


TECHNICAL BULLETIN CITY OF RALEIGH, N.C. www.raleighnc.gov				OFFICE OF THE FIRE MARSHAL	
Subject Emergency Responder Radio Coverage	Bulletin # TB-17	SECTION	PAGE	EFFECTIVE DATE	
		NCFPC	1 of 6	1/1/2019	
		PREPARED BY Office of the Fire Marshal		Revision Date 12/2/2021	

1.0 **Purpose**

The purpose of this policy is to provide a clear understanding of the current North Carolina Fire Prevention Code requirements for Emergency Responder Radio Coverage

2.0 **Organization(s) Affected**

COR Development Services, Raleigh Fire Department Office of the Fire Marshal, Wake County, Project development teams, General Contractors, Bi-Directional Antenna System design, installation and service companies.

3.0 **References**

North Carolina Fire Prevention Code, current adopted edition; North Carolina Building Code, current adopted edition; NFPA 72, current adopted edition; National Electrical Code, current North Carolina adopted edition; North Carolina Approved Amendments to the current North Carolina Building, Fire, and Electrical codes.

4.0 **Definitions**

Unless otherwise expressly stated, the following definitions shall, for the purposes of this technical bulletin, have the meanings as shown in 4.0.

DAS- Distributed Antenna System

BDA- Bi-Directional Antenna System

(ER-RSS-Outside)- Emergency Responder Radio Signal Strength Outside Building

(ER-RSS-Inside)- Emergency Responder Radio Signal Strength Inside Building

Design Professional- Registered Architect or Licensed Professional Engineer

Raw Survey- Initial survey of Emergency Responder Radio Signal Strength Outside Building

“ERRCS”- Emergency Responder Radio Coverage System.

5.0 **Requirements**

5.1 All **new** buildings shall have approved radio coverage for emergency responders within the building (ER-RSS-Inside), based upon the current coverage levels of the public safety communication system at the exterior of the building (ER-RSS-Outside). This requirement does not require improvement of the current public safety communication system.

5.1.1 Exceptions:

5.1.1.1 Where approved by **the building official and the fire code official**, a dedicated fire phone communication system shall be permitted to be installed and maintained.

5.1.1.2 Where it is determined by the **fire code official** that an emergency responder radio coverage system (BDA, DAS) is not needed.

5.1.1.3 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.

5.2 A preliminary evaluation plan (raw survey) of the current outside Radio Signal Strength (ER-RSS-Outside) shall be developed for all new buildings. (Step 1). This is required to provide necessary information for the proper design of new buildings. The required form for the preliminary evaluation would be a site plan with the existing Emergency Responder Radio Signal Strength (ER-RSS-Outside) measured in 5 places where the proposed building is to be constructed. Existing Control Frequency signal strength to be indicated on the site plan. This plan shall be developed within 12 months of the building plan submittal as new buildings constructed may impact the current Radio Signal strength available.

5.3 The preliminary evaluation plan of current (ER-RSS-Outside) can be developed by an FCC licensed radio technician (General Class) or a North Carolina Design Professional, both of which require detailed knowledge of the Wake County Emergency Responder Radio System.

5.4 Building plan submittal packages shall include either (1) a plan indicating that an Emergency Responder Radio Coverage System will be installed with engineered shop drawings to be a delayed submittal **OR** (2) an evaluation by a North Carolina Design Professional based on the current raw survey (ER-RSS-Outside) that in their opinion the proposed building is most likely to meet the minimum radio signal strength requirements (ER-RSS-Inside) referenced in the current North Carolina Fire Prevention Code, (-95 dBm) receive and transmit in 95% of all areas on each floor of the building.

5.5 The purpose of the above requirement (5.4) is to help identify building construction that will not meet the minimum requirements (Minimum Emergency Responder Radio Coverage) at the end of the building process.

5.6 Buildings and structures determined to not meet the required minimum Emergency Responder Radio Signal Strength shall submit a design for an Emergency Responder Radio Coverage System (ERRCS), with FCC and UL 2524 certified signal boosters. Alternate FCC certified signal booster systems may be submitted for evaluation. This design is required to be submitted as part of the building permit package. Design drawings to be prepared under the supervision of a North Carolina Registered Design Professional.

