Washoe County Regional Communications System (WCRCS)

PUBLIC SAFETY SIGNAL BOOSTERS

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RECOMMENDATIONS & REQUIREMENTS

January 26, 2023

Version 1.0

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Date: January 26, 2023

From: The office of the Washoe County Regional Communications Coordinator

Subject: Public Safety Signal Boosters

To Whom it may concern:

The use of public safety signal boosters is a growing consideration for fire marshals and building codes officials across Washoe County. Signal boosters are also referred to as Bi-Directional Amplifier (BDA) systems, Directional Amplifier Systems (DAS) and Emergency Radio Responder Communications Systems (ERRCS). A jurisdiction’s decision to require a building owner to install a public safety signal booster is a public safety decision for the jurisdiction and an operational cost to building owner. The regulations for the engineering and installation of a signal booster go beyond the International Fire Code (IFC) and the National Fire Protection Association (NFPA). The Federal Communications Commission (FCC) has very specific regulations on public safety signal boosters and enforces those regulations with potentially significant fines. Public safety signal boosters are signal boosters that ONLY amplify the public safety frequencies or bands utilized by first responders, law enforcement, EMS, and fire, at a specific location. The FCC prohibits these public safety signal boosters from amplifying cellular spectrum bands (cellular requires different equipment and has different regulations).

The purpose of this document is to help educate, provide guidance, and support the proper installation, registration and consent form requirements needed when a jurisdiction requires a building owner to install a public safety signal booster. If there are public safety signal boosters already installed in your jurisdiction that are not in compliance with the FCC regulations, contact us at [wcrcs@washoecounty.gov](mailto:wcrcs@washoecounty.gov), and we will be glad to assist you.

An in-building public safety signal booster is an extension of the public safety radio system utilized by the jurisdiction. Signal boosters utilize a fixed transmitter and receiver on the public safety radio system and the FCC requires the signal booster to be registered and the Licensee(s) of the radio system must provide written consent for the signal booster to operate on the public safety radio system. If a signal booster malfunctions or begins to isolate (audio begins to echo itself) it can disrupt your public safety communications.

The guidance in these signal booster documents was developed by the Washoe County Regional Communications System staff to help coordinate countywide guidance for public safety signal booster use and educate users on FCC regulations for public safety signal boosters. The information attached represents key elements that fire officials, building codes officials and building owners need to be aware of when installing or engineering a signal booster to support public safety and first responders.

Please do not hesitate to contact our staff if you have any questions

Respectfully,

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## Disclaimer:

This document does **NOT** address or represent all National Fire Protection Association NFPA 1225 , International Fire Code (IFC), Federal Communications Commission (FCC) regulations and areas of compliance for Public Safety Signal Booster requirements. This document only highlights selected sections for Signal Booster compliance within NFPA 1225, IFC and FCC regulations. Signal Booster design engineers, vendors, contractors, qualified installers and building owner(s) are responsible for full compliance of all Federal, State and Local code requirements.

## WCRCS 800 Radio Network

The Washoe County Regional Communications System 700/800 Network is a countywide radio network that provides primary public safety radio communications for numerous jurisdictions across Washoe County. The network is made up of FCC Licensees from numerous authorities having jurisdiction (AHJ). As the administrator and primary Licensee for the WCRCS 700/800 Network, the Washoe County Regional Communications System staff is providing coordination between the Licensees and jurisdictions to simplify the process for building owners, signal booster vendors and users of the WCRCS 700/800 Network.

### What is an Emergency Responder Communication Enhancement System (ERCES)?

An infrastructure solution installed within a building to enhance the communications capabilities for first 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.

### What Is a Signal Booster?

A device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas and other locations where these signals would otherwise be too weak for reliable communications. Sometimes referred to as a bi-directional amplifier (BDA) system. Signal booster systems may contain both Class A and Class B signal boosters as components.

### What Buildings May Require a Signal Booster?

The WC Fire Code requires signal boosters in any building, new or existing, when the emergency responder communication coverage is compromised due to the construction materials of the building. This requirement is enforced by the local building and fire code officials (authority having jurisdiction, AHJ) and may vary from jurisdiction to jurisdiction.

For new construction, the Office of State Fire Marshal **recommends** that AHJ’s consider the following exceptions which will be published in the 2024 Washoe County Fire Code.

Emergency Responder Communication Enhancement Systems are required in all new buildings except the following:

1. Where it is determined by the fire code official that the radio communications coverage system is not needed.
2. One-story buildings not exceeding 12,000 square feet with no below ground area(s).

### Distributed Antenna System (DAS).

A network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a structure.

## FCC Required Certification.

All repeaters, transmitters, receivers, and signal boosters shall be installed and operated in a manner consistent with Title 47, CFR Within these regulations is a mandatory requirement that repeaters, transmitters, and signal boosters have Federal Communications Commission (FCC) “certification.” FCC certification verification can be obtained from any FCC office or online [https://www.fcc.gov/oet/ea/fccid.](https://www.fcc.gov/oet/ea/fccid)

### Signal Booster Types.

**Class A signal booster**. A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.

**Class B signal booster**. A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz.

**What is a Passband**. A passband is the range of frequencies or wavelengths that can pass through a filter. For example, a radio receiver contains a bandpass filter to select the frequency of the desired radio signal out of all the radio waves picked up by its antenna. The passband of a receiver is the range of frequencies it can receive.

### Signal Booster Design & Engineering:

Where an engineering design is needed or required, a signal booster design software such as IB-Wave shall be used by engineers for signal predication in new or existing construction and design layout.

### Public Safety Signal Boosters.

FCC (47 §CFR 90.219(7)) Signal booster passbands are limited to the service band or bands for which the operator (Licensee) is authorized (Licensed). In general, signal boosters should utilize the minimum passband that is sufficient to accomplish the Public Safety purpose. Except for distributed antenna systems (DAS) installed in buildings, the passband of a Class B signal booster should **not** encompass both commercial services (such as Enhanced Specialized Mobile Radio (ESMR) and Cellular systems) and part §90 Land Mobile and Public Safety Services.

### Deployment

FCC (47 §90.203(a)(2) and part 2, subpart J) Deployment of public safety signal boosters must be carried out in accordance with the rules in this paragraph.

1. Signal boosters may be used to improve coverage in weak signal areas only.
2. Signal boosters must not be used to extend Private Land Mobile Radio Service(s) (PLMRS) stations' normal operating range.
3. Except as set forth in paragraph (d)(3)(ii) of this section, signal boosters must be deployed such that the radiated power of each retransmitted channel, on the forward link and on the reverse link, does not exceed 5 Watts effective radiated power (ERP).

### **FCC Minimum qualifications of personnel**

The minimum qualifications of the system designer and lead installation personnel shall include both of the following (2018 IFC 510.5.2):

1. A valid FCC-issued general radio operator’s license.
2. Certification of inbuilding system training issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.

