Guidelines for Design & Permitting –

Public Safety Radio Enhancement Systems

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Reedy Creek
IMPROVEMENT DISTRICT

Introduction

This document has been created to provide permitting information Public Safety Radio Enhancements Systems (PSRE) and the necessary information to be included in permit submittals. This document contains information from both the EPCOT Building and the Florida Fire Prevention codes and is designed to be used in conjunction with these codes. This document is not meant to be a substitution for any required code or state laws.

References:

Florida State Statute 633.202(18)

NFPA 1, 2018 Edition – 11.10 Two-Way Radio Communication Enhancement Systems

NFPA 1221, 2016 Edition - 9.6 Two – Way Radio Communications Enhancement Systems

NFPA 70, The National Electrical Code, 2014 Edition

Permitting a Two-Way Radio Communication Enhancement System

The installation of any two-way radio communication enhancement system will require an Alarm Permit (AF). The primary power source provided to the system shall be from a dedicated branch circuit and shall also require an electrical permit (EL).

General Permitting Requirements

All permit application and submittal packages shall be submitted by registered users of the online permitting system, Accela Citizen Access (ACA) at: https://ca.rcid.org/CitizenAccess/ .

Request for registration to apply for permits via ACA shall be sent to RCIDPermits@rcid.org .

Permit Application Requirements

A completed and approved permit application is required prior to the commencement of any work. Along with the application, certain other documentation shall be provided, such as, but not limited to, the following:

1. A signed and notarized permit application including:
2. Electrical Engineering Documents in accordance with Florida Administrative Code (see below)
3. Electrical Submittals and shop drawings, if applicable (see below)
4. A copy of the Contract/Purchase Order/Letter of Intent
5. Payment of permit fees, per the current District Fee Schedule

Electrical Engineering Documents

Florida Administrative Code, Chapter 61G15-33 provides the requirements for electrical engineering documents that shall be submitted for any two-way radio communication enhancement system. Electrical Engineering Documents for communications systems shall be signed and sealed by a professional engineer and must include the following information, if applicable to the particular project:

a) System riser diagram for each cabling system.
b) Equipment legend.

c) Cabling type and performance data of the transmission.
d) Device type and locations.
e) Backup power sources where applicable.
f) Installation, identification and testing requirements.
g) Characteristics and locations of surge protective devices, if included in the engineering design.

Layout (Shop) Drawings

Public Safety Radio Enhancement Systems shall be designed in accordance with The Florida Fire Prevention Code and NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.* The following list contains the minimum documentation required for all two-way radio communication enhancement systems, including new systems and additions or alterations to existing systems:

1. Written narrative providing intent and system description
2. Riser diagram
3. Floor plan layout showing location of all devices and control equipment
4. Equipment technical data sheets
5. Manufacturers published instructions, including operation and maintenance instructions
6. Battery calculations
7. Pathway Survivability
8. Lightning Protection

The person responsible for system design (layout) shall be identified on the system design documents

Design Requirements
The system shall provide for reception of the Public Safety Radio Enhancement frequencies as specified herein. Two- way radio contractor shall meet with local municipal emergency representative to determine all local frequencies channels and modulation requirements. Design to include Public Safety radio system frequencies (Law Enforcement, EMS & Fire) for Reedy Creek Improvement District, Orange and Osceola County, Florida.

System shall be designed to comply with all code requirements including, but not limited to:

1. Inbound - General Areas - A minimum inbound signal strength of -95 dBm @ 95%. The inbound signal level shall be sufficient to provide a minimum of DAQ 3.0 for either analog or digital signals.
2. Outbound – General Areas A minimum outbound signal strength of -95 dBm @ 95%. The outbound signal level shall be sufficient to provide a minimum of DAQ 3.0 for either analog or digital signals.
3. Inbound – Critical Areas and areas deemed critical by the AHJ - A minimum inbound signal strength of -95 dBm, for 99% of the area.
4. Outbound – Critical Areas and areas deemed critical by the AHJ - A minimum inbound signal strength of -95 dBm, for 99% of the area.
5. The maximum propagation delay shall be a value of 5ns/m for fiber and 3.8ns/m for common Coaxial cable (LDF4-50A).

For Critical Areas, the PSRE solution shall provide the above-specified coverage in 99% of the floor area. Critical Areas including fire command centers, fire pump rooms, exit stairs & passageways, elevator

lobbies, elevator hoistways, standpipe cabinets, sprinkler sectional valve locations, public bathrooms, law enforcement holding areas, Special Amusements ride areas, and other areas deemed critical by the AHJ.

A dedicated monitoring panel shall be provided within the fire command center to annunciate the status of all RF emitting devices and system component locations. Public Safety Radio Enhancement equipment shall be clearly labeled as "Public Safety Radio Enhancement Equipment". The monitoring panel shall provide visual and labeled indications of the following for each system component and RF emitting device:

1. Normal ac power
2. Loss of normal ac power
3. Battery charger failure
4. Low battery capacity (to 70 percent depletion)
5. Donor antenna malfunction
6. Active RF emitting device malfunction
7. System component malfunction

The communications link between the dedicated monitoring panel and the two-way radio communications enhancement system must be monitored for integrity.