5.7 (ERRCS) Shop Drawings shall be submitted with vendor specific equipment details for approval prior to installation of equipment. Shop drawings shall include a detailed system design from a computer-generated model that predicts the RF propagation within the facility. Details shall provide calculations for power levels throughout the system and provide an uplink noise analysis. Shop drawings shall detail the locations of all equipment and cables in the facility. Shop drawings to be prepared under supervision of FCC Licensed General Class Radio Technician with certification of in building system training, and under the supervision of a North Carolina Registered Design Professional. All systems shall have a way to deenergize the system or a "kill switch" at the fire alarm panel with instructions.

5.8 At the final inspection of all new buildings, detailed maps of each floor divided into 20 equal spaces for floors < 20,000 square feet or a maximum grid size of 40' x 40' for larger floors. This measurement (-dBm) shall be recorded as the Radio Signal Strength (RSS) available. All grid measurements shall be an average value of the control channel RSS. Measurements shall be taken with a calibrated Spectrum Analyzer. Each equal space (square) not meeting the minimum -95 dBm shall be sub-divided into 4 equal spaces with an average measurement meeting the -95 dBm minimum. 2 adjacent spaces not meeting the minimum -95 dBm is not allowed. The above measurements are subject to the 95% or 99% pass requirements for the receiving (Rx) and transmitting (Tx) frequency signals.

5.9 Transmitter registration, ALL radio signal amplifiers operating on Wake County Emergency Communication Center Frequencies Shall obtain registration documents from the Federal Communications Commission or Authorization letter from Wake County prior to powering any system on Wake County's frequencies. Documentation shall be attached to all transmitters prior to powering unit up.

5.10 Final inspection shall include in addition an evaluation of the Control Frequency signal strength level, provide time-lapse spectrum analyzer screen-shot that shows that when the traffic channels are active, they all are being received at about the same signal level.

5.11 Provisions are required at an "approved location" in the building Fire Command Room or at the Fire Alarm remote annunciator to disable the radio transmitter in the event of a system malfunction. Instructions for disabling the transmitter shall be firmly attached to the wall at the fire alarm zone map in a rigid frame and plexi-glass.

6.0 Radio System Specifications:

6.1 Raleigh-Wake Emergency Communications Center (911 Center), provides interoperable communications with emergency responders over a P-25 Digital Trunked system transmitting and receiving on 800 Mhz. band Frequencies. There are multiple frequencies and repeaters incorporated into the system. The frequencies labeled as simulcast transmit from most repeater towers at the same time. The Fuquay Varina transmitter is not currently on the simulcast system and operates on different frequencies. The system automatically assigns frequencies by request

to users' system wide, therefore all system frequencies are required to be available. At minimum the following groups of frequencies shall be evaluated (control channel, transmit and receive pair. (NFPA 72, 24.5.2.4))

6.2 Frequency changes: Systems shall be capable of upgrade, to allow for instances where the jurisdiction changes frequencies or adds system frequencies, to maintain radio system coverage as originally designed

6.3 The Two-Way Radio Communications Enhancement System installation and components shall be installed per the system manufacturers installation manual, NFPA 72, NEC, NC Fire Prevention Code, NC Building Code, and comply with all applicable federal regulations including but not limited to, FCC 47 CFR Part 90.

6.4 Installations shall be registered in the FCC signal booster database that can be accessed at <https://signalboosters.fcc.gov/signal-boosters/>.

6.5 Installations of Class-B boosters shall be registered, a copy of the registration, or at least the call sign, should be posted at/on the Class-B device.

6.6 Installations of Class-A boosters will require authorization from the Licensee (Wake County) before being activated. Copy of the authorization issued by the City/Licensee to be posted alongside the Class-A booster.

6.7 All signal boosters shall have FCC certification and UL listing, prior to installation.

6.8 All repeaters, transmitters, receivers and signal boosters shall be installed and operated per the equipment manufacturers installation and operation manual and in a manner consistent with Title 47 Code of Federal Register (CRF)

6.9 The minimum qualifications of the system designer and lead installation personnel shall include the following:

6.9.1 A valid FCC issued General Class Radio Operators License

6.9.2 Certification of in-building system training issued by a nationally recognized organization, school, or a certificate issued by the manufacturer of the equipment being installed

6.9.3 These qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the fire code official is provided and approved in the system permit."

