Emergency Responder Radio System Guidelines

All 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 section shall not require improvement of the existing public safety communication systems. The intent of this guideline is to provide the Columbus Division of Fire interpretation of the minimum standards necessary to meet the requirements for emergency responder radio coverage in accordance with the state code and NFPA Standards.

OFC 104.1 General. The fire code official is hereby authorized to enforce the provisions of this code and to the extent the state fire marshal has not rendered an interpretation or issued a "Technical Bulletin" regarding a particular topic, the fire code official shall have the authority to render interpretations of this code, and to adopt policies, procedures, rules and regulations in order to clarify the application of its provisions. Such interpretations, policies, procedures, rules and regulations shall be in compliance with the intent and purpose of this code and shall not have the effect of waiving requirements specifically provided for in this code.

OFC 102.8 Harmonizing provisions. Where there is a conflict between a general requirement and a specific requirement of this code or its referenced standards, the specific requirement shall be applicable. A conflict occurs when both the general and specific requirements cannot be satisfied at the same time for the regulated matter. Where, in a specific case, different paragraphs of this code or its referenced standards specify different materials, methods of construction or other requirements, the most restrictive provision that provides the highest degree of safety shall govern. If there is a conflict between a requirement of this code and a referenced standard, the provisions of this code shall govern unless otherwise provided in section 3781.11 of the Revised Code.

The steps to be taken in regard to the need and installation of an Emergency Responder Radio System are as follows:

Step 1 - When the building plans are submitted to the City of Columbus Building and Zoning Services, a Division of Fire Emergency Responder Radio System Acknowledgement Form must be submitted with he plans.

Step 2 - When the building is “closed in” an initial radio signal strength (Spectrum Analysis) and clarity study is run on a 20 grid block per floor and results are submitted to Columbus Division of Fire (CFD). If more than one block on a given floor is over the -95db threshold, or a critical area has poor coverage a system will likely be required for effected areas by CFD. If the system passes the initial radio signal strength (Spectrum Analysis) and clarity study; then a final inspection can be scheduled with the CFD after the strength (Spectrum Analysis) and clarity study has been reviewed by CFD..

Step 3 - An installation permit application with design and cut sheets are submitted to CFD for review and approval or a correction letter would be sent to owner. A Fire Alarm and/or Electrical permits may also be required by the Building and Zoning Services.

Step 4 – Once an installation permit is received; the installation, initial dummy load testing, and live testing can be completed. A second radio signal strength (Spectrum Analysis) and clarity study with the system in place will be submitted to CFD for review.

Step 5 - Final Inspection by CFD is scheduled per the Code Compliance Guidelines

Step 6 - Owner contractor to provide as-built and final testing documentation as per Code Compliance Guidelines

Step 7 - Sign off Final Permit CFD

Step 8 - Owner obtains Annual Operating Permit based on annual 3rd party testing

1.0 PERMITS

1.1 This guideline applies to all buildings within the City of Columbus.

1.1.1 Where approved by the fire code official, a wired communication system may be permitted to be installed and/or maintained in an existing building in lieu of an approved radio coverage system. (*Note: Be prepared to discuss the affects the installation of an EMERGENCY RESPONDER RADIO System (ERRS) system will have and why it is not feasible for this building.*

1.1.2 **Buildings which will achieve radio coverage without amplification are exempt**. When it is determined, by a radio signal strength and clarity study, that the radio coverage system is not needed. Buildings which will achieve radio coverage without amplification are exempt. The radio signal strength and clarity study must be completed by a licensed third party and the test results submitted to the Division of Fire, Fire Prevention Bureau for review.

1.1.3 In facilities where emergency responder radio coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the fire code official shall have the authority to accept an automatically activated emergency responder radio coverage system.

