jurisdiction by the Federal Communications Commission (FCC) shall be installed without prior coordination and approval of the FDNY. The building manager/owner shall suspend and correct other equipment installations that degrade the performance of the public safety radio system or Fire Department In-Building Auxiliary Radio Communication System.

**1.1.2.2 Approval and Permit** Plans shall be submitted for design approval prior to installation. At the conclusion of successful acceptance testing, a renewable permit shall be issued for the Fire Department Auxiliary Radio Communication System by the FDNY.

### **1.2 Coverage Areas**

**1.2.1 Radio Coverage** Radio coverage shall be provided throughout the building as a percentage of floor area, as stated in 1.2.2 through 1.2.3.

**1.2.2 Critical Areas** Critical areas, such as the Fire Command Center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and mechanical rooms not accessible to the public, shall be provided with 97 percent floor area radio coverage.

**1.2.3 General Building Areas** General building areas in buildings constructed under the 2008 Building Code shall be provided with 97 percent floor area radio coverage. General areas in existing buildings built prior to the 2008 Building Code shall be provided with 97 percent floor area radio coverage.

**1.2.4 Amplification Components** Buildings and structures that cannot support the required level of radio coverage shall be equipped with a radiating cable system and/or a distributed antenna system (DAS) with FCC certified signal boosters or systems otherwise approved in order to achieve the required adequate radio coverage.

### **1.3 RF Signal Strength**

**1.3.1 In-Building Coverage** Coverage shall be -93 dBm over 97% of each floor, with 95% reliability, measured at the input of the receiver as worn and operated during typical fire and rescue operations, and provide an intelligible delivered audio quality (DAQ) of 3.4 or better in accordance with the published public safety standards TIA/TSB-88B.

**1.3.2 Perimeter** External perimeter coverage at street level shall be limited to one-block radius. This coverage shall be present at all sides of the facility.

**1.3.3 Uplink vs. Downlink** Radio coverage must be balanced uplink vs. downlink. In any area that a portable radio can receive, it must be able to access the system transmitting at a minimum 2 watt power.

**1.3.4 Equipment** The completed equipment, antenna and radiating cable installation must comply with fixed site installation standards, including all lightning protection and grounding requirements.

### **1.4 System Frequency Technicalities**

**1.4.1 System Frequencies** The Fire Department In-Building Auxiliary Radio Communication System shall be capable of transmitting all Fire radio frequencies assigned to the jurisdiction and be capable of using any modulation technology.

**1.4.2 List of Assigned Frequencies** The FDNY channel frequencies will be provided upon agreement to install Repeater/Simplex System. Repeater/Simplex System shall be capable of 25/12.5 kHz (Analog and Digital) operation to meet present requirements as well as new and future FCC imposed narrow band operations.

**1.4.3 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.

#### **1.4.4 Signaling (i.e. Motorola MDC and Trunk Signaling Block TSBK)**

**Repeater:** Signaling transmitted by the portable radios for ID and Emergency Alert signals shall pass through the repeater and rebroadcast to all receiving radios.

**Simplex System:** Signaling transmitted by the portable radios for ID and Emergency Alert signals shall be displayed at the console radio of a simplex system.

## **1.5 System Components**

**1.5.1 Component Approval** Components utilized in the installation of the Fire Department In-Building Auxiliary Radio Communication System, such as repeaters, transmitters, receivers, signal boosters, cabling, and fiber distributed antenna system shall be **FCC compliant** and shall be compatible with the FDNY radio system.

**1.5.2 Component Enclosures** Where equipment is subject to environmental or mechanical exposure, all repeaters, transmitter, receiver, and signal booster components shall be **housed** in a NEMA 4 or 4X type enclosure(s).

**1.5.3 Labeling** FDNY cabling shall be permanently labeled and identified as “**FDNY Communications Use**”.

**1.5.4 Signal Booster Components** If used, signal boosters shall meet the following requirements, as well as any other requirements determined by the FDNY Bureau of Technology Development and Systems (BTDS):

1. Signal boosters shall have FCC certification prior to installation.
2. All signal boosters shall have both analog and digital communications compatibility at the time of installation.
3. The signal booster delay shall not cause Time Domain Interference (TDI) perceptible to the human ear.

**1.5.5 Power** UPS/Generator power redundancy shall be provided in accordance RCNY 4000-06 (NYC Electrical Code for Fire Alarm). The Fire Department In-Building Auxiliary Radio Communication System including all its active components shall be equipped with a secondary source of power. The secondary source of power shall be a battery system. In addition to the battery system where the building is equipped with an emergency generator, it shall supply power to the Fire Department In-Building Auxiliary Radio Communication System. The secondary power supply shall supply power automatically when the primary power source is lost. The battery power source shall be capable of operating the Fire Department In-Building Auxiliary Radio Communication System for a period of at least 12 hours. The transfer switch used for the fire alarm system may be used for the Fire Department In-Building Auxiliary Radio Communication System.

