



Construction Permit Application

Emergency Responder Communication System



www.cityofvancouver.us/departments/fire-department

International Fire Code as adopted by VMC 16.04 (Washington State Fire Code)

Permitting Requirements

An emergency responder communications enhancement system (ERCES), also known as a Distributed Antenna System, is an infrastructure solution installed within a building to enhance the communications capabilities for fire responders that utilizes solutions such as a signal booster, voting receiver, base station, or other technology capable of enhancing the radio frequency (RF) to ensure effective public safety communications.

A **construction permit** is required for installation of or modification to in-building ERCES and related equipment. All new buildings require ERCES unless exempted by the fire code official in accordance with WSFC 510.1. Maintenance performed in accordance with the WSFC is not considered to be a modification and does not require a construction permit.

Project Information

Site Address		Owner Name	
Other			

Applicant Information

Company Name		Address		
Contact Name				
Office Phone		Cellular		Email

Contractor

Company Name		Address		
Contact Name				
Office Phone		Cellular		Email
Related Permits:	FRI _____	CMI _____	DEF _____	MPE _____

Description of Work

Electronic Plan Standards

File Naming Standards:

Electronic plans and documents shall be named as specified in the City of Vancouver [ePLANS](https://www.cityofvancouver.us/business/permits-licenses-and-inspections/eplans/) system:
<https://www.cityofvancouver.us/business/permits-licenses-and-inspections/eplans/>



Acceptable File Types:

Plans, calculations, specifications and supporting documents shall be uploaded as a PDF file.

Plan Sheet Standards:

All plans shall be drawn to scale, as identified in the checklist, and each sheet shall state the scale and show a measurable scale on the page for measurement calibrations.

Document Orientation:

All plans must be uploaded in "Landscape" format in the horizontal position with a north indicator. All other documents can be in "Portrait" format.

Stamped:

Where documentation contains a code analysis or engineering calculations, such documents shall be stamped by the design professional.

Minimum Submittal Checklist for Upload to ePLANS

- Completed Fire Installation Permit Application – Emergency Responder Communication Coverage System Permit (this document) Check all *Permit Conditions* checkboxes that are applicable to your project
- Supporting documents listed below (See *Document Details* below)
- Site plans and floor plans (see *Plan Details* below)

Document Details

With your completed permit application, provide the following documents:

- The grid square diagram created as part of testing in WSFC 510.5.3(2) and 510.5.3(3).
- Data sheets and/or manufacturer specifications for the ERCES equipment; back up battery; and charging system (if utilized)
- A diagram showing device locations and wiring schematic.
- A copy of the electrical permit.

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 records listed above in the Distributed Antenna System enclosure or the building engineer's office. The records shall be available to the fire code official and maintained by the building owner for the life of the system (WSFC 510.5.4).

Plan Details

The following is a list of information required on all plan submittals for review of an Emergency Responder Communication Systems permit. The plan shall be drawn to 1/8" = 1'-0" minimum scale. The applicant is required to submit all applicable information so an accurate and timely review may be completed:

- Pretesting or modeling documentation
- Site plan to include a north arrow, a measurable scale for calibration purposes, fire hydrants, emergency access lanes and doors, vehicle gates, fire department connection, facility evacuation meeting point locations, sprinkler riser, fire alarm control panel, Knox Box, and roof access (if provided). Show floor plan grids used for testing or modeling.
- Location of all signage, on-site documentation, etc.
- Design and location of all elements of the ERCES including wiring, signal boosters, panels, portable radios, antenna, etc.
- In-building emergency responder communications enhancement system (ERCES) information

Permit Conditions

The following is a list of WSFC requirements related to Emergency Responder Communication Coverage Systems. Use this form to confirm that all applicable requirements are met. Non-applicable requirements can be left blank.

General:

- Approved in-building, emergency responder communications enhancement system (ERCES) for emergency responders shall be provided in all new buildings. In-building ERCES within the building shall be based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building. The ERCES, where required, shall be of a type determined by the fire code official and the frequency license holder(s). This permit shall not require improvement of the existing public safety communication systems (WSFC 510.1).

Exceptions:

1. Where approved by the building official and the fire code official, a wired communication system in accordance with WSFC 907.2.13.2 shall be permitted to be installed or maintained instead of an approved communication coverage system.
2. Where it is determined that the communication coverage system is not needed.
3. In facilities where emergency responder communication 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 have the authority to accept an automatically activated emergency responder communication coverage system.