1.1.4 The common method to achieve compliance with Ohio Fire Code 510 is the installation of a bidirectional amplifier (BDA), an amplified distributed antenna system (DAS), or other proven signal amplification technology capable of achieving the required radio coverage. A DAS is a network of cables and antennas configured to distribute the signals from the BDA evenly throughout the building. This is usually accomplished through the use of multiple antennas or radiating cable (also known as leaky coaxial cable). When combined with a BDA, DAS is usually the best option for enabling capacity and coverage inside dense infrastructures, such as shopping malls, multi-tenant commercial and residential centers, and high rise buildings. In addition to the standard coaxial cable distribution, DAS can also use a fiber-optic backbone to distribute signals. This fiber-optic option provides a lower loss solution for larger venues or more complex systems like business and residential campuses, as fiber-optics can extend out to miles before it impacts system performance. The building-by-building approach may accommodate start-up requirements, however, developing fiber optic systems that support multi building and larger applications should be seriously considered. Taking a system approach could reduce initial and life-cycle costs as well as provide improved control of the radio system. This approach will only be approved for buildings located on the same parcel as identified by the county auditor.

1.2 A construction permit is required for installation of or modification to Emergency Responder Radio Systems (ERRS) and related equipment. To acquire an installation permit for ERRS, submit the following to the Columbus Division of Fire, Bureau of Fire Prevention located at 3639 Parsons Avenue, Columbus, Ohio 43207.

1.2.1 A completed Emergency Responder Radio System Application – provide all required information.

1.2.2 A copy of the City of Columbus Building and Zoning Services (BZS) "Certificate of Plan Approval" – this may be obtained from the architect or general contractor, if applicable.

1.2.3 A copy of any approved "variance" or "alternate methods" that is relevant to the ERRS, if applicable. Check with the architect or general contractor if a "variance" or "alternate methods" was submitted to and approved by the City of Columbus.

1.2.4 A minimum of three sets of shop quality plans and one submittal packet for the proposed ERRS – one set of plans shall be retained by the Fire Prevention Bureau.

1.2.5 City of Columbus Building and Zoning Services may require separate permitting of any electrical and / or Fire Alarm work in association with the ERRS.

1.3. Permits are required for any of the following work:

1.3.1 Installation of a new ERRS

1.3.2 Any alteration to an existing ERRS

1.3.3 Addition to an existing ERRS

1.3.4 Demolition of a part or of a whole ERRS

1.3.5 Maintenance performed in accordance with this code is not considered a modification and does not require a permit.

1.4. Initial Permit fees based on one hour of plan review and one hour of inspection time.

1.5. The permit applicant shall be the installing contractor. See item 4.10 herein for ERRS personnel qualifications.

1.6. Installation, alteration, or demolition of a system shall not commence prior to the approval of plans and the issuance of a permit.

1.7. The Columbus Division of Fire approved set of plans shall be kept at the project site until final approval of the permit, after which they shall remain in the possession of the owner.

1.8. Equipment shall have FCC certification prior to installation.

1.9. **Operating Permit** – An emergency responder radio system operating permit will be required starting January 1, 2018. The owner/tenant shall contact Bureau of Fire Prevention at (614) 645-7641, as soon as possible after the project final, to obtain the yearly operating permit.

2.0 PLANS

2.1 General Requirements for All ERRS Projects.

2.1.1 Plans and attachments shall be clearly labeled and legible.

2.1.2 Plans and all revisions to the plans shall be dated. If utilizing an existing drawing or portion of a drawing, the area of work shall be highlighted and clouded with an appropriate symbol. Provide a revision list with a symbol, date, description, and initials.

2.1.3 When making alterations, additions, or deletions to an existing system, all existing devices and equipment shall be shown and properly identified on the floor plan and system riser (single-line) diagram.

2.1.4 Plans shall include a title sheet, an equipment list, a floor plan, a system riser diagram, and secondary power calculations (see paragraphs 2.2 through 2.9).

2.1.5 Attachments shall include the manufacturer's specification sheets for all equipment and devices such as; cables, amplifiers, ups, batteries and antenna; indicating the FCC certification. See paragraph 2.9.

2.1.6 Note: Failure to provide any of the information required in sections 2.1 through 2.9 will result in the plans being disapproved.

2.2. Title Sheet

2.2.1 The front sheet shall contain the following information:

2.2.1.1 Project name and address of the project.

2.2.1.2 The designer's full name (no initials, pseudonyms, acronyms, or aliases) FCC License number and signature. The designer of record shall be responsible for the entire system being worked on.

