

PERMIT SUBMITTAL REQUIREMENTS

- All files to be Portable Document Format - PDF
- Scaled plans (minimum 1/8" scale) showing the location of equipment, the coverage area of the system being installed, the location of the buildings FIRE ALARM PANEL, FIRE SPRINKLER RISERS, and the FIRE COMMAND ROOM (if there is one).
- Provide a detailed scope of work.
- A copy of the **SIGNED** Frequency Use Agreement between King County Radio Communications and the In-Building System Owner.
- A copy of valid FCC-issued general radio telephone operator's license for the system designer and system installers
- A copy of the system designer and the system installers certification of in-building system training issued by an approved organization or approved school, or a certificate issued by the manufacturer of the equipment being installed.
- All required documents need to be uploaded and all permit fees need to be paid, for a complete application submittal to be processed.

INSTALLATION AND USE REQUIREMENTS

- The system installation and operation must comply with:
 - **2018 International Fire Code** as amended by the **City of Tukwila**.
 - **WAC 51-54A-510**
 - Be forward compatible with the **PSERN** system.
 - Be approved by the emergency radio system authority.
- After the system has been installed and tested, an Emergency Responder Radio System **Compliance Letter** must be issued by King County Radio and a certification document from the installation company, stating that the emergency responder radio system has been installed and tested in accordance with this code and that the system is complete and fully functional (a copy must be given to the Fire Inspector at final inspection).
- System must pass Emergency Radio Final inspection (Talk-Back Test) by the Fire Department, **before** building occupancy is allowed.

Technical specifications for a Distributed Antenna Signal (DAS) to connect with the current King County Emergency Radio Communications System (KCERCS), you will need to contact your System Operator.

King County Radio Communications

<https://www.kingcounty.gov/depts/it/services/radio-services.aspx>

Puget Sound Emergency Radio Network (PSERN)

<https://psern.org/>

Valley Communications Center

<https://www.valleycom.org/>

EMERGENCY RESPONDER RADIO SYSTEM CODE REQUIREMENTS

Section 510 of the International Fire Code entitled "Emergency Responder Radio Coverage" is amended by the following:

- Section 510.1 **EMERGENCY RESPONDER RADIO COVERAGE (NEW BUILDINGS)**: Approved radio coverage for emergency responders shall be provided within buildings that meet any one of the following conditions:
 - The building is five stories or more above grade plane (as defined by the International Building Code, Section 202); or
 - The total building area is 50,000 square feet or more; or
 - The total basement area is 10,000 square feet or more; or
 - There are floors used for human occupancy more than 30 feet below the finished floor of the lowest level of exit discharge; or
 - Buildings or structures where the Fire or Police Chief determines that in-building radio coverage is critical because of its unique design, location, use or occupancy.

Exceptions:

- *Buildings and areas of buildings that have minimum radio coverage signal strength levels of the King County Regional 800 MHz Radio System within the building in accordance with Section 510.4.1 without the use of a radio coverage system. When determining if the minimum signal strength exists at a subject building (as referenced in Section 510.4.1.1), the signal strength shall be measured at any point on the exterior of the building up to the highest point on the roof.*
- *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 Marshal shall have the authority to accept an automatically activated emergency responder radio coverage system.*
- *One- and two-family dwellings and townhouses.*
- Section 510.2 **EMERGENCY RESPONDER RADIO COVERAGE (EXISTING BUILDINGS)**: Existing buildings shall be provided with approved radio coverage for emergency responders when:
 - Whenever an existing wired communications system cannot be repaired or is being replaced.
 - When a building undergoing substantial alteration meets any one of the conditions listed in Section 510.1. For purposes of this section, a substantial alteration shall be defined as an alteration that costs 50 percent or more of the current assessed value of the structure and impacts more than 50 percent of the gross floor area.
 - When buildings, classes of buildings or specific occupancies do not have the minimum radio coverage signal strength as identified in Section 510.4.1 and the Fire or Police Chief determines that the lack of minimum signal strength poses an undue risk to emergency responders that cannot be reasonably mitigated by other means.
- Section 510.3 **PERMITS REQUIRED**: A Construction Permit for the installation of or modification to emergency responder radio coverage systems and related equipment is required as specified in Section 105.7.6. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.
 - Prior coordination and approval from the Public Safety Radio System Operator is required before installation of an Emergency Responder Radio System. Until PSERN is the single operator of the county wide system (projected date Q4 2022 / Q1 2023), such approval is required from EPSCA, King County, Seattle or ValleyCom depending on the location of the installation.