### Authority to Operate a Signal Booster Requirements

Signal boosters (Class A & Class B) must be in compliance with all NFPA 1225, IFC and FCC regulations and installed by a qualified installer. Non-licensees (such as a building owner or a signal booster installation contractor(s)) seeking to operate signal boosters must obtain the express consent of the licensee(s) for the frequencies which the device or system is intended to amplify. The consent must be maintained in a recordable format that can be presented to an FCC representative or other relevant licensee(s) investigating interference. All Class B signal boosters (as defined in 47 §CFR 90.219) must be registered online a[t](http://www.fcc.gov/signal-boosters/registration) [www.fcc.gov/signalboosters/registration](http://www.fcc.gov/signal-boosters/registration) prior to activation and testing of the signal booster.

### Authority Having Jurisdiction (AHJ)

All signal booster’s installations must also be in compliance with the authority having jurisdiction (AHJ) building codes and fire codes. Local jurisdictions may require a permit and have additional requirements or policies from those listed in this document.

### Non-Licensee Requirements

All non-licensees installing Signal Boosters (Class A or B) amplifying public safety spectrum must receive written consent from the FCC licensee(s). Jurisdictions using the WCRCS 700/800 radio network FCC licenses, should e-mail [WCRCS@washoecounty.gov](mailto:WCRCS@washoecounty.gov), and mlawney@washoecounty.gov for frequency, site, and Consent of Licensee Application information.

### FCC Required Registration for Class B Signal Booster(s)

To register a Class B signal booster(s), you will first need an FCC Registration Number (FRN). The signal booster installer, building owner or licensee must register the booster. If you do not already have a (FRN) you can register for a (FRN) at [https://www.fcc.gov/wireless/support/universal-licensing-system-uls-resources/getting-fccregistration-](https://www.fcc.gov/wireless/support/universal-licensing-system-uls-resources/getting-fcc-registration-number-frn)number- frn go to the FCC Commission’s Registration Systems (CORES). Once you have an FRN you can proceed to [www.fcc.gov/signal-boosters/registration](http://www.fcc.gov/signal-boosters/registration) to register your signal booster(s). If multiple signal boosters are required, each must be registered separately. You will need the Licensee’s frequency license number(s) to complete the registration.

## Signal Strength.

### Inbound. IFC 2018 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 code official and WCRCS Representative*. The inbound signal level shall be 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.

### Outbound. IFC 2018 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 code official and WCRCS representative*. 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.

## Design Considerations

### Component Enclosures

**NFPA 1225-18.3.1 Enclosures.** All signal booster components shall be contained in a National Electrical Manufacturer’s Association (NEMA) 4-type waterproof cabinet.

Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher-rated cabinet

### Coaxial Cables

NFPA-1225-18.12.3.1 Component requirements (NFPA NEC 70 Chapters 7 & 8) 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 fire rating. The connection between the backbone cable and the antenna cables shall be made within an enclosure that matches the building’s fire rating, and passage of the antenna distribution cable in and out of the enclosure shall be fire- stopped.

### Antenna Isolation

NFPA 1225-18.3.3.2 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.

### Oscillation Suppression

Signal boosters utilized to enhance Public Safety radio coverage shall utilize oscillation prevention circuitry (2018 IFC 510.4.2.4(5)) in the design of the signal booster to reduce public safety radio interference. Public safety radio signal boosters and distributed antenna systems (DAS) should only be deployed in areas where signal enhancement is required to prevent transmitter oscillation. Signal booster systems that begin oscillating should immediately notify the authorities having jurisdiction (AHJs), alarm company or vendor servicing the signal booster. Continued signal booster(s) oscillation will directly interfere with public safety radio operations.

### Power Sources

NFPA-1225-18.13 At least two (2) independent and reliable power supplies shall be provided for all RF-emitting devices, one primary and one secondary.

### Primary Power Source

NFPA-1225-18.13.1 The primary power source shall be all of the following:

1. Supplied from a dedicated branch circuit
2. Permanently connected
3. Compliant with NFPA 72
4. Protected from over Voltage

### Secondary Power Source

NFPA-1225-18.13.2 The secondary power source shall consist of one of the following:

1. A storage battery dedicated to the system with at least 12 hours of 100 percent system operation capacity.
2. An alternate power source of 12 hours at 100 percent system operation capacity as approved by the AHJ.
3. A 2-hour standby battery and connection to the facility generator power system, providing the facility generator power system can support the complete load for 12 hours.

### System Monitoring:

IFC 2018 (510.4.2.5) The emergency responder radio enhancement system shall be monitored by a listed fire alarm control unit, or where approved by the fire code official, shall sound an audible signal at a constantly attended (7x24) on-site location.

### Fire Alarm System

IFC 2018 (510.4.2.5) The emergency responder radio enhancement system shall be monitored by a listed *fire alarm control unit*, or where approved by the *fire code official*, shall sound an audible signal at a constantly attended on-site location. Automatic supervisory signals shall include the following:

* 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. Failure of critical system components
  7. The communications link between the *fire alarm system* and the emergency responder radio enhancement system

### Dedicated Signal Booster Panel

NFPA-1221-2019 (9.6.13.2.1) & NFPA 1225-18.14.2.2 A dedicated annunciator shall be provided within the fire command center to annunciate the status of all RF-emitting devices and active system component locations. This device shall provide visual and labeled indications of the following for each system component and RF-emitting device:

1. Normal ac power
2. Loss of normal ac power
3. Battery charger failure
4. Low-battery capacity (i.e., to 70 percent depletion)
5. Donor antenna malfunction
6. Active RF-emitting device malfunction
7. Active system component malfunction

### Additional Frequencies and Change of Frequencies.

2018 IFC (510.4.2.6) & NFPA 1225-18.11.2 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.

### FCC Required Device Labeling

Signal booster(s) must be labeled to indicate whether it’s a Class A or Class B and must be included on marketing materials, instruction manuals, packaging and on the **FRONT** of the device, the following advisory; “WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have a FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR §90.219) online at [www.fcc.gov/signal-boosters/registration](http://www.fcc.gov/signal-boosters/registration) . The consent must be maintained in a recordable format that can be presented to an FCC representative or other relevant licensee investigating interference. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.”

***Effective January 1, 2020,*** *this label configuration is required!*

The minimum label size shall be 5-1/2 inches by 2-1/4 inches with a ½” yellow banner. The warning label must be clearly distinguishable, include the same wording listed above and utilize a #10 font or larger

### FCC Required Certification

Use of repeaters, transmitters, or signal boosters that do not have an existing FCC-issued certification is a violation of federal law, and users are subject to fine and/or imprisonment. A label displaying the exact FCC certification number must be placed in a visible place on the equipment itself.

### Underwriters Laboratories (UL) 2524

It is suggested that Signal Boosters have a UL-2524 In-building Two- Way Emergency Radio Communications Enhancement Systems listing.

### System Design and Deployment Questions

For radio frequency channels, repeater site locations and radio system questions please contact [WCRCS@washoecounty.gov](mailto:WCRCS@washoecounty.gov) to request a Consent of Licensee Application. All other questions should be directed to the authority having jurisdiction (AHJ). Please provide the following information in your request.