2.2.1.3 Business name, address, and FCC issued License of the installing contractor**.** <u>If the designer of the ERRS is not the installing contractor, the following shall be clearly indicated/printed on the plans</u>:

2.3.1.3.1 **DESIGNED BY** - followed by the designer's business name, address, designer of record's full name and signature. (See IFC (2015) 510.5.2 and item 4.10 herein for qualifications)

2.3.1.3.2 **INSTALLING CONTRACTOR** - followed by the installing contractor's business name, address. (See IFC 510.5.2 and item 4.10 herein for qualifications)

2.2.1.4 Type of supervising station service as per NFPA 72.

2.2.1.5 Occupancy group(s) of building or area as defined by the Ohio Building Code.

2.2.1.6 Number of stories below grade, number of stories above grade, building height, total building area, and building construction type.

2.2.1.7 Scope of work. If the scope of work is the demolition of an existing ERRS, justification for removal shall be provided. See 1.1.2 herein.

2.2.1.8 Description of transmission zone assignments.

2.2.1.9. A note stating that the design and installation complies with NFPA 72 (<u>*2016 edition), NFPA 1221 (2016 edition)*</u>, the National Electrical Code (Current Edition as found in the referenced standards of the Ohio Building Code), the Ohio Fire Code (Current edition), the Ohio Building Code (Current edition), and the Columbus Division of Fire ordinances, policies, and standards.

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2.2.1.10 A clear site map and/or vicinity map.

2.2.1.11 All other pertinent notes.

2.2.2 A key plan of the building and/or complex indicating the street location and the area of work within the building shall be provided.

2.3 Equipment List
2.3.1 Provide the model number, manufacturer's name, description, quantity, and symbols to be used (legend) for each device, equipment, and conductors proposed to be installed *(Note: The Fire Department reserves the right to disallow any listed product due to past performance).*

2.3.2 The symbols used on the plans shall match the legend. Strike out any "typical" symbols that do not pertain.

2.4 Floor Plan – the following shall be clearly indicated:

2.4.1 Scale used and a graphical representation of the scale. The minimum scale for ERRS plans is 1/8" = 1'-0". Metric scale shall not be accepted.

2.4.2 Room and Room Names.

2.4.3 The locations of partitions, non-rated walls, and rated walls.

2.4.4 The location of all Emergency Responder equipment.

2.4.5 Power and Panel locations.

2.4.6 Raceway routing.

2.4.7 Conduit and conductor size.

2.4.8 Roof plan showing location(s) of antennae.

2.4.9 Location(s) of In Building Antennae.

2.4.10 Band width.

2.5 Riser Diagram – provide the following:

2.5.1 Single-line wiring diagram (riser diagram) that shows the interconnection of equipment of the whole system.

2.5.2 Type and size of wire or conductor to be used.

2.5.3 Schematic drawing of electrical system and backup power.

2.6 Detail Diagram – Show Supervisory points from repeater.

2.7 Calculations

2.7.1 Secondary power calculation – See 3.20 herein.

2.8 Signal propagation Map – Provide a color map indicating the signal strengths as designed and then as installed by As-Built.

2.9 Attachments

2.9.1 Manufacturer's specification sheets for all devices, equipment, and materials to be used shall be submitted, including the cables, amplifiers, ups, batteries, antenna and transponder to the supervising station. Highlight on the cut sheet which device or equipment is being used, the listing information, and the application per listing.

3.0 DESIGN AND INSTALLATION

3.1 ERRS shall be designed and installed in accordance with NFPA 72 (2016 edition), NFPA 1221 (2016 edition), the Ohio Fire Code, the National Electrical Code (Current Edition as found in the referenced standards of the Ohio Building Code), the Ohio Building Code (current), and the Columbus Division of Fire ordinances, policies, and standards.

3.2 It is recommended that the design of the ERRS is to provide signal amplification on every floor of the building. During installation, install infrastructure (equipment space, electrical power and cable pathways) throughout the building. However, install amplification only on floors that fail to pass the Contractor's pre-installation (original signal strength test) and/or final acceptance tests.