- To be forward compatible, designers and contractors should be aware of PSERN's requirements for Distributed Antenna Systems which can be found on their website (<https://PSERN.org>).
- Section 510.4 **TECHNICAL REQUIREMENTS:** Systems, components, and equipment required to provide the emergency responder radio coverage system shall comply with Sections 510.4.1 through 510.4.2.8.
- Section 510.4.1 **EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEM SIGNAL STRENGTH:** The building shall be considered to have acceptable emergency responder communications enhancement system coverage when signal strength measurements in 95 percent of all areas on each floor of the building meet the signal strength requirements in Sections 510.4.1.1 through 510.4.1.3.
 - **Exception:**
 - *Critical areas, such as the fire command center(s), the fire pump room(s), interior exit stairways, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas required by the Fire Marshal, shall be provided with 99 percent floor area radio coverage.*
- Section 510.4.1.1 **MINIMUM SIGNAL STRENGTH INTO THE BUILDING:** The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the Fire Marshal. The inbound signal level shall be a minimum of -95dBm in 95 percent of the coverage area and 99 percent in critical areas and sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 or an equivalent Signal-to-Interference-Plus-Noise Ratio (SINR) applicable to the technology for either analog or digital signals.
- Section 510.4.1.2 **MINIMUM SIGNAL STRENGTH OUT OF THE BUILDING:** The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the Fire Marshal. The outbound signal level shall be sufficient to provide not less than a DAQ of 3.0 or an equivalent SINR applicable to the technology for either analog or digital signals. A minimum signal strength of -95 dBm shall be received by the King County Regional 800 MHz Radio System when transmitted from within the building.
- Section 510.4.1.3 **SYSTEM PERFORMANCE:** Signal strength shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as specified by the radio system manager in Section 510.4.2.2.
- Section 510.4.2 **SYSTEM DESIGN:** The emergency responder radio coverage system shall be designed in accordance with Sections 510.4.2.1 through 510.4.2.8 and NFPA 1221 (Current Addition).
- Section 510.4.2.1 **AMPLIFICATION SYSTEMS AND COMPONENTS:** Buildings and structures that cannot support the required level of radio coverage shall be equipped with systems and components to enhance the public safety radio signals and achieve the required level of radio coverage specified in Sections 510.4.1 through 510.4.1.3. Public safety communications enhancement systems utilizing radio-frequency-emitting devices and cabling shall be allowed by the Public Safety Radio System Operator. Prior to installation, all RF-emitting devices shall have the certification of the radio licensing authority and be suitable for public safety use.
- Section 510.4.2.2 **TECHNICAL CRITERIA:** The Public Safety Radio System Operator shall provide the various frequencies required, the location of radio sites, the effective radiated power of radio sites, the maximum propagation delay in microseconds, the applications being used and other supporting technical information necessary for system design upon request by the building owner or owner's representative.
- Section 510.4.2.3 **POWER SUPPLY SOURCES:** Emergency responder radio coverage systems shall be provided with dedicated standby batteries or provided with 2-hour standby batteries and connected to the facility generator power system in accordance with Section 1203. The standby power supply shall

be capable of operating the emergency responder radio coverage system at 100 percent system capacity for a duration of not less than 12 hours.