6.10 System design software with prediction tools are to be used in the design plan to give an accurate display of the overall design and RF propagation, e.g., IBwave, Ranplan. Design process shall include site surveys to collect pre and post installation data to validate predictions and ensure proper loss, gain, and power levels

6.11 A calibrated spectrum analyzer or portable radio capable of reading RSSI and programmed to the appropriate control channel and direct frequencies will be used to test pre and post installation signal levels in dBm. RSSI and loss, gain, power levels will be included in the completed As-Built documentation. The spectrum analyzer should be within one year of its last factory-authorized calibration. Antenna used on the spectrum analyzer shall be of similar dB gain as the emergency responder portable radios.

6.12 A calibrated coax cable sweep test device such as a calibrated Spectrum Analyzer with a tracking generator will be used to capture accurate losses to validate design loss predictions and ensure proper installation of connectors. All measured cable losses will be included in the completed As-Built documentation.

6.13 Minimum Uplink and Downlink Isolation shall be 20 dB minimum as measured and added to the gain setting of the BDA to prevent Oscillation

6.14 Maximum propagation delay shall be 20 microseconds to prevent transmission delay and overlap causing interference and broken signals

6.15 Oscillation Suppression shall be required as a function of the BDA. The BDA shall self-adjust when detection of oscillation occurs without shutting down the BDA in the event oscillation occurs during an emergency event.

7.0 Acceptance Test Requirements

7.1 Critical areas will have 99 percent coverage and General areas will have 95 percent coverage. Critical areas must be designated on the survey in addition to 20 grids. (Elevator lobby, stair case, mechanical rooms).

7.2 Test will be deemed failed if two or more adjacent grids do not meet the required signal level.

7.3 Each Floor must be divided into a minimum of 20 grids and one sample must be taken from the center of each grid.

7.4 A calibrated spectrum analyzer or portable radio capable of measuring RSSI will be used to ensure a signal level of -95 dBm or greater in each grid.

8.0 Goal

The goal of this policy is to reduce hazards to responders and building occupants during emergency operations. Timely radio communications during emergencies are critical to the safety of the responders and occupants of the facilities. Emergency operations include Medical, Fire, and Law Enforcement responses.

9.0 Summary

9.1 Step 1> Survey and map the Emergency Responder Radio Signal Strength (Outside) at the property. (Raw Survey)

9.2 Step 2> Document that an ERRCS will be installed OR a Registered Design Professional to review the ER-RSS Outside survey and building construction plans to determine that the minimum ER-RSS Inside will likely be available in the proposed building.

9.3 Step 3> When the Design Professional determines that a BDA or RCS system will be required, an engineered plan shall be submitted at the time of building permit submittal. This plan shall at minimum document that a system is being installed and the location of the major components of the system shown on the plan. (shop drawings) including the radio wave propagation plan can be submitted when the building is under construction.

9.4 Step 4> Prior to construction of the BDA system, shop drawings with complete submittals shall be submitted for review and approved for construction.

9.5 Step 5> Prior to final inspection, an ER-RSS Inside survey shall be performed and mapped. This shall be submitted to the Design Professional and your Deputy Fire Marshal assigned to the inspection.

10.0 System Frequencies

10.1 Control Frequencies

SYSTEM	CHANNEL	Frequency TX	Frequency RX
SIMULCAST	1	853.9250	808.9250
SIMULCAST	2	853.9625	808.9625
SIMULCAST	3	853.4625	808.4625
SIMULCAST	4	853.1500	808.1500

10.2 System Frequencies

SYSTEM	CHANNEL	Frequency TX	Frequency RX
SIMULCAST	5	852.9625	807.9625
SIMULCAST	6	852.7875	807.7875
SIMULCAST	7	852.2625	807.2625
SIMULCAST	8	852.1500	807.1500
SIMULCAST	9	851.9625	806.9625
SIMULCAST	10	851.7625	806.7625
SIMULCAST	11	851.6250	806.6250
SIMULCAST	12	851.4625	806.4625
SIMULCAST	13	851.2625	806.2625
SIMULCAST	14	851.2000	806.2000
SIMULCAST	15	853.2625	808.2625
SIMULCAST	16	851.2875	806.2875
SIMULCAST	17	851.0375	806.0375
SIMULCAST	18	853.4625	810.4625
SIMULCAST	19	852.6500	807.6500
SIMULCAST	20	853.6500	808.6500
SIMULCAST	21	851.5375	806.5375
SIMULCAST	22	853.2000	808.2000
SIMULCAST	23	851.6500	806.6500
SIMULCAST	24	851.1500	806.1500

10.3 Transmitter Locations

Contact Fire Marshal's office if further information is needed for design.