3.3 Components used in the installation of the ERRS, such as repeaters, transmitters, receivers, signal boosters, cabling, and fiber-distributed antenna systems, shall be tested for compatibility with the public safety radio system.

3.4 ERRS shall permit the simultaneous use and interoperability of analog and digital modulation radios.

3.5 ERRS shall be neutral host and nonproprietary.

3.6 ERRS shall not infringe on or be overrun by adjacent building communication systems or cellular telephone service provider systems.

3.7. Permanent external filters and attachments shall not be permitted.

3.9. **Maximum power output**: The maximum power allowed by FCC. The minimum power required to carry out the desired communication shall not be exceeded. The responsibility for staying within these power limits falls on the professional installer.

3.10. Documentation required is presented in NFPA 72 (2013) Chapter 7.

3.11. **Retroactivity:** 2511.05 - Compliance Schedule for Emergency Responder Radio System in Existing Buildings

2511.05.01. Building owners shall conduct a test of the Emergency Responder Radio System coverage and submit test results to the fire code official not later than 3 years of the first effective date of this code. Testing shall meet the guidelines established by the Division of Fire and include both radio signal strength and delivered audio quality. If Emergency Responder Radio System coverage is not provided, based upon the existing coverage levels of the public safety communication system, then an amplification system shall be provided within 6 years of the first effective date of this code.

Exceptions:

(A) Buildings less than three stories in height and does not contain a basement or extend one or more levels below grade.

(B) Buildings with an area of less than 10,000 sq. ft. and does not contain a basement or extend one or more levels below grade.

(C) One and two-family dwellings and townhouses that are built to the Ohio Residential Code (ORC).

2511.05.02 Building owners shall conduct a test of the Emergency Responder Radio System coverage and submit test results to the fire code official when a Change of Use of the building or part of the building occurs. Testing shall meet the guidelines established by the Division of Fire and include both radio signal strength and delivered audio quality. If Emergency Responder Radio System coverage is not provided, based upon the existing coverage levels of the public safety communication system, then an amplification system shall be provided before occupying.

2511.05.03 Building owners shall conduct a test of the Emergency Responder Radio System coverage and submit the test results to the fire code official when the proposed construction costs of the renovation or addition exceed 25% of the "full and fair cash value" of the building based upon all work completed with a 36 month period. Testing shall meet the guidelines established by the Division of Fire and include both radio signal strength and delivered audio quality. If Emergency Responder Radio System coverage is not provided, based upon the existing coverage levels of the public safety communication system, then an amplification system shall be provided before occupying.

2511.05.04 Emergency Responder Radio System amplification shall be designed, installed, and tested in compliance with Ohio Fire Code 510 and City of Columbus Fire Code 2505.16

3.13. Emergency responders include City of Columbus Fire and Police Departments and their automatic response partners See Appendix A.

3.14. **Frequencies**: For current published frequencies refer to Appendix A.

3.15. **Location:** ERRS head-end including all common equipment location shall be approved by the Fire Code Official. A sign or map identifying location of room and master power switch shall be provided as needed to assure the location is readily identifiable to emergency responders.

3.15.1 Locate the ERRS node equipment in Telecommunications Rooms (TRs).

3.15.2 The ERRS headend room and the TRs containing ERRS equipment shall be evaluated by a mechanical engineer to determine ventilation needs based on the heat load for the various spaces.

3.15.3 Rooms housing ERRS equipment to be separated from the remainder of the building by 2 hour rated fire barriers.

3.15.4 Provide pathway (circuit) survivability in accordance with code.

3.15.5 Location of the main RF and donor site (site closest to the jobsite) and their power - The Lat/Long coordinates will be provided to the contractor developing the DAS system and will vary by location. At no time will the contractor be allowed access to city radio sites.

3.16. **Additional frequencies.** Provide ERRS expandability to permit future additions and changes to the emergency responder radio frequencies

3.16.1. A 700MHz system may be deployed in the future and this will also be a requirement for the building owner. For planning purposes, factor the data from the 800MHz tests to model the indoor 700MHz requirements. The building owner shall modify or expand the emergency responder radio coverage system at his or her expense in the event frequency changes are required by the FCC or additional frequencies are made available by the FCC. Prior approval of a public safety radio coverage system on previous frequencies does not exempt this section.