- Section 510.4.2.4 **SIGNAL BOOSTER REQUIREMENTS:** If used, signal boosters shall meet the following requirements:
 - All signal booster components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4, IP66-type waterproof cabinet or equivalent.
 - Exception:**
 - *Listed battery systems that are contained in integrated battery cabinets.*
 - Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher-rated cabinet, IP65-type waterproof cabinet or equivalent.
 - Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use prior to installation.
 - Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20dB greater than the system gain under all operating conditions.
 - Bi-Directional Amplifiers (BDAs) used in emergency responder radio coverage systems shall be fitted with anti-oscillation circuitry and per-channel AGC.
 - The installation of amplification systems or systems that operate on or provide the means to cause interference on any emergency responder radio coverage networks shall be coordinated and approved by the Public Safety Radio System Operator.
 - Unless otherwise approved by the Public Safety Radio System Operator, only channelized signal boosters shall be permitted.
 - Exception:**
 - *Broadband BDAs may be utilized when specifically authorized in writing by the Public Safety Radio System Operator.*
 - BDAs must also comply with PSERN's detailed requirements, which include channelized, minimum of 28 channels, supporting analog, P25 Phase I (FDMA), and P25 Phase II (TDMA). Information regarding PSERN requirements can be found via their website (<https://PSERN.org>).
- Section 510.4.2.5 **SYSTEM MONITORING:** The emergency responder radio enhancement system shall include automatic supervisory and trouble signals that are monitored by a supervisory service and are annunciated by the fire alarm system in accordance with NFPA 72. The following conditions shall be separately annunciated by the fire alarm system, or, if the status of each of the following conditions is individually displayed on a dedicated panel on the radio enhancement system, a single automatic supervisory signal may be annunciated on the fire alarm system indicating deficiencies of the radio enhancement system:
 - Loss of normal AC power supply.
 - System battery charger(s) failure.
 - Malfunction of the donor antenna(s).
 - Failure of active RF-emitting device(s).
 - Low-battery capacity at 70 percent reduction of operating capacity.
 - Active system component malfunction.
 - Malfunction of the communications link between the fire alarm system and the emergency responder radio enhancement system.

- Section 510.4.2.6 **ADDITIONAL FREQUENCIES AND CHANGE OF FREQUENCIES:** The emergency responder radio coverage system shall be capable of modification or expansion in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority.
- Section 510.4.2.7 **DESIGN DOCUMENTS:** The Fire Marshal shall have the authority to require “as-built” design documents and specifications for emergency responder communications coverage systems. The documents shall be in a format acceptable to the Fire Marshal.
- Section 510.4.2.8 **RADIO COMMUNICATION ANTENNA DENSITY:** Systems shall be engineered to minimize the near-far effect. Radio enhancement system designs shall include sufficient antenna density to address reduced gain conditions.

Exception:

- *Class A narrow band signal booster devices with independent AGC/ALC circuits per channel. Systems where all portable devices within the same band use active power control.*

- Section 510.5 **INSTALLATION REQUIREMENTS:** The installation of the public safety radio coverage system shall be in accordance with NFPA 1221 (current addition) and Sections 510.5.1 through 510.5.7.
- Section 510.5.1 **APPROVAL PRIOR TO INSTALLATION:** Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC or other radio licensing authority shall not be installed without prior coordination and approval of the Public Safety Radio System Operator.
- Section 510.5.2 **MINIMUM QUALIFICATIONS OF PERSONNEL:** The minimum qualifications of the system designer and lead installation personnel shall include both of the following:
 - A valid FCC-issued general radio telephone operator’s license.
 - Certification of in-building system training issued by an approved organization or approved school, or a certificate issued by the manufacturer of the equipment being installed.
- Section 510.5.3 **ACCEPTANCE TEST PROCEDURES:** Where an emergency responder radio coverage system is required, and upon completion of installation, the building owner shall have the radio system tested to verify that two-way coverage on each floor of the building is in accordance with Section 510.4.1. The test procedure shall be conducted as follows:
 - Each floor of the building shall be divided into a grid of 20 approximately equal test areas, with a maximum test area size of 6,400 square feet. Where the floor area exceeds 128,000 square feet, the floor shall be divided into as many approximately equal test areas as needed, such that no test area exceeds the maximum square footage allowed for a test area.
 - Coverage testing of signal strength shall be conducted using a calibrated spectrum analyzer for each of the test grids. A diagram of this testing shall be created for each floor where coverage is provided, indicating the testing grid used for the test in Section 510.5.3(1), and including signal strengths and frequencies for each test area. Indicate all critical areas.
 - Functional talk-back testing shall be conducted using two calibrated portable radios of the latest brand and model used by the agency’s radio communications system or other equipment approved by the Fire Marshal. Testing shall use Digital Audible Quality (DAQ) metrics, where a passing result is a DAQ of 3 or higher. Communications between handsets shall be tested and recorded in the grid square diagram required by Section 510.5.3(2): each grid square on each floor; between each critical area and a radio outside the building; between each critical area and the fire command center or fire alarm control panel; between each landing in each stairwell and the fire command center or fire alarm control panel.
 - Failure of more than 5 percent of the test areas on any floor shall result in failure of the test.