1. Address or Longitude/Latitude
2. Type and height of structure
3. Your contact information
4. The contact information for the (AHJ)
5. Signal booster type (Class A or B)
6. Brand, Model of the signal booster if known
7. Local jurisdiction where the Signal Booster will be installed
8. Fire jurisdiction where the Signal Booster will be installed

### How Can I Check To See if A Class B Signal Booster Has Been Registered?

Go to the FCC Signal Booster registration link [www.fcc.gov/signal-boosters/registration](http://www.fcc.gov/signal-boosters/registration) at the top of the page, on the right side click on Find Boosters. This will allow you numerous search options.

### Supplemental Technical Requirements

**SUAppendix B**: Supplemental Technical Requirements

1. **BDA Information**
   1. The in-building radio system shall use a channelized BDA. The BDA shall be certified Class “A” FCC-type accepted and must operate in accordance with FCC rules. The system must also be compatible and fully operational with both P25 Phase 1 and P25 Phase 2 for all channels.
   2. The filter bandwidth for the BDA should be selected addressing increased TDI concerns. Narrower bandwidth filters can be utilized if the design addresses concern.
   3. The BDA shall also provide a squelch capability for uplink. Some BDAs meet the requirements only when the relevant features are configured appropriately, so the vendor will ensure that it is the case.
   4. The selected BDA shall be capable of “AGC per channel” and “Oscillation Control” features. This includes, but is not limited to, an alarm and automatic shutdown for oscillating amplifiers.
   5. The signal booster shall be installed in a fire-engine-red NEMA 4 (or 4X) waterproof enclosure with a locking mechanism with 2” high contrasting letters. Include the following information:
      1. Fire Department Signal Booster
      2. Permit Number: \_\_\_\_\_\_\_\_
      3. Serviced by: Vendor name and telephone
      4. FCC Registration ID
      5. Maximum VSWR measured in any RF branch of the DAS shall not exceed 1.5:1 (14 dB Return Loss).
   6. Buildings equipped with an Emergency Responder Radio Coverage system shall be identified by a sign located on or near the Fire Alarm Control Panel stating: "This building is equipped with an Emergency Responder Radio Coverage System."
   7. Generally, fire protection and related equipment are identified by a red sign with minimum one- inch white letters.
   8. **Electrical Power requirements:**
   9. At least two (2) independent and reliable power supplies shall be provided for all RF-emitting devices, one primary and one secondary (NFPA1225-18.13)
   10. All active components of the DAS shall be powered from a power source via a dedicated (“home run”) circuit (NFPA 1225 18.13.1). No other devices may be powered on the same circuit as the BDA. In addition, a twelve-hour battery backup for the in-building system operating at 100% capacity is required (NFPA 1225 18.13.2).
   11. Surge protection device(s) can be used to protect active components of the DAS from electrical transients.
   12. Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher rated cabinet.
2. **Alarm and Monitoring System:**
   1. Local indication of the in-building radio system status to the Fire Alarm system shall include the BDA (and fiber DAS if applicable) system component malfunction summary alarms visible at the fire alarm annunciator panel.
      1. A dedicated annunciator shall be provided within the fire command center to annunciate the status of all RF-emitting and active system component locations. This device shall provide visual and labeled indications of the following for each system component and rf-emitting device (NFPA 1225 18.14.2 Dedicated Annunciation).
         1. Normal AC Power
         2. Loss of Normal AC Power
         3. Battery Charger Failure
         4. Low Battery capacity (to 70 percent depletion)
         5. Active System component malfunction
         6. Donor antenna malfunction (VSWR)
         7. Active RF-emitting device malfunction
   2. Additionally, in case that an in-building solution based on RF/Fiber Optics converters is selected, the system shall also be capable of alarming in the event of malfunction of the main and the expansion hubs.
   3. When alarms are detected, the Building Manager(s) shall be notified of the alarm condition as well and must be responsive within 4 hours. Upon detection, the Building Manager(s) must immediately notify the County of any system outage. The county will then notify radio system users of the outage.
   4. The system must monitor and produce an alarm in the event of an antenna system malfunction or signal booster failure.
   5. A separate alarm for oscillating amplifiers is also required. The selected signal booster shall be capable of “AGC Overdrive” and “Oscillation Control” features. This includes, but is not limited to, an alarm and automatic shutdown for oscillating amplifiers. These features are intended to minimize interference due to the oscillation of the signal booster(s).
   6. Power supplies must, at a minimum, alarm at loss of ac power, failure of the battery charger, and low battery charge (defined as 70% of capacity).
3. **Coaxial Cables NFPA-1225 18.12.3:**
   1. 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 couplers devices of a value determined by the overall design. Backbone cables shall be routed through an enclosure that matches the buildings fire rating. The connection between the backbone cable and the antenna cables shall be made within an enclosure that matches the buildings fire rating and passage of the antenna distribution cable in and out of the enclosure shall be fire stopped.
4. **Propagation Delay:** 
   1. The maximum radio signal propagation delay introduced by the in-building coverage solution shall not exceed 55μs utilizing a 25 kHz filter bandwidth. If a delay greater than 55μs is expected by design, then further analysis should be conducted in conjunction with the County to evaluate potential signal degradation in areas where the direct signal coming from a radio site interacts with the BDA output signal. To reliably overcome TDI issues, the signal from the BDA must be 16dB higher than ambient signals from the donor site.

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* 1. TDI will be prevalent in designs where only certain areas of a floor are serviced by the BDA due to a large TDI zone from the lack of signal level difference. To counteract this, designs should be designed to service floors in their entirety.