3.16.2. ERRS shall comply with the requirements of and obtain licensee consent from the FCC as required.

3.16.3. Do not combine the ERRS with other radio systems such as:

Cellular telephone signal enhancement.

Wi-Fi systems.

Pager systems.

Medical telemetry systems

3.17. All signal booster components shall be contained in National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet(s) or other *approved* enclosure(s).

3.18. **Secondary power supply** - Emergency responder radio coverage systems shall be provided with an approved secondary source of power per the Ohio Fire Code.

3.18.1. When primary power is lost, the power supply to the emergency responder radio coverage system shall automatically transfer to the secondary power supply. In accordance with CFD requirements for alarm systems, provide standby batteries or other approved secondary power source sufficient to supply 24 hours of Standby. The design capacity shall be based on standby plus 100% load (means of two-way conversation) for 24 hours.

3.18.2. Connect the UPS (2-hour capacity on full operational load) to a generator-backed emergency power circuit if available.

3.18.3. As a Minimum: UPS shall be enclosed in a NEMA Type 4 waterproof enclosure.

***Exception**: Listed systems that are contained in integrated battery cabinets*.

3.18.4 UPS batteries shall be of the sealed maintenance-free type.
3.18.5 Provide battery ventilation in accordance with code.

3.19. **Emergency Power Off (EPO)** - A disconnect relay connection that will disengage the Power shall be provided and be the only method of turning off a UPS system. DC Systems shall have a Battery Disconnect Switch. To turn the entire ERRS off, two actions must be completed. 1) Turn off the secondary power supply using the EPO switch and 2) Turn off the circuit breaker to cut the normal AC. The switch(es) shall be readily identifiable.

3.19. **Supervision** - As a Minimum, Provide supervision of the ERRS antennas, signal boosters, power supplies and UPS.

3.19.1. Provide supervisory and trouble signals indicating impairment. Connect the supervisory and trouble alarm contacts to the building fire alarm system.

3.19.1.1. As a Minimum, the following conditions shall be monitored through the Fire Alarm Panel:

3.19.1.1 Antenna Malfunction
3.19.1.2 Signal Booster Failure
3.19.1.3 Low Battery Capacity, sending a supervisory signal at 70% of battery capacity.
3.19.1.4 Loss of normal AC power.
3.19.1.5 Failure of battery charger.

3.19.2. Program the fire alarm system to relay ERRS supervisory and trouble signals to the appropriate supervising station. Instruct supervising station personnel to notify the Columbus Division of Fire of the impairment.

3.20. **Dedicated Panel – In compliance with** NFPA 72 (2016), NFPA 1221, and the Ohio Fire Code
3.21. **Antennas** - If outdoor antennas are required, obtain as Building and Zoning Services approval of antenna locations. Provide access for maintenance.

3.22. **Wiring**. The wiring shall be in as required by NFPA 72 (2016), NFPA 1221, and the Ohio Fire Code

3.22.1 Identify all required outside plant fiber optic cables required to connect ERRS to remote antennas, other services and other buildings.

3.22.2 The conduit is not required to be dedicated to radio system cable. Radio system cable may be comingled in the conduit with fiber-optic and other cable that will not impede signal transmission and complies with the Electrical Code.

3.22.3 Cable shall be in metal conduit, be metal clad or in metal sheathing.

3.23. **Signage**. Signage shall be provided in accordance with the following. A sign shall be located seven feet above grade directly above or near the building Knox Key Box stating “ERRS” with Radio Logo (See Appendix B). If the building does not have a Knox Key Box the sign shall be located within five feet of the

main entrance at the same height stated above. A sign shall also be provided at the fire alarm annunciator panel.

4.0 TESTING

4.1 An inspection is required to demonstrate compliance to the provisions of the code. The Owner or an authorized agent of the owner is responsible to obtain and fund special inspections services with a Contractor. The Owner is responsible to provide acceptable radio coverage within the facility, access to documentation and to request inspection after a system is first installed, annually and when modifications are made to the facility. Inspection requests will identify the Testing Service who will propose a schedule and provide supporting records. The Contractor will provide as-built documentation, commissioning test data and observations of the physical installation and performance of the signal booster system as verification of proper system operation prior to placing the system on-the-air and to document indoor radio coverage of the system.

