

**CITY OF CAMBRIDGE FIRE  
DEPARTMENT  
TECHNICAL SERVICES DIVISION**

SPECIFICATIONS FOR

**IN BUILDING RADIO RF SIGNAL BOOSTER SYSTEMS**

**(Revised 3/07 Installers note pending change in broadcasting  
frequencies due to Nextel rebanding)**

## **PART 1 – GENERAL**

### **1.0 GENERAL DESIGN CONSIDERATIONS**

- A. Newly constructed buildings, or buildings modified affecting the fire alarm system with levels below grade, shall be tested for fire department radio signal strength. (Any building that is two stories or greater below grade, or greater than 70 feet in height will automatically be required to have a BDA) At the request of the owner's project manager, a test shall be scheduled with the Cambridge Fire Department. Furthermore, in the interest of firefighter and tenant safety, the building owner may be required to install a BDA in a building that is less than 70 feet in height or one level below grade.
- B. The Cambridge Fire Department radio test shall check the signal reception at several locations on the floor area. Signal strength shall be as required for clear reception throughout the building utilizing the type of hand held radio unit that is used by the Cambridge Fire Department. Quantity of test locations shall be determined and conducted by the local fire department representative. The owner's project manager shall be present during said test. A minimum of test point locations shall be determined by the following equation: Number of equally spaced test points = [(floor square footage) / (25000)]\*2 specific test locations may need to be considered in areas containing special wall constructions or large quantities of electromechanical building system equipment.
- C. Required Signal Levels:
1. Signal strength shall be as required for clear reception throughout the building utilizing hand held radio units of the type(s), which are used by the Cambridge Fire Department. Signal strength testing shall follow TXB-88 standards using delivered audio quality measurements (DAQ).
  2. A minimum signal strength of -95 dBm (DAQ4) shall be available on over 95% of the floor area requiring coverage when transmitted from the fire department.
  3. A minimum signal strength of -95 dBm (DAQ4) shall be received at the fire department system from over 95% of the floor area requiring coverage.
- D. Required Broadcasting Frequencies:
1. Typical downlink frequency range for Cambridge Fire Department is 851 to 868 MHz. Due to FCC mandated Nextel rebanding, the downlink frequency will change to 851 to 860 Mhz.

2. Typical uplink frequency range for Cambridge Fire Department is 806 to 823 MHz. Due to FCC mandated rebanding, the uplink frequency will change to 806 to 815 Mhz.
3. Or as required to be compatible with Cambridge Fire Department equipment.

Note: The building owner will be responsible for keeping the operational frequencies of the BDA compatible with the Cambridge Fire Department radio system.

- E. Should testing determine that a signal deficiency exists in the respective building and a signal repeater system becomes required, the Fire Department radio signal system shall be designed and installed. The bi-directional antenna type system shall consist of the following components:

1. Bi-directional radio amplifier
2. Radiating coaxial cable (if required)
3. Coaxial cable
4. Antennas (if required)
5. Terminators
6. T-taps (if required)
7. Other components and interconnecting circuitry as required
8. UPS Power systems

- F. It is the intent of these specifications that where a BDA system is required, a complete fully functioning system will be designed, approved and tested before an Occupancy Permit is issued.

## **1.01 DESIGN SUBMISSIONS**

- A. If the Cambridge Fire Department test results in the recommendation for installation of a Fire Department radio signal repeater system, then a survey and report shall be generated, for the building owner, by an experienced system vendor hired by the building owner. Furthermore, the selected vendor/electrical contractor will complete a Fire Alarm Permit Application acquired from the Fire Prevention Division stating a "BDA" installation.
- B. Plan Review: Provide one line, schematic and detail drawings of the proposed system architecture. Indicate proposed locations for system components. Provide specifications for procurement and installation of a complete system, including operating frequencies, for review by the Cambridge Fire

Department, Cambridge ISD, and all other agencies and authorities having jurisdiction.

- C. Testing and Commissioning: Coordinate the completion date of the Fire Department radio signal repeater system to allow a Certificate of Occupancy to be obtained in a timely manner, in accordance with a schedule established by the owner's project manager.

