

Clark County Fire Prevention

Las Vegas Nevada

PUBLIC SAFETY/FIRST RESPONDER RADIO AMPLIFICATION SYSTEMS

SCOPE: This guideline sets forth requirements for the design, installation and testing of Public Safety/First Responder Radio amplification systems in high-rise, subterranean, and large buildings.

PURPOSE: Standardize Fire Department requirements related to Public Safety/First Responder Radio amplification systems in commercial facilities.

DEFINITIONS

The following definitions shall apply for the purposes of this guideline.

- **Acceptance Test:** Initial test after system installation and prior to granting a fire final for the building, conducted in the presence of a team of up to four (4) Clark County Fire Department Fire Inspectors and a Las Vegas Fire Dispatch Communication Technician, to verify that the system complies with the criteria set forth in this guideline.
- **Annual Test:** Test conducted on an annual basis in the presence of a team of up to four (4) Clark County Fire Department Fire Inspectors to verify that the performance of the radio repeater system continues to meet the criteria set forth in this guideline.
- **Authorized Company:** A company that employs individual(s) that is qualified **in writing** by the equipment manufacturer to work on the radio system.
- **Commissioning Test:** Test performed by the installing contractor and/or owner's representative to ensure that the installation and performance of the radio system meets the requirements of this guideline, and to prepare the system for a successful acceptance test.
- **DAQ:** Delivered Audio Quality; a universal standard often cited in system designs and specifications.
 - DAQ 1: Unusable, speech present but unreadable.
 - DAQ 2: Understandable with considerable effort. Frequent repetition due to noise/distortion.
 - DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
 - DAQ 3.5: Speech understandable with repetition only rarely required. Some noise/distortion.
 - DAQ 4: Speech easily understood. Occasional noise/distortion.
 - DAQ 4.5: Speech easily understood. Infrequent noise/distortion.
 - DAQ 5: Speech easily understood.

- **FCC:** Federal Communications Commission.
- **Fire Command Center:** Room provided in high-rise, atrium, covered mall, and large buildings that contain master controls for a variety of life safety systems serving that building.
- **High-Rise Building:** Building having occupied floors located more than 55 feet above the lowest level of fire department vehicle access.
- **Las Vegas Fire Dispatch Communication Technician:** Communication technician employed by the Las Vegas Fire Dispatch office.
- **Radio Amplification System:** System that allows for the amplification of Public Safety/First Responder Radio signals for the purpose of allowing radio transmission in portions of the building not completely covered by the SNACC system.
- **Subterranean Building:** Building having occupied floors located more than 30 feet below the lowest level of exit discharge
- **SNACC:** Southern Nevada Area Communications Council.
- **Test Team:** For an acceptance test, a test team consists of Clark County Fire Department Fire Inspectors and a Communication Technician from the Las Vegas Fire Dispatch office. For an annual test, a test team consists of Clark County Fire Department Fire Inspectors.

RADIO COVERAGE

No person shall maintain, own, erect or construct any building or portion thereof, or cause the same to be done that fails to support adequate radio coverage for emergency responders, including but not limited to firefighters, emergency medical personnel, and police officers.

WHERE REQUIRED

Radio amplification systems shall be installed where specifically required by the Fire Code, in all high-rise buildings, and where the following criteria exist:

Inbound Signals: Where inbound field strength is less than -95 dBm throughout 95% of the area of each floor of the building from the nearest donor site for the radio associated to that radio system, a radio amplification system shall be installed within the building.

Outbound Signals: Where the outbound signal strength received from a portable radio throughout each floor throughout the building to the receiver at the donor site is less than -95 dBm from a radio associated with that radio system with a maximum of 3 watts of strength, a radio amplification system shall be installed within the building.

SYSTEM DESIGN

Public Safety/First Responder Radio amplification systems shall be designed to meet the following criteria:

- A. Minimum Signal Strength and Coverage: Radio coverage shall be designed to provide a minimum signal level of -95 dBm for two-way coverage (both talk-out and talk-in) on each building floor, and shall be available in 95% of each floor's area.
- B. The system shall be designed to provide a 95% reliability factor.
- C. Supported Frequencies: The radio system shall support frequencies in the 700 and 800 Megahertz Public Safety Bands as may be used by Public Safety/First Responder agencies. The required system parameters are as follows:
 - a. Antenna System: The cabling and antenna system shall be capable of supporting frequencies in the 700 and 800 Megahertz Public Safety Bands.
 - b. Bi-directional amplifiers shall have the capability to be field altered, retuned or reprogrammed to future Public Safety/First Responder channels in the 700 and 800 MHz bands.

SYSTEM COMPONENTS

Components used in radio amplification systems shall comply with the requirements set forth in this guideline.