## **1.6 Radio Consoles**

**1.6.1 Dedicated Radio Console** Provision shall be made available at the Fire Command Center for FDNY use of two sets of frequencies for a repeater system and a minimum of 2 frequencies for a simplex system, as required by section 1.4. A console shall be hardwired and provide voice override control of the Repeater/Simplex System at the Command Post. A system ON/OFF switch shall be located in proximity to the Fire Alarm Control Panel/Elevator Control Panel. FDNY 2642 key shall be used to activate the Repeater/Simplex System and the key shall remain in a captured mode while Repeater/Simplex System is on. The Fire Department In-Building Auxiliary Radio Communication System shall include automatic supervisory and trouble signals for malfunctions of the signal booster(s) and power supplies as follows:

1. Normal AC power
2. Loss of normal AC power
3. Low battery capacity

## **1.7 Filing/Inspection, Testing/Maintenance and OOS Systems**

**1.7.1 Filing** Before any work can precede the Building Owner/Management shall file design plans with the Dept of Buildings and the FDNY in accordance with the following:

Systems shall be filed in accordance with the 2008 New York City Construction Code to comply with 907.2.12.3-Exception 1 entitled **Fire Department Auxiliary Communication System**

- a. Plans and specifications shall be filed with the NYCDoB pursuant to BC907.1.1
- b. Docketed plans shall be filed with the FDNY plan examination unit in accordance with the requirements of the Bureau of Fire Prevention FC 907.1.1.
- c. Upon plan review and approval a permit shall be issued to allow installation.
- d. Upon completion of the installation the contractor shall file an A433r, including a test report requesting a FDNY test and inspection.
- e. Upon FDNY acceptance a Letter of Approval shall be issued.

**1.7.2 Technical Criteria** The FDNY will 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 Fire Department Auxiliary Radio Communication System.
3. Maximum Time Domain Interference (TDI).
4. Other supporting technical information necessary to direct system design.

**1.7.3 Acceptance Testing** Before final approval is issued, the Fire Department In-Building Auxiliary Radio Communication System shall be subject to a formal Acceptance Test Plan (ATP) of all components and the system as a whole; said plan to be developed to the satisfaction of the FDNY. The ATP shall ensure that two-way coverage on each floor of the building meets the minimum coverage requirements of 1.2.1 and 1.2.2 and 1.3.1.

The ATP shall consist of the following items:

1. RSSI-Radio Signal Strength Index
2. DAQ-Delivered Audio Quality
3. Console Test (i.e. lights, audio, etc)

The Building Owner/Management shall provide the FDNY with a complete set of as built design drawings of all components of the system before FDNY final approval is issued.

**1.7.4 Maintenance and Operational Testing** The Building Owner/Management shall be responsible for the maintenance and testing of the Fire Department In-Building Auxiliary Radio Communication System. The continuing reliability and the integrity of the system is dependant on an established program of routine maintenance and operational testing. The system shall be tested daily. A written (log book) record of inspections, tests, exercising, operation and repairs shall be maintained on the premises. The log must be made readily available at all times on the premises to any representative of the FDNY and shall include:

1. Recording of the daily test findings.
2. The date of the maintenance report.
3. Identification of the servicing personnel.
4. Notification of any unsatisfactory condition and the corrective action taken, including parts replaced.

**1.7.5 Annual Certification** Where a Fire Department In-Building Auxiliary Radio Communication System is approved, it shall be the building owner's responsibility to have all components of the system tested and certified every 12 months. The annual

certification will require the building owner/management to submit copy of the certification by the manufacturer and or the maintenance company to the FDNY High-Rise Unit during the scheduled annual inspection, pursuant to FDNY Fire Code Section FC 106 and Appendix A, Section FCA01 (27).

**1.7.5.1 Routine Use** The FDNY reserves the right to request testing of the system by local FDNY units for training and familiarization.

**1.7.6 Five (5) year Agency Certification** Where a Fire Department In-Building Auxiliary Radio Communications System is approved, it shall be subjected to an agency certification of all components of the system every 5 years.

**1.7.7 Manuals, Special Tools, and Spare Parts** The building owner shall maintain an instruction manual for all components of the Fire Department In-Building Auxiliary Radio Communication System. The manual shall consist of:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. An illustrated parts list and part numbers.
4. Illustrated and schematic drawings of components, including operating and safety devices, control panels, instrumentation, and annunciators.

Any special tool(s) and testing devices required for routine maintenance shall be available for use when needed. Consideration shall be given to stocking spare parts as recommended by the manufacturer.

**1.7.8 Out of Service Systems** The Building Owner/Management shall insure FDNY procedures as delineated in section 901.7 of the Fire Code is implemented.

**Addendum: Standards researched in the development of this guide.**

New York City Building Code 2008

Chapter 9 Fire Alarm Systems and Appendix Q

Chapter 33 Safeguards during Construction and Demolition

New York City Fire Code

Chapter 14 Fire Safety during Construction, Alteration, and Demolition

International Fire Code 2009

Chapter 5 Fire Service Features

Appendix J Emergency Responder Radio Coverage

NFPA 1 Fire Code 2009

Chapter 16 Safeguards During Building Construction, Alteration, and Demolition Operations

Annex O In-Building Public Safety Radio Enhancement System

NFPA 72 National Fire Alarm and Signaling Code 2010

Chapter 14 Inspection, Testing and Maintenance

Chapter 24 Emergency Communications Systems (ECS)

NFPA 101 Life Safety Code 2009

Chapter 9 Building Service and Fire Protection Equipment

NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations 2009

Chapter 7 Fire Protection

Chapter 8 Safeguarding Construction and Alteration Operations

Chapter 10 Safeguarding Demo Operations

NFPA 5000 Building Construction and Safety Code 2009

Chapter 55 Fire Protection System and Equipment

Annex G In-Building Public Safety Radio Enhancement System