Technical Requirements:

- Equipment required to provide in-building ERCES shall be listed in accordance with UL2524 (WSFC 510.4).
- The building shall be considered to have an acceptable in-building, emergency responder communication enhancement system where signal strength measurements in 95 percent of all areas and 99 percent of areas designated as critical areas on each floor of the building meet the signal strength requirements in the following (WSFC 510.4.1).
 - Signal Strength into Building: The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area. The inbound signal level shall be a minimum of -95 dBm 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 (WSFC 510.4.1.1).
 - Signal Strength Out of Building: The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area. 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 (WSFC 510.4.1.2).
 - 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 in the technical criteria provided by the fire code official. The fire code official shall maintain a document providing specific technical information and requirements for the in-building, emergency responder communication enhancement system. This document shall contain, but not be limited to, 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 (WSFC 510.4.2.2).
- The in-building ERCES shall be designed in accordance with NFPA 1221 and the following WSFC requirements (WSFC 510.4.2).
 - Amplification Systems and Components: Buildings and structures that cannot support the required level of in-building, emergency responder communication enhancement system shall be equipped with systems and components to enhance the radio signals and achieve the required level of in-building, emergency responder communication enhancement system specified below. In-building, emergency responder communication enhancement systems utilizing

radio-frequency-emitting devices and cabling shall be approved. Prior to installation, all RF-emitting devices shall have the certification of the radio licensing authority and be suitable for public safety use (WSFC 510.4.2.2).

- Standby Power: In-building, emergency responder communication enhancement systems 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 WSFC 1203. The standby power supply shall be capable of operating the in-building, emergency responder communication enhancement system at 100 percent system capacity for a duration of not less than 12 hours (WSFC 510.4.2.3).
- Signal Boosters: If used, signal boosters shall meet the following requirements (WSFC 510.4.2.4):
 1. All signal booster components shall be 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.
 2. 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
Exception: Listed battery systems that are contained in integrated battery cabinets.
 3. Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use prior to installation.
 4. Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20 dB greater than the system gain under all operating conditions.
 5. Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20 dB greater than the system gain under all operating conditions.
 6. The installation of amplification systems or enhancement systems that operate on or provide the means to cause interference on any in-building, emergency responder communication enhancement system network shall be coordinated and approved.
 7. Only channelized signal boosters shall be permitted
Exception: Broadband BDAs may be utilized when specifically authorized in writing by the frequency license holder.
- The in-building, emergency responder communication 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 in-building, emergency responder communication enhancement system, a single automatic supervisory signal may be annunciated on the fire alarm system indicating deficiencies of the in-building, emergency responder communication enhancement system (WSFC 510.4.2.5):
 1. Loss of normal AC power supply.
 2. System battery charger(s) failure.
 3. Malfunction of the donor antenna(s).
 4. Failure of active RF-emitting device(s).
 5. Low-battery capacity at 70 percent reduction of operating capacity.
 6. Active system component malfunction.
 7. Malfunction of the communications link between the fire alarm system and the in-building, emergency responder communication enhancement system.
 8. Oscillation of active RF-emitting device(s).
- The in-building ERCEs 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 (WSFC 510.4.2.6).
- The fire code official shall have the authority to require "as-built" design documents and specifications for in-building, emergency responder communication enhancement systems (WSFC 510.4.2.7).

- Systems shall be engineered to minimize the near-far effect. In-building, emergency responder communication enhancement system designs shall include sufficient antenna density to address reduced gain conditions (WSFC 510.4.2.8).
Exception: Systems where all portable devices within the same band use active power control features.

Installation Requirements:

- The installation of the in-building, emergency responder communication enhancement system shall be in accordance with NFPA 1221 and the following requirements (WSFC 510.5):
 - Mounting of Door 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 code official. A clearly visible sign stating: "MOVEMENT OR REPOSITIONING OF THIS ANTENNA IS PROHIBITED WITHOUT APPROVAL FROM THE FIRE CODE OFFICIAL."
shall be posted. The antenna installation shall be in accordance with the applicable requirements in the International Building Code (IBC) for weather protection of the building envelope (WSFC 510.5.1).
 - Prior Approval: 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 (WSFC 510.5.2).
 - Personnel Qualifications: The minimum qualifications of the system designer and lead acceptance test personnel shall include both of the following (WSFC 510.5.3):
 1. A valid FCC-issued general radio telephone operators license,
 2. 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
 - Acceptance Tests: Where an in-building emergency responder communication enhancement 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 WSFC 510.4.1. The test procedure shall be conducted as follows (WSFC 510.5.4):
 1. 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.
 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 approved radio communications system or equipment.
 3. 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 WSFC Section 510.5.4(1), and including signal strengths and frequencies for each test area. Indicate all critical areas.
 4. Functional talk-back testing shall be conducted using two calibrated portable radios of the latest brand and model used by the agency's approved radio communications system or other equipment. Testing shall use 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 panel.
 5. 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.
 6. 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.