- A. Equipment: The equipment, including but not limited to signal boosters, bi-directional amplifiers, transmitters, receivers, cabling, etc., shall be FCC certified equipment that is compatible with the existing communication system utilized by the Fire Department, and the equipment shall be compatible with analog and digital modulations.
 - a. Active equipment: signal boosters and bi-directional amplifiers shall meet FCC requirements
 - b. Passive equipment: Passband shall be 700-900 MHz, with an IP rating of 2 GHz.
 - c. Cable: Passband shall be 700-900 MHz, and the cable shall be rated for fire plenum and riser rating.
- B. Filtering: The system shall filter out non-public safety frequencies within the 700 MHz and 800 MHz bands by a minimum of 35 dBm. Bi-directional amplifier filters shall be designed to only amplify the frequencies used by Public Safety/First Responder agencies only.
- C. Power Supplies: Any part of the system that requires electrical power shall be provided with dedicated normal and emergency power feeds, and shall also be supplied by a dedicated battery system utilizing sealed lead-acid batteries. The disconnect switches for the normal and emergency power feeds shall be labeled "First Responder/Public

Safety Radio System". The battery system shall be designed such that the system is capable of continuous duty for four (4) hours in the event of failure of both the primary and the emergency power feeds. Battery systems used for bi-directional amplifiers shall be approved by the bi-directional amplifier manufacturer.

- D. Survivability
 - a. Physical Protection: All wiring shall be installed in conduit.
 - b. Fire Performance: All main risers or trunks of the antenna system shall be installed with resistance to attack from a fire using one of the following methods:
 - i. A 2-hour fire rated cable or cable system.
 - ii. Routing the cable through a 2-hour fire rated enclosure(s).
 - iii. Performance alternative approved by the authority having jurisdiction.
 - 1. Exception: Laterals to individual antennas do not have to be protected by a fire rated enclosure.
- E. Conduit and Access
 - a. Cabling shall be installed in conduit from the location of the radio transmitters to the vertical riser, and then vertically from floor to floor. Where the conduit contains multiple cables and wires, such other cables and wires shall be proven to not effect the radio system, and the total fill of the conduit shall not exceed the limits provided in the National Electrical Code.
 - b. Access shall be provided on each floor, including the ground floor and any sub level floors. Access shall be provided through 36" x 36" x 6" minimum pull boxes.
- F. Mode of Operation: The system shall be normally powered on and shall continuously provide passing of Public Safety/First Responder frequencies within the Public Safety bands.

LICENSING

- A. All Public Safety/First Responder Radio frequencies will be FCC Licensed under the SNACC system.
- B. All testing must be done on frequencies authorized by the FCC. A valid FCC license will be required if testing is done on frequencies different from the police, fire or emergency medical frequencies.

PLAN APPROVAL AND TESTING PROCEDURES

- A. Plans shall be submitted and approved prior to installation. The following information shall be submitted to the Clark County Fire Department by the designer/contractor as a permit application to the Fire Prevention Bureau:
 - a. A minimum of three copies of detailed drawings showing the

- b. A minimum of three copies of schematic drawings of the electrical system, backup power, antenna system and any other associated equipment relative to the amplification equipment, including panel locations and labeling.
 - c. A minimum of one copy of manufacturer's data sheets describing all equipment to be installed.
 - d. A Fire Department permit fee of \$75, or current standard fee, will be collected upon submittal of the plans. Plans may be expedited at an additional fee of \$85, or current standard fee, per hour.
 - e. The Fire Prevention Bureau will review plans and specifications. Upon acceptance, plans will be stamped to indicate approval. Stamped plans are required to be present at the acceptance test. Any field changes that occur during construction shall be incorporated into new As-Built plans, including any manufacturer's data sheets for any equipment changes not submitted in the original submittal. As-Built plans, if required due to system changes, shall be submitted to the Clark County Fire Department for approval.
- B. Commissioning Test: It is the building owner's responsibility to ensure that a commissioning test of the radio system occurs. The test shall ensure that two-way coverage on each floor of the building meets the minimum coverage requirements described above.
- C. Tests shall be made using frequencies close to the frequencies used by the Fire Department. If testing is done on the actual frequencies, then this testing must be coordinated with the Clark County Fire Department. All testing must be done on frequencies authorized by the FCC. A valid FCC license will be required if testing is done on frequencies different from the police, fire or emergency medical frequencies.
- D. Testing Procedures:
- a. Minimum Signal Strength: For testing system signal strength and quality, the testing shall be based on the DAQ system. A DAQ level below 3.0 shall be considered a failed test for a given grid cell.
 - b. Each floor of the building, including stairwells, basements, penthouse facilities and parking areas of the building, shall be subdivided into a grid system consisting of 40 equally spaced grids for testing. The grid cells shall have a maximum

dimension of 50 feet, and a maximum area of 2,500 square feet. Signal strength measurements shall be taken at the center of each grid. Where a floor has an area exceeding 100,000 square feet, the floor area shall be divided into equal sectors, each having a maximum area of 100,000 square feet, and each sector shall separately be divided into grid cells and tested in accordance with these procedures.