Diagram

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1. **Exterior Antenna System:**
   1. The orientation of the donor antenna shall be determined in coordination with WCRCS Radio Division. [WCRCS@washoecounty.gov](mailto:WCRCS@washoecounty.gov)
   2. If required by FAA regulations, obstruction lighting and/or marking shall be installed.
   3. Antennas will be installed in accordance with the manufacturer’s specifications in locations noted on the final approved plans.
   4. All exterior antennas are to be narrowband, high-gain, vertically polarized, and designed for the specified frequency band. Yagi or corner reflector-type antennas are accepted.
   5. Any antenna that requires painting will be painted with a non-metallic paint that is approved by the antenna manufacturer.
   6. All exterior-mounted antennas and associated hardware must be rated for 160 MPH wind gusts or higher.
   7. The antenna installation, including the shield of the coaxial cable, shall be suitably connected to the building's electrical ground system at the base of the antenna mast and at the coaxial lightning protector as per Motorola R56 and Harris Site Grounding and Lightning Protection Guidelines.
   8. Typical requirements for coaxial lightning protectors are the following:
      * Impedance: 50 Ω
      * Frequency range: as needed to the respective bands
      * VSWR: 1.1:1 or better
      * Insertion Loss: 0.1 dB or better
      * Impulse Discharge Current: 10KA or better
      * Turn-on voltage: 600 V
      * Turn-on Time: 2.5 nS for 2kV/nS
      * Energy Throughput Rating: 5 joules for 3 kA (8/20μS waveform)
      * Continuous handling RF power: 100 W or better at the respective frequency bands
      * Rated for 150 MPH wind gusts or higher
   9. A rooftop donor antenna installation shall meet the wind loading requirements of Washoe County Code and ANSI/TIA-222-G.
   10. 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 (NFPA 1225 18.3.3.2)
2. **In-Building Antennas:**
   1. The in-building antenna system shall consist of enough antennas, distributed wisely within the building to meet the coverage criteria previously specified and not excessively penetrate outside of the building. Installation is unobstructed for 24” of the radiation pattern.
3. **OSCILLATION Suppression:**
   1. Signal boosters utilized to enhance public safety radio coverage shall utilize oscillation prevention circuitry (NFPA 1225 18.3.2) in the design of the signal booster to reduce public safety radio interference. Public Safety radio signal boosters and distributed antenna system (DAS) should only be deployed in areas where signal enhancement is required to prevent transmitter oscillation. Signal booster systems that begin oscillating should immediately notify the authorities having jurisdiction (AHJ’s), alarm company or vendor servicing the signal booster. Continued signal booster oscillation will directly interfere with public safety radio operations.
4. **Labeling:**
   1. Signal booster(s) must be labeled to indicate whether it’s a class A or Class B and must be included on marketing materials, instruction manuals, packaging and on the FRONT of the device, the following advisory; “WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC Licensees and QUALIFIED INSTALLERS. You MUST have a FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class Boosters (as defined in 47 CFR 90.219) online at [www.fcc.gov/signal-boosters/registration](http://www.fcc.gov/signal-boosters/registration). The consent must be maintained in a recordable format that can be presented to an FCC representative or other relevant licensee investigating interference. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.”
   2. All cables will be labeled at every end in accordance with the approved labeling plan.
   3. The installation contractor will tag and label all coax, CAT5e, Fiber, or braided coaxial cables at both ends, indicating the active device, antenna number, and any other required information.
   4. The installation contractor will label all internal antennae with the assigned antenna number provided in the approved construction drawings. Labels will be applied to the outer diameter edge of the base plate on an omnidirectional antenna or on the side edge of a panel and be visible from the ground.
   5. All cable ID labels will be machine-generated, non-metallic, fade-resistant, and designed for communication cable application. P-Touch labeling device will be used to generate the labels unless otherwise stated in the approved plans.
5. **Future expansion and modifications:**
6. The in-building radio system shall be capable of modification or expansion in the event frequency changes are required by the County, the FCC, another federal agency, or in the case that additional frequencies are allocated to the County. In particular, the in-building radio system shall be expandable to operate on the 700 MHz National Public Safety Broadband Network frequencies upon notification by the County.
7. Where projects include multiple buildings, a fiber DAS system must be used to reduce the risk of causing interference or oscillation. With one Headend Class A BDA authorized to rebroadcast Washoe P25 frequencies.
8. The DAS system must be independent of commercial carrier circuits and service only the Public Safety Radio System. Dedicated Headend, optical units, fiber, and remotes must be used.
9. The donor antenna must be positioned in such a way that it does not feed RF signals back into its own service antennas. The same isolation requirements for BDA systems must be met for fiber DAS systems.
10. All DAS equipment must be installed per the guidelines on pathway survivability.
11. **Test procedures and measurements parameters:**
12. System isolation
    * 1. Once the DAS is deployed, and before turning up the active components of the DAS, the very first test the Contractor shall perform is to verify that the isolation between the donor and the in-door antenna systems is at least 20 dB greater than the total possible gain of the DAS. Example Below:
      2. Unit Max Gain 80 dB
      3. 80 dB Max Gain + 20 dB Isolation Value = 100 dB Total Minimum Isolation
13. Downlink Amplifier
    * 1. Downlink signal levels shall be measured to ensure the system meets the requirements of a minimum RF signal level of >-85 dBm OR DAQ 3.0, throughout the entire facility and attached structures under the conditions described in this document 90% of the time.
      2. If the signal readings are conducted using a unity-gain antenna attached to a spectrum analyzer and considering the signal attenuation due to “body effect,” the average pick levels previously obtained is an indication reasonably good of the received channel power under fading conditions in each tile. Received channel power is precisely what should be determined during the baseline study to verify the need for a DAS in the facility under study.
      3. For the benchmarking of the facility, the Contractor shall reflect on the appropriate floor plan(s) the average hold readings obtained at each test point. For the final report or As-built documentation, the Vendor should develop floor plans showing “before” and “after” measurements of the average hold readings.
      4. The contractor shall provide a **floor plan heat map that color-codes the received levels** (the map needs to demonstrate that all floors, stairwells elevators have been tested exhaustively).
14. Uplink
15. WCRCS Radio Division will provide 2 county radios, one will have a lapel mic for inside the building under test, with radio on belt, other radio outside facility under test responding to the traffic on assigned TAC channel (depends on the responding agency- City of Reno, WCSO or City of Sparks). DAQ Metrics from 0-5 where 0 is no PTT and 5 is Speech easily understood.
16. The test procedures should be conducted, considering the following:
    * + 1. Size of the building
        2. Classification of the area under test (General Structure or Critical Area)
17. Defining the test locations per the size of the building
18. For small commercial buildings, due to the small number of readings to be taken, no “Fail” conditions should be allowed. Therefore 100% of the floor area shall show >-85 dBm signal strength OR DAQ 3.0.
19. For medium and large buildings, 90% and 99% of the readings should show >-102 dBm signal strength OR DAQ 3.0 for General Structure and Critical Areas, respectively, per floor. Each floor may be broken up into multiple zones made up of a minimum of 20 grids per floor.
20. In all cases, the signal strength measurements should be reflected on a building floor plan to show “Before and After” measurements. The contractor shall provide a floor plan heat map that color-codes the received levels (the map needs to demonstrate that all floors, stairwells elevators have been tested exhaustively).
21. Indoor circuit merit testing procedure.
22. Portable radio coverage is evaluated using a portable radio inside the facility and a dispatch console at another location.
23. The facility will be mapped out in 10 feet by 10-foot sectors.
24. Transmissions must meet CM4 level in both directions (inbound and outbound) for that sector to pass.
25. The portable user is allowed to move about within the sector to optimize signal performance.
26. The messages may be repeated only one time per sector.
27. The facility radio coverage must have a 95% or greater pass samples (inbound and outbound from all the samples collected) to meet requirements.
28. Circuit merit scale definitions.
29. CM5 - Perfectly understandable speech, negligible noise/distortion.
30. CM4 - Adequately understandable speech, low noise/distortion.
31. CM3 - Understandable speech, few missing syllables, occasional repetition, low to medium noise/distortion.
32. CM2 - Difficulty understanding speech, requires frequent repetition, receiver squelches, high noise/distortion.
33. CM1 - Speech is barely understandable, channel is unusable due to high noise/distortion.
34. **Designer/ Contractors responsibilities**
35. Based on the RF survey, the contractor will then submit the survey with a scope of work to the Washoe County Radio Division.
36. In some locations, such as those with smaller footprints or those located near one of the existing WCRCS radio sites, it may be possible to achieve reliable public safety radio communications coverage throughout the area and meet code requirements without the use of a radio communications enhancement system. Public safety radio coverage in these locations must meet the same reliability requirements as those locations that require a radio communications enhancement system.
37. Design, commissioning, and testing of an in-building RF coverage solution that guarantees a minimum RF signal level of >-85 dBm OR DAQ 3.0 throughout the entire facility and attached structures under the conditions described in this document.
38. Sealed floor plans showing radio coverage for critical and general areas using industry-standard radio frequency computer-generated propagation modeling.
39. Notation that the system is upgradable for frequency band coverage changes, including at a minimum 700/800 MHz.
40. Record all appropriate signal levels after the system implementation, as previously detailed.
41. Prepare and submit to the County the “Before and After” floor plans showing signal levels.
42. Provide a floor plan heat map that color-codes the received levels.
43. Address any in-building RF coverage issue discovered during the Acceptance Test.
44. Address any reported RF interference issue related to the new DAS installation.
45. Provide the Building Owner with project documentation including but not limited to “As-built” documentation, and floor heat maps, in soft copy format (e.g., PDF), system documents, technical manuals, Return Loss or VSWR readings of the RF lines, diagrams showing equipment placement and routing for antennas, coaxial cables, fiber optics interconnections, and AC power.
46. Coaxial cables shall be certified sweep tested over the frequency range in which being utilized. Certification of sweep test shall be furnished to Washoe County WCRCS Radio Division approval prior to acceptance.
47. **Radio Communication Enhancements system implementation Process**
48. Conduct an NFPA compliant needs assessment of the project