No amplification system capable of operating on frequencies or causing interference on frequencies assigned to the jurisdiction by the licensing authority of the country of jurisdiction shall be installed without prior coordination and approval of the AHJ. Reedy Creek Emergency Services maintains a list of all inbound/outbound frequency pairs for distribution to system designers and will provide frequencies upon written request to fireprevention@rcid.org .

Where standby power systems are available, it is strongly recommended that a dedicated branch circuit feed the DAS from the standby power source.

Design Test Procedures

The design test plan should ensure testing throughout the building.

Grid cells shall be provided with definite minimum and maximum dimensions. For most buildings, using a minimum grid dimension of 20 ft (6.1 m) and a maximum grid dimension of 80 ft (24.4 m) will suffice to encompass the entire floor area. Where a floor exceeds 128,000 ft2 (11,900 m2), which is the floor area that can be covered by the maximum grid dimension of 80 ft (24.4 m), it is recommended that the floor be subdivided into sectors each having an area less than or equal to 128,000 ft2 (11,900 m2), and each sector be tested individually with 20 grid cells in each sector. Signal strength measurements and delivered audio quality (DAQ) shall be taken at the center of each grid and shall be performed using standardized parameters. The DAQ scale is a universal standard often cited in system designs and specifications, using the following measures:

(1) DAQ 1: Unusable, speech present but unreadable.
(2) DAQ 2: Understandable with considerable effort. Frequent repetition due to noise/distortion.
(3) DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
(4) DAQ 3.5: Speech understandable with repetition only rarely required. Some noise/distortion.
(5) DAQ 4: Speech easily understood. Occasional noise/distortion.

(6) DAQ 4.5: Speech easily understood. Infrequent noise/distortion.
(7) DAQ 5: Speech easily understood.

The minimum allowable DAQ for each grid cell shall be 3.0. Not more than two nonadjacent grid cells shall be allowed to fail the test. In the event that three of the areas fail the test, or if two adjacent areas fail the test, in order to be more statistically accurate the testing grid resolution should be doubled. This would require decreasing the size of the grids to one-half the dimension used in the failed test to a minimum of 10 ft (3 m) and a maximum of 40 ft (12.2 m). Further, to cover the same floor area, the number of grids is quadrupled to 80 grids. No more than eight nonadjacent and/or five adjacent grid cells shall then be allowed to fail the test.

In the event that nine or more nonadjacent and/or six or more adjacent grid cells fail the test, the system shall be redesigned. Failures shall not be allowed in critical areas. Measurements should be made with the antenna held vertically at 3 ft to 4 ft (0.9 m to 1.2 m) above the floor. The DAQ readings should be recorded on small-scale drawings that will be used for testing with the AHJ. In addition, the gain values of all RF emitting devices and system components shall be measured and the test measurement results shall be kept on file with the building owner so that the measurements can be verified each year during annual tests.

Measurement Parameters
DAQ levels should be measured to ensure the system meets the criteria NFPA 1221. Downlink measurements shall be made with the following standardized parameters:

(1) Receive antennas of equal gain to the agency's standard portable radio antenna, oriented vertically, with a centerline between 3 ft to 4 ft (0.9 m to 1.2 m) above floor
(2) Levels recorded while walking an "X" pattern, with the center of the pattern located approximately in the center of each grid area
(3) The linear distance of each side of the "X" equal to at least 10 percent of the length of the grid's side and a minimum length of 10 ft (3 m)
(4) Measurements sampled in averaging mode to include a minimum of one sample per each 5 ft (1.5 m) traveled recorded with not less than five samples per measurement recorded per side of the "X".

Acceptance Testing
An acceptance test of the PSRE system shall be scheduled with Reedy Creek Fire Department. As-built drawings shall be provided including all system design parameters, other information required from the DAQ level and commissioning tests, including a full report with grid locations, DAQ measurements, and RF emitting device or system component gain values. The acceptance test will entail a random test of radio communication in various portions of the building, especially including the critical areas. Reedy Creek Fire Department will ensure that the findings of the commissioning test with respect to DAQ levels and gain values are supported by the acceptance test.

If RF emitting devices are used in the two-way radio communications enhancement systems, a spectrum analyzer shall be used to ensure spurious oscillations are not generated nor are unauthorized carriers repeatedly in violation of radio licensing authority regulations. Downlink and uplink spectrum shall be recorded with a maximum-hold screen capture at the active system air interfaces with the system under normal load and at least one uplink carrier active on the indoor portion of the system. Measurements should be analyzed for correct gains on both uplink and downlink paths, noise floor elevation from active

components, intermodulation, and other parameters determined necessary by Reedy Creek Fire Department.

Gain values of all RF emitting devices and system components shall be measured and the results kept on file with the building owner and the AHJ. In the event that the measurement results are lost, the building owner will need to repeat the acceptance test to re-establish the gain values. Where the two-way radio communications enhancement system is shared with other non-public safety services, the testing of the public safety system should be made under simulated heavy traffic load conditions of the non-public safety services to ensure that the DAQ values, noise floors, intermodulation, and other parameters, as described by the AHJ for both in-bound and out-bound, are met for the public safety portion of the system.