- c. A maximum of two (2) nonadjacent grid cells will be allowed to fail the test. In the event that three (3) or more nonadjacent grid cells and/or two (2) or more adjacent grid cells fail the test, the testing grid resolution may be doubled and the test may be repeated. Failures shall not be allowed in critical areas, including but not limited to the fire command center, fire pump room, emergency generator room, stairwells with a standpipe, elevator lobbies serving the emergency elevator and other areas as identified by the fire department.
- d. For a repeated test due to a failure, the grid cell resolution may be doubled, to have 160 equally spaced grids having a maximum dimension of 25 feet, and a maximum area of 625 square feet. A maximum of eight (8) nonadjacent and/or five (5) adjacent grid cells will be allowed to fail the test. In the event that nine (9) or more nonadjacent and/or six (6) or more adjacent grid cells fail the test, the radio system shall be redesigned and reinstalled to meet the minimum requirements of this guideline.
- e. Measurements shall be made with the antenna held in a vertical position at three (3) to four (4) feet above the floor (portable radio worn on the belt or turnout coat pocket).
- f. Coverage shall be provided to the floor areas at the minimum percentage of floor area required in this guideline.

E. Acceptance Testing:

- a. All acceptance testing shall be done in the presence of a team of up to four (4) Clark County Fire Department Fire Inspectors and one (1) Las Vegas Fire Dispatch Communication Technician, at no expense to the County. Fees to test with Clark County Fire Department Fire Inspectors and Las Vegas Fire Dispatch Communication Technician are charged at a rate of \$80, or current standard fee, per hour per person, with a 3-hour minimum charge.
- b. Drawings (24" X 36" maximum) of the building shall be provided

by the owner/contractor to the test team. The plans shall show each floor divided into the grids as described above. Each grid shall be labeled to indicate the DAQ result from the commissioning test.

- c. The owner/contractor shall provide the latest approved plans that represent the final condition of the installation to the test team for review.
- d. The owner shall provide written documentation to the test team indicating that the owner has accepted the responsibility to maintain the radio system.
- e. The owner shall provide written documentation certifying that an acceptable sweep test to measure the level of RF radiation has been conducted and that the antennae system complies with FCC OET 65 Standards.
- f. All results of the system-commissioning test (output wattage, gain level, DAQ OR SIGNAL LEVEL reading, etc) shall be provided for review by the test team.
- g. The test team shall conduct a random sampling of tests throughout the facility, with the test locations to be determined at the discretion of the test team. The tests shall be used to determine the effectiveness of the radio system and to determine the accuracy of the commissioning test. If there are any issues that arise during test that result in failure of the acceptance test, the Clark County Fire Department will require that commissioning tests be conducted again and that another round of acceptance testing be scheduled.
- h. Upon approval of the radio system at the acceptance test, the Clark County Fire Department test team will provide a written approval form indicating that the system has been accepted for fire department communications.

MAINTENANCE AND ANNUAL TESTING

System maintenance and annual testing must include the following:

- A. Document control shall be provided to maintain reference for annual testing and maintenance. Documents to be maintained include a minimum of two copies of the final approved construction plans, a minimum of one copy of the commissioning test report, and a minimum of one copy of the small-scale drawings provided by contractor to the Clark County Fire Department test team. These documents shall be

maintained in the Fire Command Center, or in an approved location when there is no Fire Command Center available.

- B. Annual tests shall be conducted in the presence of a team of up to four (4) Clark County Fire Department Fire Inspectors.
 - a. Battery power shall be used for the duration of the annual test.
 - b. If communications appear to have degraded or if the tests fail to demonstrate adequate system performance, the owner of the building is required to remedy the problem and restore the system in a manner consistent with the original approval criteria.
 - c. The annual testing will be done at no expense to the County. Fees to test with the Clark County Fire Department Fire Inspectors are charged at a rate of \$80, or current standard fee, per hour per person, with a 3-hour minimum charge.

- C. Maintenance & Servicing: At final acceptance the applicant shall supply a letter to the Fire Department indicating that the building owner accepts the property owner's responsibilities. This letter is to be on company letterhead signed by the property owner or a legal representative. The property owner's responsibilities are as follows:
 - a. Perform upgrades to the system as directed by the Clark County Fire Department.
 - b. Have a maintenance contract in place with an authorized company that will provide a 24-hour emergency response seven (7) days a week, with arrival within two (2) hours after notification of system malfunction, and will maintain the system in accordance with FCC requirements.
 - c. Batteries shall be checked on a monthly basis and shall be replaced every five (5) years, or as recommended by the manufacturer.
 - d. Have a maintenance contract in place with an authorized company that will perform the annual test in the presence of a team of Clark County Fire Department Fire Inspectors.
 - e. Maintain a list of contact personnel with phone numbers at the radio system cabinet. The contact personnel shall have knowledge of the building and the system and be available to respond to the building in the case of an emergency.

FIRE DEPARTMENT RADIOS

The owner shall provide Fire Department Radios, which will be used for testing purposes, to the Clark County Fire Department Fire Inspectors at the acceptance test, as follows:

- A. A minimum of two (2) radios, and no less than one (1) radio for every 1 million square feet, or portion thereof, of building area, shall be provided to the Clark County Fire Department.

- B. Radios shall be Motorola Model XTS 5000 or current recommended model, with lapel microphone.
- C. Warranty and ownership of the radios shall be transferred to the Clark County Fire Department upon successful completion of the acceptance test.