The entire system shall meet with the approval of the Cambridge Fire Department, Cambridge ISD, and all other agencies and authorities having jurisdiction, before a Certificate of Occupancy will be issued.

## **1.02 SUBMITTALS**

- A. Shop Drawings: Indicate dimensions and components for each device, which is not a standard product of the manufacturer.
- B. Product Data: Provide dimensions, ratings, and performance data.
- C. Design Data: Include signal calculations.
- C. Test Reports: Indicate measured signal levels pre-installation and post-installation.
- D. Filings: The design engineer shall provide all necessary documents required by the contractor for submitting to the Cambridge Fire Department, Cambridge ISD, and any other agencies having jurisdiction. Necessary documents shall include but not be limited to the required quantities of floor plans, system narrative, system specifications, wiring diagrams, shop drawings and any aforementioned documents requiring the engineer's signature.
- E. Permits: Permits necessary for installation of the work shall be obtained prior to beginning work. All filing fees, permit costs, and inspection fees shall be included as part of the required work.

## **PART II – PRODUCTS**

### **2.0 GENERAL**

- A. The system shall be completed with all components and wiring required for compliance with all applicable codes and regulations, and for its operation as described hereinafter. No exclusion from or limitation in the symbolism used on the drawings or the language used in these specifications shall be

interpreted as a reason for omitting any appurtenances or accessories required to enable the system to perform the specified functions.

- B. Upon completion of the installation, the work shall include making all arrangements with the owner's project manager and providing any assistance necessary for inspection and test as required for approval by the Cambridge Fire Department. Modifications, adjustments and/or corrective work necessary to obtain approval along with subsequent inspection and test resulting from the issuance of a "Notice of Defect" shall precede any consideration of formal acceptance by the building owner. In conjunction with the above, training as deemed necessary to instruct authorized building personnel in the proper operation of the system shall also form a part of the required work.

## **2.01 POWER SUPPLY**

- A. The central equipment shall be supplied with an emergency power unit including batteries and battery charging equipment that maintains this equipment, and all outlying equipment that requires power operation, without any change in status for a minimum period of twenty-four (24) hours. Optionally, emergency power may be supplied by an emergency generator. The emergency power units(s) shall be sized to meet the following minimum requirements: operating in normal (supervisory) mode, twenty-four (24) hours, followed by twelve (12) hours of emergency operation. Batteries shall be of the sealed maintenance free type.
- B. System design shall be such that neither the failure of the normal power source, the transfer to an emergency source, nor the transfer back to the normal source shall cause a change in system status.

## **2.02 ALARMING**

- A. Battery low voltage alarm contacts shall activate "trouble" indication at the Fire Alarm Annunciator to read "BDA Back up Power Trouble."
- B. Loss of A.C. input power or failure of the UPS power system shall provide an Indication at the Fire Alarm Annunciator to read "BDA Power Failure."
- C. Amplifier failure shall provide an indication at the Fire Alarm Annunciator to read "BDA System Failure."
- D. Alarms from the amplifier and power systems shall be of a contact closure type with demarcation on a punch-block. Normally open and normally closed points shall be clearly identified so appropriate status can be visualized at the central equipment. The contractor shall be responsible for wiring the alarms

to the punch-block but not to the fire control central equipment, which will be done by others.

## **2.03 EQUIPMENT LOCATION AND PROTECTION**

### **A. Secured Space:**

The bi-directional radio amplifiers shall not be located in electric closets. They shall be located in a suitable non-finished space as approved by the engineer and/or where specifically shown on the drawings. The entrance to the secured space shall clearly identify the space as having the “Cambridge Fire Department” radio signal repeater equipment, by the use of an attached engraved nameplate.

### **B. Unsecured Space:**

The bi-directional amplifiers shall be provided with NEMA 1 enclosures, hinged lockable doors, electric supervision against unauthorized access and the removal of any components, and shall each have an attached engraved nameplate identifying the unit.

