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FIRE

**FIRE MARSHAL'S
Technical Advisory**

OFFICE

Date: June 14, 2017

Advisory: No.17-01

Subject: Emergency Responder Radio Coverage.

Code Reference: 2014 Eugene Springfield Fire Code, Section 510, 1103.2

Question(s): What are the technical design specifications necessary for the creation of an in-building radio signal amplification systems within the jurisdiction of the Eugene Springfield Fire Department?

Answer(s): The requirements specified in the fire code in Section 510 apply as well as the OSSC requirements in the following Sections: 915, 403.4.5, 907.2.13.2. In addition, Form OSSC 915 will need to be completed for each structure under consideration.

Permits: For the purpose of permits, plan review, inspections, and approvals, in-building radio signal amplification systems shall follow the fee schedule requirements for a fire alarm system when calculating fees. Applicable permit fees and procedures as established by the City of the facility that the in-building radio signal amplification system is housed in will apply. While permit submittals of in-building radio signal amplification systems are treated the same as a fire alarm system submittal, they are required to be submitted separately and are not required to be submitted with the alarm system.

In-building Radio Signal Amplification System Operational Requirements:

1. Geographic location of the various radio transmission sites as well as neighboring structures or will dictate which specific frequencies will be amplified/repeated for any structure outfitted with an in-building radio signal amplification system.
2. All structures outfitted with an in-building radio signal amplification systems must incorporate at least 3 VHF duplex channels (see table below).
3. IDLH operations at incidents will utilize Duplex channels only in structures that have in-building radio signal amplification systems complying with this technical advisory.
4. An agreement between the owner of the building and the City of Eugene and/or agencies of the Lane Fire Defense Board (LFDB), who are the holders of the FCC Licenses necessary to operate the radio services utilized for public safety purposes, must be signed prior to powering up the building's signal booster equipment.

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Agency Specifications:

VHF Duplex Channels						
Eugene Springfield METRO DAS list (in order of preference)						
Channel	Description	Radio Site TX	Radio Site RX	Sites	Site ERP	Location
Metro 4	Coburg Duplex	159.2025	153.7925	Coburg Ridge	34w	LAT 44-06-55.4N, LNG 123-00-04.3 W
Lane 5	County Duplex	159.135	154.2275	Coburg Ridge	32w	LAT 44-06-55.4N, LNG 123-00-04.3 W
Metro 6	Quarry Duplex	154.445	151.130	Quarry Hill	25w	LAT 44-01-57.3N, LNG 123+00-29.2 W
East 3	East Duplex	154.890	159.1575	Lowell	108w	LAT 43-55-39.79 N, LNG 122-45-42.43 W
Metro 7	Skinner Butte Duplex	155.025	153.830	Skinner Butte	26w	LAT 44-03-29.12N LNG 123-05-31.85

The following law enforcement frequencies must be included as well.

UHF Frequencies				
Channel	Description	Radio Site TX	Radio Site Rx	Radio Sites
LRIG Simulcast 1	Trunked Ch. 1	460.3125	465.3125	Metro Simulcast
LRIG Simulcast 2	Trunked Ch. 2	460.1875	465.1875	Metro Simulcast
LRIG Simulcast 3	Trunked Ch. 3	453.925	458.925	Metro Simulcast
LRIG Simulcast 4	Trunked Ch. 4	453.8125	458.8125	Metro Simulcast
LRIG Simulcast 5	Trunked Ch. 5	453.6125	458.6125	Metro Simulcast
LRIG Simulcast 6	Trunked Ch. 6	453.4875	458.4875	Metro Simulcast
LRIG Simulcast 7	Trunked Ch. 7	453.325	458.325	Metro Simulcast
LRIG Simulcast 8	Trunked Ch. 8	453.2375	458.2375	Metro Simulcast

Note: Only frequencies listed in the tables above shall be included in the design of the in-building radio signal amplification system. In-vehicle repeater (IVR) frequencies, including 173.3125 and 173.2625 will be avoided.

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Acceptance Test Procedures:

1. The testing plan including documentation and forms to be used shall be included as a required component of the design permit package submitted to the Fire Marshal's Office for approval.
2. In addition to the requirements of Section 510.5.3 the following procedures shall be used:

Testing procedures will be done on a grid system. A grid is overlaid onto a floor area to provide 20 grid cells. Grid cells are provided with definite minimum and maximum dimensions. For most buildings, using a minimum grid dimension of 20 ft. and a maximum grid dimension of 80 ft. will suffice to encompass the entire floor area.

Where a floor exceeds 128,000 ft², which is the floor area that can be covered by the maximum grid dimension of 80 ft., it is recommended that the floor be subdivided into sectors, each having an area of less than or equal to 128,000 ft², and that each sector be tested individually with 20 grid cells in each sector.