Exception:

- *Critical areas shall be provided with 99 percent floor area coverage.*
- In the event that two of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of not more than two nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 95 percent coverage requirement.
- A test location approximately in the center of each test area shall be selected for the test, with the radio 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 test area. Failure in the selected test location shall be considered to be a failure of that test area. Additional test locations shall not be permitted.
- 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.
- As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at the time of installation and at subsequent annual inspections.
- Systems incorporating Class B signal booster devices or Class B broadband fiber remote devices shall be tested using two portable radios simultaneously conducting subjective voice quality checks. One portable radio shall be positioned not greater than 10 feet (3048 mm) from the indoor antenna. The second portable radio shall be positioned at a distance that represents the farthest distance from any indoor antenna. With both portable radios simultaneously keyed up on different frequencies within the same band, subjective audio testing shall be conducted and comply with DAQ levels as specified in Sections 510.4.1.1 and 510.4.1.2.
- Documentation maintained on premises. At the conclusion of the testing, and prior to issuance of the building Certificate of Occupancy, the building owner or owner's representative shall place a copy of the following records in the DAS enclosure or the building engineer's office. The records shall be available to the Fire Marshal and maintained by the building owner for the life of the system:
 - A certification letter stating that the emergency responder radio coverage system has been installed and tested in accordance with this code, and that the system is complete and fully functional.
 - The grid square diagram created as part of testing in Sections 510.5.3(2) and 510.5.3(3).
 - Data sheets and/or manufacturer specifications for the emergency responder radio coverage system equipment; back up battery; and charging system (if utilized).
 - A diagram showing device locations and wiring schematic,
 - A copy of the electrical permit.
- Acceptance test reporting to Fire Marshal. At the conclusion of the testing, and prior to issuance of the building Certificate of Occupancy, the building owner or owner's representative shall submit to the Fire Marshal an acceptance test report that includes items from Section 510.5.3.
- Section 510.5.4 **FCC COMPLIANCE:** The emergency responder radio coverage system installation and components shall comply with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219.

- Section 510.5.5 **MOUNTING OF THE DONOR ANTENNA(S)**: To maintain proper alignment with the system designed donor site, donor antennas shall be permanently affixed on the highest possible position on the building or where approved by the Fire Marshal.

A clearly visible sign shall be placed near the antenna stating, “movement or repositioning of this antenna is prohibited without approval from the Fire Marshal or designee.”

The antenna installation shall be in accordance with the applicable requirements in the International Building Code for weather protection of the building envelope.

- Section 510.5.6 **WIRING**: The backbone, antenna distribution, radiating, or any fiber-optic cables shall be rated as plenum cables. The backbone cables shall be connected to the antenna distribution, radiating, or copper cables using hybrid coupler devices of a value determined by the overall design.

Backbone cables shall be routed through an enclosure that matches the building’s required fire-resistance rating for shafts or interior exit stairways. The connection between the backbone cable and the antenna cables shall be made within an enclosure that matches the building’s fire-resistance rating for shafts or interior exit stairways, and passage of the antenna distribution cable in and out of the enclosure shall be protected as a penetration per the International Building Code.

- Section 510.5.7 **IDENTIFICATION SIGNS**: Emergency responder radio coverage systems shall be identified by an approved sign located on or near the Fire Alarm Control Panel or other approved location stating “This building is equipped with an Emergency Responder Radio Coverage System. Control Equipment located in room”.

A sign stating “Emergency Responder Radio Coverage System Equipment” shall be placed on or adjacent to the door of the room containing the main system components.

- Section 510.6 **MAINTENANCE**: The emergency responder radio coverage system shall be maintained operational at all times in accordance with Sections 510.6.1 through 510.6.7.