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1. **Conduct System Planning and design:**
2. The applicant shall include an RF Professional Engineer (PE) designed NFPA compliant two-way radio communication enhancement system in the design requirements for the project. A qualified integrator or installation firm is hired to install, test, and activate the two-way radio communications enhancement system as a part of the building project. Washoe County WCRCS Radio Division shall aid the integrator/installer in directing the selection of the donor sites for the proposed two-way radio communications enhancement system for the public safety communication systems. The applicant must obtain the proper fire and building permits to cover the installation of the two-way radio communication enhancement system. Note: The fire alarm contractor is responsible for the fire alarm permit application and integration of the radio communications enhancement system into the fire alarm supervisory notification/alarm panel.
3. **Submit retransmission Application:**
4. The integrator/installer shall complete a Retransmission Application for each BDA headend in the system design (Appendix D). Retransmission Applications must include the Permit Number assigned for the work. The owner shall submit Retransmission Application(s), proposed design documentation, system design diagrams, bill of materials (including specification sheets), floor plan diagrams, which include a heat map that color-codes the received levels, maps that demonstrate that all floors, stairwells, elevators have been tested exhaustively, to Washoe County WCRCS Radio Division for review.

Diagram

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1. **Obtain County Review and provisional retransmission authorization:**
2. The Washoe County WCRCS Radio Division will conduct a technical review of the proposed design along with the heat map that color-codes the received levels (the map needs to demonstrate that all floors, stairwells, elevators have been covered). Upon approval of the design, Washoe County WCRCS Radio Division will issue a signed Provisional Retransmission Authorization (Appendix C) to the applicant, which authorizes the operation of the system for the purposes of installation, testing, and optimization. The Provisional Retransmission Authorization is valid for a period of one year from the date of issuance.
3. **Perform System Installation:**
4. The integrator/installer proceeds with the installation of the approved system(s) in accordance with the project’s plan and schedule. Substantial design changes from those specified in the initial design must be approved by the Washoe County WCRCS Radio Division (e.g., selection of a different donor site, selection of different model BDA, selection of a different donor antenna, additions or changes to the number of line amplifiers in the design, and changes to the equipment room location in building).
5. **Perform Pre-commissioning Activation and optimization:**
6. DAS Integrator/installer posts the Provisional Retransmission Authorization at the headend location(s). The integrator/installer shall notify the Washoe County WCRCS Radio Division when ready to activate the system for the first time.
7. **Perform Fire Alarm/Two-Way Radio Communication Enhancement System testing:**
8. The DAS integrator/installer coordinates the scheduling of system testing with the fire alarm contractor at the site. Testing shall include integrator/installer staff, fire alarm contractor staff, WCRCS or Fire Marshal staff, and its third-party representatives. The test participants conduct NFPA compliant coverage testing and supervisory notification/alarm panel testing on the scheduled date. The Washoe County WCRCS Radio Division reviews the integrators test documentation and completes an evaluation of the system to ensure documentation accuracy and evaluate the impact on the Public Safety Radio System. Upon completion of the evaluation, the Washoe County WCRCS Radio Division will submit their findings to the appropriate Fire Marshal along with approval recommendations.
9. **Submit As-built Documentation:**
10. The DAS integrator/installer provides test results, including the heat map and full system as-built documentation to Washoe County WCRCS Radio Division in soft copy (e.g., PDF) format. With the recommendation of the Fire Marshal/Fire Chief, WCRCS issues a Final Retransmission Authorization (Appendix F) valid for a period of five years from the date of issuance. The Final Retransmission Authorization must be posted at the headend location. The Washoe County WCRCS Radio Division files the as-built documentation to the system archives.

### Exceptions to the Code

WCRCS can adopted the NFPA 1225 Standard for the Installation of all Bidirectional Amplifiers (BDA) Distributed Amplifier Systems (DAS) and Emergency Responders Radio Communication Systems (ERRCS). Specifications for NFPA 1225 or the Emergency Responders Radio Communication Systems (ERRCS, DAS & BDA) can be found: [NFPA 1225: Standard for Emergency Services Communications](https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1225)

NFPA References Electrical Specifications out of sections 700 and 800 of the NEC 70. Specifications for NFPA NEC 70, electrical specifications can be found: [NFPA 70®: National Electrical Code®](https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70)

**NFPA 1225 Exceptions:**

Splitters will not be accepted in the design of a DAS, Booster, ERRCS, or BDA system within the Washoe County Regional Communications System. (\*\*Coupler should be used in lieu of Splitters: Splitters do not pass communication traffic when the device is burned up, whereas a Coupler that burns up will act as a passive allowing traffic downstream of the damaged device. Adoption of this principal design is for the safety of our First Responders**)**

**Article 770 Optical Fiber Cables**

**Exception to 770.26:** Fire Rated Plenum Cabling is established by a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196 2017 Standard for Fire Test for circuits Integrity of Fire-resistant Power, Instrumentation, Control, and Data Cables. This requirement is for all Infrastructure cabling: ie Copper Power Cabling, and Optical Fiber Cabling. Type CMR communications riser cables shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Fire Stopping stuff required between transition of walls partitions, floors, and ceilings. Recommend using Fire Rated Corrugated Fiber tubing for installation of fiber, for cases where UL2196 Fiber is cost prohibitive.

