


Emergency Responder Radio Signal Survey for:


Pemberville, Ohio 43450

June 11, 2021

Introduction:

On June 10, 2021, JDRM Engineering conducted an in-building signal strength test of public safety radio system frequencies used by emergency responders in Pemberville, Ohio. The purpose of the test was to determine if the in-building signal strengths conform to the requirements of the 2017 Ohio Building Code (OBC), 2017 Ohio Fire Code (OFC), and the 2016 National Fire Protection Agency (NFPA) Code 1221. These are the current adopted codes in the State of Ohio.

Code Requirements:

OBC Article 916.1 states:

“Emergency responder radio coverage shall be provided in all new buildings in accordance with Section 510 of the *fire code*.”

OFC Article 510 states:

“510.1 Emergency responder radio coverage in new buildings. All new buildings shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building. This paragraph shall not require improvement of the existing public safety communication systems.”

“510.2 Emergency responder radio coverage in existing buildings. Existing buildings shall be provided with approved radio coverage for emergency responders as required in rule 1301:7-7-11 of the Administrative Code.”

“510.4.1 Radio signal strength. The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95 percent of all areas on each floor of the building meet the signal strength requirements in paragraphs 510.4.1.1 and 510.4.1.2 of this rule.”

“510.4.1.1 Minimum signal strength into the building. A minimum signal strength of -95 dBm shall be receivable within the building.”

“510.4.1.2 Minimum signal strength out of the building. A minimum signal strength of -95 dBm shall be received by the agency's radio system when transmitted from within the building.”

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Code Requirements (*cont.*):

In addition, for installed emergency responder radio coverage systems, the NFPA mandates additional coverage requirements. 2016 NFPA 1221 states:

“9.6.7.4 Critical Areas. Critical areas, including 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 AHJ, shall be provided with 99 percent floor area radio coverage.”

Testing Parameters:

First responders in Luckey utilize Lucas County’s Countywide Communications System for dispatch and primary communications. This system operates on a frequency range of 854-863 MHz. The control channel of 855.8875 MHz was used for testing.

First responders in Luckey also utilize the Ohio MARCS-IP P25 radio system. This statewide, multi-agency system operates on in the 700 - 800 MHz frequency range. The control channel of 774.88125 MHz was used for testing.

The Wood County Sheriff’s Office utilizes a VHF radio system which operates on a frequency of 154.72500 MHz for dispatch and primary communications.

The OFC calls for measuring signal strength for both incoming (downlink) and outgoing (uplink) signal, however, uplink measurements were not obtainable. In lieu of signal uplink measurement, Delivered Audio Quality (DAQ) measurements were performed to gauge signal strength out of the building. DAQ measurements are an alternative test method specified in NFPA 1221.

Test Equipment:

Testing of signal strength was done utilizing a PCtel IBflex scanning receiver, serial number 81812011 last calibrated on 01/05/2021. The lab recommends calibration every year.

The antenna used for signal testing of Wood County Sheriff was Motorola model number NAR6593 (126-174 MHz) This is the same type antenna commonly used on emergency responder portable radios.

The antenna used for signal testing of Lucas County and MARCS was Motorola model number PMAS4001A (764-870MHz). This is the same type antenna commonly used on emergency responder portable radios.

For DAQ testing, Motorola APX 6000 and Motorola XPR6550 radios were provided by the Lucas County Sheriffs Office and the Wood County Sheriffs Office.

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Testing Method:

For initial signal testing, the OFC does not call out specific testing procedures. However, for consistency we follow the guidelines of OFC 510.5.3, which defines the testing procedure for an installed emergency responder radio amplification system. This procedure calls for each floor of the building to be divided into a test grid of twenty (20) or more areas of approximately equal size. Also, per the practice of NFPA 1221, we test and evaluate for 99% coverage of critical areas such as stairwells, fire pump rooms and fire command centers. In each grid area, a single centralized location was chosen to test from. From that location, dBm levels of downlink signals were measured with the scanning receiver and radio calls were made with the hand-held radios in order to test voice quality.

A stationary receiving location, representing an incident commander's location, was chosen in the front of the building near the main entrance. For control purposes, baseline tests of outdoor ambient signal level and DAQ was conducted from this same location.

Testing Method (cont.):

Voice quality was measured using the Delivered Audio Quality (DAQ) standard method of rating:

- DAQ 1: Unusable. Speech present, but not understandable.
- DAQ 2: Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion.
- DAQ 3: Speech understandable with slight effort. Requires occasional repetition due to noise or distortion.
- DAQ 3.4: Speech understandable without repetition. Some noise or distortion present.
- DAQ 4: Speech easily understandable. Little noise or distortion.
- DAQ 4.5: Speech easily understandable. Rare noise or distortion.
- DAQ 5: Perfect. No distortion or noise discernible.

Test Reports:

The test results summary follows this written report. This summary indicates grid areas, downlink signal levels, voice quality levels, and pass/fail grades for each grid area.

For signal strength, grid areas where the average signal level is equal to or greater than -95dBm are shown to **PASS** the OFC 510 signal level requirements. Grid areas with signal levels less than -95dBm are shown to **FAIL** the signal level requirements. It should be noted that the higher the negative dBm number, the weaker the signal strength (i.e. a -80dBm signal is weaker than a -65dBm signal).

For DAQ rating, grid areas with a rating of 3 or greater are considered to **PASS** with an acceptable voice quality. Grid areas with a rating less than 3 are considered to **FAIL** with an unacceptable voice quality.

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Conclusion:


Both floors presented issues with signal strength and voice quality. With this being the case, most grid areas failed the requirements of OFC 510.4.1. Unless waived by the Authority Having Jurisdiction, those areas that failed will require signal amplification.

Signal amplification is achieved by installing a Distributed Antenna System (DAS) within the building. The DAS receives the outdoor ambient signal via a roof mounted antenna and then amplifies and distributes this signal into the deficient areas of the building. Such a system should be designed and installed by a certified radio communications vendor to meet or exceed the requirements of OFC 510 and NFPA 1221.

Notes:

Testing of emergency responder radio systems is subject to many variables that may affect the test results (including, but not limited to: atmospheric conditions, weather, season of the year and condition of the handheld radios provided). Due to these variables, the test results presented in this report reflect conditions experienced at the time of testing and may differ from tests performed at other times or by other testing companies. Ultimately, the Authority Having Jurisdiction has discretion on how to interpret and act upon the test results according to their operational needs and day-to-day knowledge regarding the performance of their radio systems in the geographical area being tested.

Respectfully submitted,



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