7. 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.
 8. 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.
 9. 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.
 10. Systems shall be tested using two portable radios simultaneously conducting subjective voice quality checks. One portable radio shall be positioned not greater than 10 feet 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 WSFC 510.4.1.1 and 510.4.1.2.
 11. 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 Distributed Antenna System enclosure or the building engineer's office. The records shall be available to the fire code official and maintained by the building owner for the life of the system.
 - a. A certification letter stating that the ERCES has been installed and tested in accordance with this code, and that the system is complete and fully functional.
 - b. The grid square diagram created as part of testing in WSFC 510.5.3(2) and 510.5.3(3).
 - c. Data sheets and/or manufacturer specifications for the ERCES equipment; back up battery; and charging system (if utilized).
 - d. A diagram showing device locations and wiring schematic.
 - e. A copy of the electrical permit.
- FCC Compliance: The in-building, emergency responder communication enhancement system installation and components shall comply with all applicable federal regulations including, but not limited to, FCC 47 C.F.R. Part 90.219 (WSFC 510.5.5).
 - 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 WSBC (WSFC 510.5.6).
 - Emergency responder enhancement 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 ENHANCEMENT COVERAGE SYSTEM. CONTROL EQUIPMENT LOCATED IN" or as approved by the fire code official.

- A sign stating "EMERGENCY RESPONDER ENHANCEMENT COVERAGE SYSTEM EQUIPMENT" shall be placed on or adjacent to the door of the room containing the main system components (WSFC 510.5.7).
- A certification letter stating that the ERCES has been installed and tested in accordance with this code, and that the system is complete and fully functional, is required.

Maintenance:

- The owner of the building or owner's authorized agent shall have the in-building ERCES 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 (WSFC 510.6.1):
 1. In-building coverage test as described in WSFC 510.5.4 or 510.6.1.1.
Exception: Group R Occupancy annual testing is not required within dwelling units.
 2. 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.
 3. Backup batteries and power supplies shall be tested under load of a period of 1 hour to verify that 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.
 4. All other active components shall be checked to verify operation within the manufacturer's specification.
 5. 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 enhancement system as required in WSFC 510.4.2.5. The test is performed by simulating alarms to the fire alarm control panel. The certifications in WSFC 510.5.2 are sufficient for the personnel performing this testing.
 6. 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 WSFC Section 510.5.3.
 7. At the conclusion of the testing, a report, which shall verify compliance with the above criteria, shall be submitted to the fire code official.
- When the comprehensive test documentation required by WSFC 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 required in-building coverage test in WSFC 510.6.1(1) may be conducted as follows (WSFC 510.6.1.1):
 1. Functional talk-back testing shall be conducted using two calibrated portable radios of the latest brand and model used by the agency's approved radio communications system or other equipment. Testing shall use 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 and between the fire alarm control panel and each landing in each stairwell.
 2. Coverage testing of signal strength shall be conducted using a calibrated spectrum analyzer for:
 - a. 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.
 - b. Each of the critical areas identified in acceptance test documentation required by WSFC 510.5.3
 - c. One grid square per serving antenna.
 3. The test area boundaries shall not deviate from the areas established at the time of the acceptance test. The building shall be considered to have acceptable emergency responder communication coverage when the required signal strength requirements in WSFC 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 nonfunctional 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, the radio coverage verification testing described in WSFC 510.5.4 shall be conducted.
- The building owner shall modify or expand the in-building, emergency responder communication enhancement system at their 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. Prior approval of an in-building, emergency responder communication enhancement system on previous frequencies does not exempt this section (WSFC 510.6.2).

- Where other nonpublic safety amplification systems installed in buildings reduce the performance or cause interference with the in-building, emergency responder communication enhancement system, the nonpublic safety amplification system shall be corrected or removed (WSFC 510.6.3).
- Agency 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 or to disable a system adversely impacting the emergency responder communication enhancement system in the region (WSFC 510.6.4).

Existing Buildings:

- Existing buildings other than Group R-3, that do not have approved in-building, emergency response communication enhancement system for emergency responders in the building based on existing coverage levels of the public safety communication systems, shall be equipped with such coverage according to one of the following (WSFC 1103.2):
 1. Where an existing wired communication system cannot be repaired or is being replaced, or where not approved in accordance with Section 510.1, Exception 1 (where approved by the building official and the fire code official, a wired communication system in accordance with Section 907.2.13.2 shall be permitted to be installed or maintained instead of an approved communication coverage system).
 2. Within a timeframe established by the adopting authority.
Exception: Where it is determined by the fire code official that the in-building emergency responder communication enhancement system is not needed.

NOTE: *This is not intended to be an all-inclusive list. The WSFC requirements listed are intended to ensure that we have adequate information to begin a review of the application. Additional information may be required.*

I understand that all applicable codes apply and that other regulatory codes may also apply. Errors and/or omissions on the plans and corrections from field inspections are the responsibility of the owner/contractor. All work is subject to compliance with City of Vancouver ordinances and laws of the State of Washington.

APPLICANT NAME: _____ APPLICATION DATE: _____

APPLICANT SIGNATURE: _____