**Article 800 General Requirements for Communications Systems**

TABLE 800.179 Cable Markings

Cable Marking Type

CMP Communications plenum cable

CMR Communications riser cable

CMG Communications general-purpose cable

CM Communications general-purpose cable

CMX Communications cable, limited use

CMUC Undercarpet communications wire and cable

**Informational Note:** Cable types are listed in descending order of fire resistance rating.

1. **Circuit Integrity (CI) cable or Electrical Circuit Protection System**
   1. Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 800.179(C)(1) or 800.179(C)(2). **Information Note: WCRCS is providing information for circuit integrity (CI) cable and electrical Circuits protective systems, including requirements required to maintain the fire rating within the Informational Notes.**
      * 1. Circuit Integrity (CI) Cables- Cables specified in 800.179(A) through 800.179(D), and used for survivability of critical circuits, shall have an additional classification using the suffix “CI”. In order to maintain its listed fire rating, cricuit integrity (CI) cables shall only be installed in free air**. Informational Note: Circuit integrity (CI) Cable is established by a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196 2017 Standard for Fire Test for circuits Integrity of fire-resistant Power, Instrumentation, Control, and Data Cables.**
        2. **Fire- Resistive Cables-** Circuit Integrity (CI) Cables- Cables specified in 805.179(A) through 805.179(D) and 805.179(C)(1) that are part of an electrical circuit protective system, shall be fire resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged and shall be installed in accordance with the listing of the protective system. Informational Note: Electrical Circuit protective system **is established by a minimum 2-hour fire resistance rating for the System when tested in accordance with UL Subject 1724, Outline of investigation for Fire tests for electrical Circuit protective system.**

**800.180 Grounding Devices**

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non—current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

**800.182 Communications Raceways and Cable Routing Assemblies**

Communications raceways and cable routing assemblies shall be listed in accordance with 800.182(A) through (C).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-4-2015, Cable Routing Assemblies and communications Raceways.

(A)Plenum Communications Raceways and Plenum Cable Routing Assemblies. Plenum communications raceways and plenum cable routing assemblies shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

(B)Riser Communications Raceways and Riser Cable Routing Assemblies. Riser communications raceways and routing assemblies shall be listed as having adequate fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

(C)General-Purpose Communications Raceways and General Purpose Cable Routing Assemblies. General-purpose communications raceways and general-purpose cable routing assemblies shall be listed as being resistant to the spread of fire.

## FCC Required Consent of Licensee Application

For obtaining a WCRCS 700/800 network Signal Booster Consent of Licensee Application, contact the Washoe County Regional Communications System

#### Contact Information:

Washoe County Regional Communications, Division of Technology Services,

224 Edison Way reno NV 89502

Email: [WCRCS@washoecounty.gov](mailto:WCRCS@washoecounty.gov) or [mlawney@washoecounty.gov](mailto:mlawney@washoecounty.gov)

Phone: (775) 858-5952 or (775) 771-424

### Signal Booster Consent of Licensee Application process

The Washoe County Regional Communications, Division of Technology Services, will facilitate the coordination of public safety signal booster installations across the county. Beginning October 1, 2023, Signal Booster Consent of Licensee Applications and Retransmission Authorizations will be processed through a new online portal. Public safety signal boosters may be required by the local AHJ for any new or existing building in accordance with the requirements of the WC Fire Code.

1. In accordance with the requirements of the WC Fire Code, new or existing buildings whose emergency responder communication coverage is compromised due to the construction materials of the building should have a signal booster design and engineering study to determine if all or portions of the building require a public safety signal booster. Consult with the local authority having jurisdiction (AHJ).
2. If needed, frequency and tower location information needed to complete the signal booster design and engineering study is available from the public safety licensee holder upon request.
3. If it is determined that an ERCES is required, the installer must notify the FCC licensee & the Washoe County Regional Communications, Division of Technology Services to apply for a Retransmission Consent Authorization Agreement. To apply email [WCRCS@washoecounty.gov](mailto:palmetto800@admin.sc.gov) to receive a link to the online application survey.
4. Complete the online application. The coordinates should represent the location the equipment is installed as accurately as possible, not the coordinates of the site or building address. All fields on the application are required. If you have any questions please contact Washoe County Regional Communications, Division of Technology Services at [WCRCS@washoecounty.gov](mailto:palmetto800@admin.sc.gov).
5. Retransmission Consent Authorization forms will be issued by the Washoe County Regional Communications, Division of Technology Services, or the appropriate FCC licensee
6. The consent authorization must be maintained by the building owner in a recordable format that can be presented to an FCC representative or other relevant licensee investigating interference.
7. Notify the public safety licensee when the signal booster installation is complete.
8. You MUST have Class B signal boosters registered (as defined in 47 CFR §90.219) at [www.fcc.gov/signal-boosters/registration.](http://www.fcc.gov/signal-boosters/registration) Coordinate with the public safety licensee to determine the best way to have your device registered.

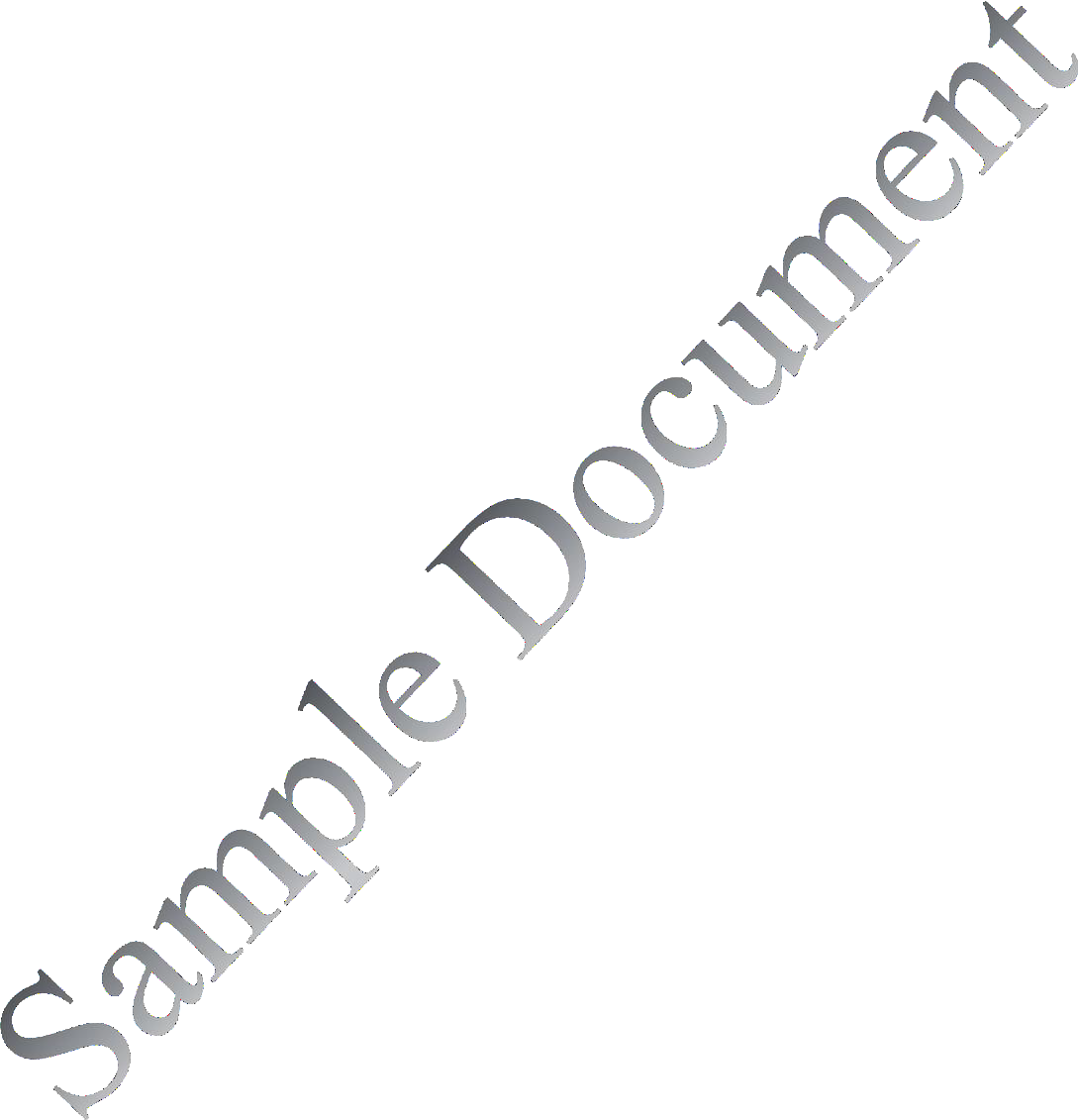
**NOTE:** Unauthorized use of a signal booster may result in significant FCC forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