3. Signal quality measurements shall be taken at the center of each grid
4. Where signal quality measurements cannot be performed at the grid center (due to walls or structures in the way) a note explaining why and an alternate position as close to center of the grid utilized.

Signal quality measurements shall be performed using standardized parameters as specified in the following:

Downlink measurements should be made with the following standardized parameters:

- (1) Calibrated spectrum analyzer or calibrated automatic signal level measurement recording system to measure signal strength in dBm
- (2) Receiving antennas of equal gain to the agency's standard portable radio antenna, oriented vertically, with a centerline between 3 ft. (0.91 m) and 4 ft. (1.22 m) above floor
- (3) Resolution bandwidth nearest the bandwidth of the channel under test
- (4) Levels recorded while walking an "X" pattern, with the center of the pattern located approximately in the center of each grid area
- (5) 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. (3.0 m)
- (6) Measurement sampled in averaging mode to include a minimum of one sample per each 5 ft. (1.52 m) traveled, recorded with not less than five samples per measurement recorded per side of the "X"

Note:

Deviation from this measurement methodology shall only be approved by the fire code official.

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Signal quality is typically recorded on the delivered audio quality (DAQ) scale. This 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 3.4: 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

5. The DAQ and signal strength measurements shall be recorded on small-scale drawings.
6. Drawings with recorded signal strength measurements shall be retained as part of the acceptance testing documentation.
7. All acceptance testing documentation shall be provided to the fire code official upon successful completion of acceptance testing.
8. The minimum allowable DAQ for each grid cell typically is DAQ 3 (17 ± 1.5 dB SINAD).
9. The minimum downlink signal strength is -95 dBm.
10. The minimum signal strengths allowable are -95 dBm and will be recorded in each cell as well as the DAQ.
11. 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 the following applies:
12. In order to be more statistically accurate, the testing grid resolution shall be doubled. This will require decreasing the size to one-half the dimension used in the failed test to a minimum of 10 ft. and a maximum of 40 ft. . . . Further, to cover the same floor area, the number of grids is quadrupled to 80.
13. Not more than eight nonadjacent 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, consideration should be given to redesigning and reinstalling the public safety radio enhancement system to meet the minimum system design requirements.
14. Failures shall not be allowed in critical areas. Critical areas are: fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the fire code official.
15. Measurements shall be made with the antenna held in a vertical position at (3 ft. to 4 ft.) above the floor.

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16. In addition, the gain values of all amplifiers 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.
17. Prior to final system acceptance testing and after any major adjustments to signal strength or configuration of the system a spectrum analyzer should be utilized to ensure spurious oscillations are not being generated or unauthorized carriers are being repeated in violation of FCC regulations. The system designer or his representative shall include an affidavit stating that as part of the system acceptance documentation.
18. Individuals performing acceptance testing shall have expertise in design, installation and function of in-building radio signal amplification systems, be FCC certificated, and be approved by the fire code official.
19. Expense for system acceptance testing shall be borne by the applicant.
20. Expense for Central Lane Communication (CLCC) and /or any Department designated personnel utilized in the acceptance testing process shall be borne by the applicant.
21. Prior to utilization of any licensed frequency used by CLCC a Eugene BDA agreement must be executed. Contact CLCC for information.
22. Arrangements for CLCC and/or any fire department designated personnel utilized in acceptance testing shall be made at least 10 days prior to scheduled testing.
23. Once accepted the in-building radio signal amplification system will not be permitted to be turned off without first notifying the fire code official in accordance with the fire system impairment section of the fire code.
24. After system acceptance testing results are received by the fire code official, Fire personnel may perform random broadcast/receive tests during building walkthroughs to verify acceptance testing results are maintained.
25. No recommendation for approval of a temporary certificate of occupancy will be made to the building official official without approval of the in-building radio signal amplification system by the fire code official.
26. Gain values of all amplifiers should be measured and the results kept on file with the building owner and the fire code official. In the event that the measurement results become lost, the building owner will need to repeat the acceptance test to reestablish the gain values.

Maintenance:

In addition to the maintenance requirements detailed in the fire code the following additional information is applicable.

1. All expense for the annual system maintenance testing shall be borne by the system owner.
2. Arrangements for CLCC and/or any Department designated personnel utilized in maintenance testing shall be made at least 10 days prior to scheduled testing.
3. Expense for CLCC and /or any Department designated personnel utilized in the maintenance testing process shall be borne by the system owner.

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4. Interference or disruption to CLCC radio system operations caused by an installed in-building radio signal amplification system must be corrected immediately upon discovery and is the responsibility of the building owner.
5. Records of all system inspections, tests, repairs and maintenance shall be maintained on the premises for a minimum of 3 years.
6. Service contractors shall submit, in the manner specified by the Fire Marshal, reports of inspections and tests to the Eugene Springfield Fire Marshal's Office within 30 days of performing the inspection, test or maintenance.