4.2 **Field testing.** Radio protocols will need to be coordinated with Columbus Fire Prevention Bureau. As they will be testing on the City's assigned channels, use clear regular voice communications.

4.3 CFD Departmental interaction procedure for testing:

4.3.1 Contact **Fire Prevention Bureau at 614-221-3132 Ext. 7-5635 to schedule any testing. A minimum of three (3) full business days lead time is required.**

4.8 **Acceptance testing.** Upon completion of installation, the building owner shall have the radio system tested to ensure that ERRS is functional.

4.8.1 The two primary considerations for the Acceptance Tests are:

4.8.1.1 Equipment Validation (Again - before it is placed on the air)

4.8.1.2 Coverage Validation (to document the improved coverage)

4.8.2 Any transmitter test shall document that the transmitter is set to the minimum power required to carry out the desired coverage.

4.8.8 After completion of Signal Level Measurements and evaluation of Audio Quality, CFD will be asked by the contractor to schedule a Fire Crew to survey the building and verify Fire Command and Dispatch radio operation. Failure of the operational check will require that the Owner correct deficiencies and re-schedule Acceptance Testing.

4.9 **Annual testing and proof of compliance.** The emergency responder radio coverage system shall be inspected and tested by qualified personnel annually, or, whenever structural changes occur in or around the complex, including additions or remodels that could materially change the original field performance tests. A final test report provided by the Owner's Testing Agency shall be provided to CFD.

4.9.1 Columbus Division of Fire personnel shall have the right to enter onto the property at any reasonable time to conduct field testing to verify the required level of radio coverage.

4.10 **Minimum qualifications of personnel**. Only certification of in-building training is considered demonstration of adequate skills and experience. The minimum qualifications of the system designer, lead installation personnel and personnel conducting radio system tests shall include possession of:

4.10.1 A valid FCC-issued general radio operators license; and
4.10.2 Certification of in-building system training issued by;
4.10.2.1 Association of Public Safety Communications Officials (APCO), or
4.10.2.2 National Association of Business Education Radio (NABER), or
4.10.2.3 Personal Communications Industry Association (PCIA) or,
4.10.2.4 The manufacturer of the equipment being installed.

Note: All design documents and all tests shall be recorded and the data signed by a person meeting the minimum qualifications required by Ohio Fire Code and herein.

5.0 Inspections

5.1 Field inspections shall be scheduled only after a permit has been issued.

5.2 Inspections shall be scheduled by the installing contractor only. When scheduling for inspection, request for sufficient time to complete a thorough inspection of the work performed. Travel time is included in your inspection time.

5.3 The contractor shall schedule CFD to survey the building and verify Fire Command and Dispatch radio operation through the Fire Prevention Bureau per 4.8.8 herein. Inspections may be scheduled by calling (614) 221-3132 Ext. 7-5635. An inspector will call to schedule the time and date of the inspection.

5.4 Missed inspections or inspections canceled within 24 hours shall be counted against inspection time. The installing contractor shall conduct a complete test of the system and shall complete all parts of the "Record of Completion" **prior** to the Columbus Division of Fire inspection date.

5.5 Necessary coordination shall be made such that representatives of other contractors whose equipment are involved in the testing are present.

5.6 There shall be sufficient personnel and equipment to demonstrate the installation.

5.7 At the time of inspection, the contractor shall hand the following documentation to the CFD inspector upon his/her arrival, which includes:

5.8.1 Approved and stamped plans.

5.8.2 A copy of the completed "Emergency Communications Systems Supplementary Record of Completion".

5.8.2.1 The Emergency Communications Systems Supplementary Record of Completion shall include the names and contact information of personnel to be contacted at any time (24/7/365) if access to the equipment is needed.