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WCRCS 700/800 Retransmission Consent Authorization

The Washoe County Regional Communications, Division of Technology Services (County) hereby grants authorization to

 (Operator), to operate a two-way public safety radio communications signal booster (System) on 700/800 MHz public safety frequencies licensed to the Washoe County Division of Technology Services (Licensee) by the Federal Communications Commission (FCC) under call sign(s) , , and

at the following location:

Name: Address: City: State: Zip Code: Latitude: Longitude: Signal Booster Brand/Model: Class: Contact: Phone: E-mail:

This Authorization is subject to the following conditions:

* 1. The signal booster shall be operated, maintained, and tested annually in accordance with manufacturer’s instructions, the International Fire Code (IFC), FCC rules and regulations and National Fire Protection Association (NFPA) 1221 National Fire Alarm and Signaling Code, 2018 edition.
  2. The signal booster shall not cause interference to radio systems or equipment operated by the State or any other FCC licensee.
  3. Signal booster passbands are limited to the service band or bands for which the public safety Licensee is authorized. In general, signal boosters should utilize the minimum passband that is sufficient to accomplish the purpose. Except for distributed antenna systems (DAS) installed in buildings, the passband of a Class B booster should not encompass both commercial services (such as ESMR and Cellular Radiotelephone) and part 90 Land Mobile and Public Safety Services.

A picture containing text, bottle cap, gear

Description automatically generated**WCRCS 800 Retransmission Authorization**

* 1. The Operator shall promptly resolve any interference that occurs to radio systems, equipment of the State or any FCC licensee, up to and including deactivation of the signal booster, if necessary, until such time the interference is corrected.

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* 1. In the event of an outage of the signal booster, the Operator shall notify; the authority having jurisdiction (AHJ) in accordance with the regulations, policies and procedures for reporting any fire alarm/fire safety system outage.
  2. The Operator shall provide access to the signal booster for inspection upon request by the County, AHJ or the FCC.
  3. A separate retransmission authorization shall be obtained for each headend location in the system design and posted conspicuously with the headend equipment.
  4. The signal booster must be labeled in accordance with FCC requirements to indicate whether it's a Class A or Class Band must include the following advisory:

"WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or

express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at [www.fcc.gov/signal-](http://www.fcc.gov/signal-boosters/registration)

[boosters/registration](http://www.fcc.gov/signal-boosters/registration). The consent must be maintained in a recordable format that can be presented to an FCC representative or relevant licensee investigating interference. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each violation."

* 1. Class B signal boosters must be registered with the FCC (as defined in 47 CFR 90.219) at [www.fcc.gov/signal-boosters/registration](http://www.fcc.gov/signal-boosters/registration) prior to testing and utilization.
  2. The County, as FCC Licensee of the frequencies, reserves the right to terminate this consent authorization at its discretion..

If you have questions, please e-mail [WCRCS@washoecounty.gov](mailto:WCRCS800@admin.sc.gov) or call (775) 858-5952 or (775) 771-4241.

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Washoe County Regional Communications,

Division of Technology Services

cc: Local Fire Marshal

Part 90 Signal Boosters I Federal Communications Commission

**Federal Communications Commission**

Home/ Wireless/ Bureau Divisions/ Mobility Division/ Signal Boosters/

**Part 90 Signal Boosters**

Part 90 Signal Boosters are a type of Industrial Signal Booster. Part 90 Signal Boosters sold and marketed starting on March 1, 2014 must meet new FCC requirements. In addition, Class B Signal Boosters must be registered directly with the FCC before being used.

Register Your Part-90 Class B Signal Booster(https://signalboosters.fcc.gov/signal­ boosters/)

On February 20, 2013, the FCC released a Report and Order that included the following actions related to Part 90 Signal Boosters:

* Clarification of FCC rules to make it clear that non-licensees who seek to operate signal boosters must obtain the consent of the licensee[s] whose signals they intend to amplify;
* Adoption of a registration requirement for existing and future Class B signal booster installations;
* Permit Part 90 licensees to deploy Class A (narrowband) signal boosters in both fixed and mobile environments provided that they do not cause interference to other licensed services in the band. Prohibit mobile deployment of Class B (wideband) signal boosters, but allow fixed deployment of Class B signal boosters;
* Require system integrators and installers to consider the potential adverse effects of the increased noise floor on PLMR systems and establish additional emission limits to reduce the interference potential of signal boosters;
  + Update the FCC equipment authorization process to differentiate between Class A and Class B signal boosters and testing procedures;
  + Establish labeling requirements to promote compliance with FCC rules; and
  + Clarify certain definitions and power requirements.

Several of these changes are highlighted below with additional information.

Part 90 Signal Boosters I Federal Communications Commission

## Part 90 Signal Booster Classifications

Class A signal booster. A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.

Class B signal booster. A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz.

## Registration System for Class B Signal Boosters

On February 20, 2013, the FCC released a Report and Order that included a requirement for new and existing Class B signal boosters to be registered with the FCC. By creating a permanent record of all Class B signal booster installations in a searchable database, licensees will be able to search online for signal booster installations if they experience interference or other degradations to their system. This will allow licensees to identify and shut down signal boosters causing harmful interference as necessary.

Licensees and signal booster operators were required to register existing Class B signal booster installations with the FCC by November 1, 2014. After November 1, 2014, operation of an existing, unregistered Class B signal booster is unauthorized and subject to enforcement action. Any new Class B signal booster installed after November 1, 2014 must be registered prior to operation. To encourage compliance with this new requirement, registration will be free of cost to the operator and/or licensee.

## Manufacturers and Labeling Requirements

As of February 20, 2013, the FCC will no longer accept applications for equipment certification for Part 90 Signal Boosters that do not comply with the FCC's new rules. In addition, the FCC will cease certification of devices which do not comply with the new rules. As of March 1, 2014, all Industrial Signal Boosters sold and marketed in the United States must meet the FCC's new rules.

Part 90 Signal Boosters I Federal Communications Commission

# Transition Process

The FCC established a two-step transition process for equipment certification for Part 90 Signal Boosters sold and marketed in the United States.