### **C. The bi-directional amplifier shall be supplied with cavity style filtering in order to minimize unwanted frequencies from entering the amplifier. Cavities shall be tuned to the frequencies from Section 1 Item D. above. Cavity filters will be housed to allow access by technicians, but will be protected from tampering, or accidental damage.**

### **D. TX/RX Inc., Cellwave Inc. or other approved units as approved by Cambridge Fire Department – Technical Services Division, shall manufacture the bi-directional radio amplifier.**

### **E. The bi-directional amplifier shall contain automatic limiting control circuitry to avoid producing overdriven outputs from the amplifier.**

### **F. The firefighters communication bi-directional radio amplifier system shall be By a competent installer with a minimum of five years service in in-building RF solutions.**

## **2.03 MAINTENANCE**

### **A. The owner will check the bi-directional amplifier annually, with all functions tested and a report filed with the Technical Services Office of the Cambridge Fire Department.**

## **PART III – INSTALLATION**

### **3.0 GENERAL**

- A. Components indicated on the drawings shall be located where shown. Components which are required for proper operation, but which are not indicated on the drawings shall be located in mechanical rooms, at accessible locations within suspended ceilings, or at locations for which express permission of the owner's project manager has been obtained.

### **3.01 CABLE AND CONDUIT**

- A. Note the following circuitry requirements:
1. Conduit intended for use with the firefighter's communication bi-directional radio amplifier system shall be steel electrical metallic tubing (EMT), except as follows:
    - a. It shall be galvanized steel intermediate conduit where mounted within 8'-0" of the floor in mechanical spaces or otherwise exposed to mechanical damage, or where intended for embedment in concrete.
    - b. It shall be galvanized steel intermediate conduit if local authorities prohibit use of EMT.
    - c. It shall be rigid galvanized steel conduit for the power supply to the central equipment and to all outlying equipment cabinets requiring a 120-volt or 120/208-volt supply.
  2. Where wires and cables are permitted to be run without conduit, they shall be independently supported from the building structure or ceiling suspension systems at intervals not exceeding four feet on center, utilizing cable supports specifically approved for the purpose. Wires and cables shall not rest on or depend on support from suspended ceiling media (tiles, lath, plaster, as well as splines, runners or bars in the plane of the ceiling), nor shall they be supported from pipes, ducts or conduits. Bundling and/or supporting ties shall be of a type suitable for use in a ceiling air handling plenum regardless of whether or not installed in a plenum.
  3. Cables shall be tagged or labeled at each termination point and in each intermediate junction box, pull box or cabinet through which they pass, as well as intervals not exceeding 50 feet on centers where cables are run without conduit.

4. Comply with applicable building and electrical code requirements for locating and routing circuitry, for installing circuitry, and for fire stopping.
5. The covers of all dedicated junction, pull boxes shall be painted red and labeled "Fire Dept. Radio System". Junction and pull boxes will not be shared with other systems.
6. Cables other than radiating coaxial cables shall be run in conduit where indicated by the Engineer. Where not indicated, cable shall be installed per manufacturer's recommendation. Conduit shall be electrical metallic tubing or threaded conduit subject to the restrictions specified elsewhere for light and power circuitry.
7. Radiating coaxial cables shall be run without conduit. Where installed in a plenum type ceiling cable insulation shall be of a fire-resistant low-smoke producing type, with a minimum rating of CATVR. This classification shall be clearly marked on the outer surface of the cable at regular intervals.

### **3.02 TESTING**

- A. Submit certification that system is compatible with Cambridge Fire Department radio systems prior to installation.
- B. Verify proper operation of system by means of field tests in accordance with Cambridge Fire Department requirements, and include all adjustments and modifications to the system required for proper operation. Coverage of each floor of the building to a minimum of 95% is required for acceptance. Testing shall be performed and signed by a qualified radio technician with a minimum of 10 years RF experience whose qualifications are acceptable to Cambridge Fire Department.
- C. No activation, or power up of any RF equipment is permitted without first obtaining permission of the Cambridge Fire Department – Technical Services Division. This includes any testing or calibration.

Technical Services Division: 617-349-4920

Emergency Communications: 617-349-4900 ask for a supervisor