5.8.3 As-built plans if installation has deviations from the approved plan.

5.8.4 All previous records of inspections.

5.9 After the successful completion of the tests/inspections, provide the following to the CFD inspector:

5.9.1 Documents specified in NFPA 72 (2016) and NFPA 1221 (2016)

5.10 After final completion and acceptance of the project, the contractor shall provide the following to the owner:

5.10.1 Documents specified in NFPA 72 (2016) and NFPA 1221 (2016)

5.10.2 All literature and instructions provided by the manufacturers describing proper operation and maintenance of all devices and equipment,

5.10.3 A copy of the approved plan and as-built plan, if applicable,

5.10.4 A copy of the Certificate of Completion, and

5.11 Code requires one set of ERRS technical information and documentation to be filed in the Fire Command Center (if one exists) or in the ERRS headend room. After final completion and acceptance of the project, the Owner shall maintain the following on site:

5.11.1 Documents specified in NFPA 72 (2016) and NFPA 1221 (2016)

5.11.2 All literature and instructions provided by the manufacturers describing proper operation and maintenance of all devices and equipment,

5.11.3 A copy of the as-built plan,

5.11.4 Summary drawing showing locations of ERRS headend and node equipment, and antenna sites,

5.11.5 Summary of ERRS frequencies utilized,

5.11.6 Table of effective radiated power at antenna sites,

5.11.7 Keys to radio equipment room in key box

5.11.9 A copy of the Certificate of Completion, and

5.11.10 The names and contact information of personnel to be contacted at any time (24/7/365) if access to the equipment is needed.

6.0 Document Revisions

6.1 This document is subject to revisions. For general information and to verify that you have the most current document, please call (614) 221-3132 Ext. 7-5635, and request the current version date.

Appendix A

City of Columbus Trunked System in MHz (P-25 Digital IP)

CH	INPUT FREQ	OUTPUT FREQ
21	813.0125	858.0125
23	814.4375	859.4375
24	815.4875	860.4875
25	814.4875	859.4875
5	811.4375	856.4375
6	813.4375	858.4375
7	812.4375	857.4375
8	813.4875	858.4875
9	812.4875	857.4875
10	811.4875	856.4875
11	815.9375	860.9375
12	814.9375	859.9375
13	813.9375	858.9375
14	812.9375	857.9375
15	811.9375	856.9375
16	815.9875	860.9875
17	814.9875	859.9875
18	813.9875	858.9875
19	812.9875	857.9875
20	811.9875	856.9875
1 CONTROL	814.2125	859.2125
22	806.1625	851.1625
2 CONTROL	806.4125	851.4125
3 CONTROL	806.6625	851.6625
4 CONTROL	808.0375	853.0375
26	808.4500	853.4500
27	808.7750	853.7750
28	815.2125	860.2125

Franklin County Trunked System in MHz (Backup System for Public Safety) (Motorola Type II-Analog)

CH	INPUT FREQ	OUTPUT FREQ
1 Control	812.6125	857.6125
2 Control	814.2625	859.2625
3 Control	813.2625	858.2625
4 Control	812.2625	857.2625
5	811.26250	856.2625
6	808.8125	853.8125
7	808.6750	853.6750
8	808.4250	853.4250
9	808.1500	853.1500

10	807.9375	852.9375
11	807.6875	852.6875
12	807.0875	852.0875
13	806.7375	851.7375
14	806.4625	851.4625
15	806.3875	851.3875
16	806.2125	851.2125
17	806.1375	851.1375
18	808.5125	853.5125

National Mutual Aid 800 MHz Frequencies in MHz (Mobile only)

CH	INPUT FREQ	OUTPUT FREQ
8CALL90 REPEATER	806.0125	851.0125
8CALL91 REPEATER	806.5125	851.5125
8CALL92 REPEATER	807.0125	852.0125
8CALL93 REPEATER	807.5125	852.5125
8CALL94 REPEATER	808.0125	853.0125

Simplex Frequencies

CH	INPUT FREQ	OUTPUT FREQ
Direct A	857.4625	857.4625
Direct B	857.7625	857.7625
Direct C	856.5125	856.5125

Attention: In anticipation of radio service providers migrating to APCO-25 based digital radio systems the amplifier chosen must be able to amplify frequencies in the 700 MHz and 800 MHz public safety radio bands. This will ensure that the amplifier will work with all future public safety assigned frequency ranges.