# Labeling Requirements

Part 90 Signal Boosters must include a label with the following information:

1. As of February 20, 2013, the FCC will no longer accept applications for equipment certification for Part 90 Signal Boosters that do not comply with the FCC's new rules. In addition, the FCC will cease certification of devices which do not comply with the new rules.
2. As of March 1, 2014, all Industrial Signal Boosters sold and marketed in the United States must meet the FCC's new rules.

*It is possible that the warning label looks different than the sample label below. However, the warning label must include the same information.*

**WARNING.** This is **NOT a CONSUMER** device. It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS.** You **MUST** have an **FCC LICENSE** or express consent of an FCC Licensee to operate this device. You **MUST** register Class B signal boosters (as defined in 47 CFR 90.219) online at

[**www.fcc.gov/signal-boosters/registration.**](http://www.fcc.gov/signal-boosters/registration)Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

**Part 90 Signal Boosters**

**Bureau/Office:**

Wireless Telecommunications (https://[www.fcc.gov/wireless-telecommunications)](http://www.fcc.gov/wireless-telecommunications))

**Tags:**

Signal Boosters (/tags/signal-boosters) - Wireless Services (/tags/wireless-services)

FCC — Code of Federal Regulations

**ELECTRONIC CODE OF FEDERAL REGULATIONS**

e-CFR data is current as of November 1, 2019

Title 47 → Chapter I → Subchapter D → Part 90 → Subpart I → §90.219

Title 47: Telecommunication

PART 90—PRIVATE LAND MOBILE RADIO SERVICES Subpart I—General

Technical Standards

**§90.219 Use of signal boosters.**

This section contains technical and operational rules allowing the use of signal boosters in the Private Land Mobile Radio Services (PLMRS). Rules for signal booster operation in the Commercial Mobile Radio Services under part 90 are found in §20.21 of this chapter.

* 1. *Definitions.* The definitions in this paragraph apply only to the rules in this section.

*Class A signal booster.* A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.

*Class B signal booster.* A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz.

*Coverage area of a PLMRS station.* All locations within the normal reliable operating range (service contour) of a PLMRS station.

*Deploy a signal booster.* Install and/or initially adjust a signal booster.

*Distributed Antenna System (DAS).* A network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure.

*Operate a signal booster.* Maintain operational control over, and responsibility for the proper functioning of, a signal booster.

*Signal booster.* A device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas and other locations where these signals would otherwise be too weak for reliable communications. Signal booster systems may contain both Class A and Class B signal boosters as components.

* 1. *Authority to operate.* PLMRS licensees for stations operating on assigned channels higher than 150 MHz may operate signal boosters, limited to the service band for which they are authorized, as needed anywhere within the PLMRS stations' service contour, but may not extend the stations' service contour.
     1. PLMRS licensees may also consent to operation of signal boosters by non-licensees (such as a building owner or a signal booster installation contractor) within their service contour and across their applicable frequencies, but must maintain a reasonable level of control over these operations in order to resolve interference problems.
        1. Non-licensees seeking to operate signal boosters must obtain the express consent of the licensee(s) of the frequencies for which the device or system is intended to amplify. The consent must be maintained in a recordable format that can be presented to an FCC representative or other relevant licensee investigating interference.
        2. Consent is not required from third party (unintended) licensees whose signals are incidentally retransmitted. However, signal booster operation is on a non-interference basis and operations may be required to cease or alter the operating parameters due to a request from an FCC representative or a licensee's request to resolve interference.
     2. [Reserved]
  2. *Licensee responsibility; interference.* PLMRS licensees that operate signal boosters are responsible for their proper operation, and are responsible for correcting any harmful interference that signal booster operation may cause to other licensed communications services. Normal co-channel transmissions are not considered to be harmful interference. Licensees are required to resolve interference problems pursuant to §90.173(b). Licensees shall act in good faith regarding the operation of signal boosters and in the resolution of interference due to signal booster operation. Licensees who are unable to determine the location or cause of signal booster interference may seek assistance from the FCC to resolve such problems.
  3. *Deployment rules.* Deployment of signal boosters must be carried out in accordance with the rules in this paragraph.

FCC — Code of Federal Regulations

* + 1. Signal boosters may be used to improve coverage in weak signal areas only.
    2. Signal boosters must not be used to extend PLMRS stations' normal operating range.

(3)(i) Except as set forth in paragraph (d)(3)(ii) of this section, signal boosters must be deployed such that the radiated power of each retransmitted channel, on the forward link and on the reverse link, does not exceed 5 Watts effective radiated power (ERP).

(ii) Railroad licensees may operate Class A signal boosters transmitting on a single channel with up to 30 Watts ERP on frequencies 452/457.9000 to 452/457.96875 MHz in areas where communication between the front and rear of trains is unsatisfactory due to distance or intervening terrain barriers.

1. Class B signal boosters may be deployed only at fixed locations; mobile operation of Class B signal boosters is prohibited after November 1, 2014.
2. Class B signal booster installations must be registered in the FCC signal booster database that can be accessed at the following URL: [*www.fcc.gov/signal-boosters/registration.*](http://www.fcc.gov/signal-boosters/registration)
3. Good engineering practice must be used in regard to the radiation of intermodulation products and noise, such that interference to licensed communications systems is avoided. In the event of harmful interference caused by any given deployment, the FCC may require additional attenuation or filtering of the emissions and/or noise from signal boosters or signal booster systems, as necessary to eliminate the interference.
   1. In general, the ERP of intermodulation products should not exceed −30 dBm in 10 kHz measurement bandwidth.
   2. In general, the ERP of noise within the passband should not exceed −43 dBm in 10 kHz measurement bandwidth.
   3. In general, the ERP of noise on spectrum more than 1 MHz outside of the passband should not exceed −70 dBm in

a 10 kHz measurement bandwidth.

1. Signal booster passbands are limited to the service band or bands for which the operator is authorized. In general, signal boosters should utilize the minimum passband that is sufficient to accomplish the purpose. Except for distributed antenna systems (DAS) installed in buildings, the passband of a Class B booster should not encompass both commercial services (such as ESMR and Cellular Radiotelephone) and part 90 Land Mobile and Public Safety Services.
   1. *Device Specifications.* In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.
      1. The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.
      2. The noise figure of a signal booster must not exceed 9 dB in either direction.
      3. Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.
      4. A signal booster must be designed such that all signals that it retransmits meet the following requirements:
         1. The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, *provided that* the retransmitted signals meet the requirements of §90.213.
         2. There is no change in the occupied bandwidth of the retransmitted signals.
         3. The retransmitted signals continue to meet the unwanted emissions limits of §90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin). (5) On or after March 1, 2014, a signal booster must be labeled to indicate whether it is a Class A or Class B device, and the label must include the following advisory
2. In on-line point-of-sale marketing materials,
3. In any print or on-line owner's manual and installation instructions, (3) On the outside packaging of the device, and

(4) On a label affixed to the device:

“WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You

MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at [*www.fcc.gov/signal-boosters/registration.*](http://www.fcc.gov/signal-boosters/registration)Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.”