- Section 510.6.1 **TESTING AND PROOF OF COMPLIANCE**: The owner of the building or owner’s authorized agent shall have the emergency responder radio coverage system inspected and tested annually or where structural changes occur including additions or remodels that could materially change the original field performance tests. Testing shall consist of the following items (1) through (7):

- In-building coverage test as required by the Fire Marshal as described in Section 510.5.3, “Acceptance test procedure,” or 510.6.1.1, “Alternative in-building coverage test”.

Exception:

- *Group R Occupancy annual testing is not required within dwelling units.*

- Signal boosters shall be tested to verify that the gain/output level is the same as it was upon initial installation and acceptance or set to optimize the performance of the system.
- Backup batteries and power supplies shall be tested under load of a period of 1 hour to verify they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.
- If a fire alarm system is present in the building, a test shall be conducted to verify that the fire alarm system is properly supervising the emergency responder communication system as required in Section 510.4.2.5. The test is performed by simulating alarms to the fire alarm control panel. The certifications in Section 510.5.2 are sufficient for the personnel performing this testing.
- Other active components shall be checked to verify operation within the manufacturer’s specifications.
- At the conclusion of the testing, a report that shall verify compliance with Section 510.6.1 shall be submitted to the Fire Marshal by way of the department’s third-party compliance vendor.

- At the conclusion of testing, a record of the inspection and maintenance along with an updated grid diagram of each floor showing tested strengths in each grid square and each critical area shall be added to the documentation maintained on the premises in accordance with Section 510.5.3.
- Section 510.6.1.1 **ALTERNATIVE IN-BUILDING COVERAGE TEST:** When the comprehensive test documentation required by Section 510.5.3 is available, or the most recent full five-year test results are available if the system is older than six years, the in-building coverage test required by the Fire Marshal in Section 510.6.1(1), may be conducted as follows:
 - Functional talk-back testing shall be conducted using two calibrated portable radios of the latest brand and model used by the agency's radio communications system or other equipment approved by the Fire Marshal. Testing shall use Digital Audible Quality (DAQ) metrics, where a passing result is a DAQ of 3 or higher. Communications between handsets in the following locations shall be tested: between the fire command center or fire alarm control panel and a location outside the building; between the fire alarm control panel and each landing in each stairwell.
 - Coverage testing of signal strength shall be conducted using a calibrated spectrum analyzer for:
 - Three grid areas per floor. The three grid areas to be tested on each floor are the three grid areas with poorest performance in the acceptance test or the most recent annual test, whichever is more recent; and
 - Each of the critical areas identified in acceptance test documentation required by Section 510.5.3, or as modified by the Fire Marshal, and
 - One grid square per serving antenna.
 - The test area boundaries shall not deviate from the areas established at the time of the acceptance test, or as modified by the Fire Marshal. The building shall be considered to have acceptable emergency responder radio coverage when the required signal strength requirements in Sections 510.4.1.1 and 510.4.1.2 are located in 95 percent of all areas on each floor of the building and 99 percent in Critical Areas, and any non-functional serving antenna are repaired to function within normal ranges.

If the documentation of the acceptance test or most recent previous annual test results are not available or acceptable to the Fire Marshal, the radio coverage verification testing described in 510.5.3 shall be conducted.

The alternative in-building coverage test provides an alternative testing protocol for the in-building coverage test in subsection (1) of Section 510.6.1. There is no change or alternative to annual testing requirements enumerated in subsections (2) – (7) of Section 510.6.1, which must be performed at the time of each annual test.
- Section 510.6.2 **ADDITIONAL FREQUENCIES:** 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 other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority Public Safety Radio System Operator or FCC license holder. Prior approval of a public safety radio coverage system on previous frequencies does not exempt this section.
- Section 510.6.3 **NONPUBLIC SAFETY SYSTEM:** Where other nonpublic safety amplification systems installed in buildings reduce the performance or cause interference with the emergency responder communications coverage system, the nonpublic safety amplification system shall be corrected or removed.
- Section 510.6.4 **FIELD TESTING:** The Fire Marshal or designee 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 or to disable a system that due to malfunction or poor maintenance has the potential to impact the emergency responder radio system in the region.