a. Location of radio sites- The locations for the tower sites for both trunked radio systems are as follows:

City of Columbus Trunked System

Site Name	Street	City	ASR	GPS Coordinates	Site Elevation	AGL	ERP
Rhodes Tower	30 E. Broad St.	Columbus	1019228	39-57-47.0 N 082-59-59.0 W	758 ft	645 ft	245w
Griggs Tower	3080 Dublin Rd.	Columbus	1019375	40-00-50.0 N 083-05-40.0 W	810 ft	314 ft	295w
Groves Tower	4250 Groves Rd.	Columbus	1019426	39-56-02.0 N 082-53-18.0 W	758 ft	314 ft	295w
Lazelle Tower	442 Lazelle Rd.	Columbus	1245403	40-08-14.0 N 082-59-44.0 W	935 ft	390 ft	188w
Morse Tower	4250 Morse Rd.	Columbus	1019430	40-03-48.0 N 082-53-45.0 W	810 ft	314 ft	295w
Parsons Tower	5900 Parsons Ave.	Lockbourne	1019427	39-50-29.0 N 082-59-23.0 W	725 ft	314 ft	295w
E. Broad Tower	6504 E. Broad St.	Columbus	None	39-58-57.9 N 082-49-40.7 W	895 ft	182.7 ft.	200w

Franklin County Trunked System

Site Name	Street	City	ASR	GPS Coordinates	Site Elevation	AGL	ERP
WOSU Tower	6131 Highland Lakes Ave.	Westerville	1054358	40-09-33.0 N 082-55-23.0 W	921 ft	1107 ft	266w
County Building	373 S. High St.	Columbus	1202259	39-57-13.0 N 083-00-02.0 W	760 ft	528 ft	266w

Appendix B

A sign is required to indicate that an ERRS is installed in the building. The sign shall be no smaller than 10" high and 16" wide and be placed 6" above the Rapid Key Entry Box on the front of the building, if applicable. If there is no Rapid Key Entry Box then the sign shall be installed at a height of 7' from the ground and within 5' of the main entrance. An additional signs, same size and style shall be placed above the fire alarm panel and any remote annunciators.

The sign shall be white with the red radio icon and with the letters "ERRS" in red reflective letters.

Appendix C

Testing Procedures

1. Each floor of the building shall be divided into a grid of 20 approximately equal areas and all critical areas shall be identified. Grid size should not be less than 1,000 sq. ft. or greater than 10,000 sq. ft. (Example – A 4,000 sq. ft. area would require to only have four test grids and a million sq. ft. building would require a 100 test grids)

2. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system.

3. A maximum of two nonadjacent areas shall be allowed to fail the test.

4. In the event that three of the areas fail the test, in order to be more statistically accurate, the floor may be divided into 40 equal areas. A maximum of four nonadjacent areas shall be allowed to fail the test. If the system fails the 40-area test, the system shall be altered to meet the 90-percent coverage requirement.

5. A test location approximately in the center of each grid area shall be selected for the test, then the radio shall be enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire area. If the test fails in the selected test location, that grid area shall fail, and prospecting for a better spot within the grid area shall not be allowed.

6. 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 during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.

7. As part of the installation a spectrum analyzer or other suitable test equipment shall be utilized to insure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at time of installation and subsequent annual inspections.

8. For testing system signal strength and quality, the testing shall be based on the delivered audio quality (DAQ) system. A DAQ level below 3.0 shall be considered a failed test for a given grid cell.

9. Measurements shall be made with the antenna held in a vertical position at 3 to 4 feet above the floor to simulate a typical portable radio worn on the belt or turnout coat pocket.

10. At the conclusion of the testing, a report which compliance with this document shall be submitted to the fire code official. The report shall include the testing method used; readings taken, and final results. A small scale drawing (11 inch x 17 inch maximum) of each floor of the structure shall also be provided. The plans shall show each floor divided into the grids as described above and all critical areas. Each grid and critical area shall be labeled to indicate the dBm level and DAQ result from the test.