



**Summit County, Colorado, Fire District's  
Radio Amplification Policy  
April 16, 2008**

**RADIO AMPLIFICATION CONCEPT**

The intent of this requirement is to benefit and protect the health, safety and welfare of the County's residents by providing emergency service personnel (fire, medical, and law enforcement) the ability to operate hand held portable radios inside buildings and structures that inhibit transmission and reception of radio communications. This document establishes a uniform practice on the installation of a public safety radio amplification system to insure a reasonable degree of reliability for emergency services communication from within certain buildings and structures via the emergency communications center.

## **CHAPTER 1** **AUTHORITY**

**101.1** Section 102.8 of the currently adopted Fire Codes authorize that “requirements that are essential for the public safety of an existing or proposed activity, building or structure, or for the safety of the occupants thereof, which are not specifically provided for by this code shall be determined by the fire code official.”

**101.2** Section 104.1 of the currently adopted Fire Codes authorize “the fire code official is hereby authorized to enforce the provisions of this code and shall have the authority to render interpretations of this code, and to adopt policies, procedures, rules and regulations in order to clarify the application of its provisions. Such interpretations, policies, procedures, rules and regulations shall be in compliance with the intent and purpose of this code and shall not have the effect of waiving requirements specifically provided for in this code.

**101.3** Therefore, the Summit County Fire District's require that a public safety radio amplification system shall be installed within certain buildings and structures to provide for emergency communications to and from the emergency communications center. It is the responsibility of the emergency service provider to get the signal to and from the building.

## **CHAPTER 2** **DEFINITIONS**

**201.1 Scope.** Unless otherwise expressly stated, the following words and terms shall, for the purposes of this policy, have the meanings shown in this chapter.

**201.2 Interchangeability.** Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

**201.3 Terms defined in other codes.** Where terms are not defined in this policy and are defined in the *Codes*, such terms shall have the meanings ascribed to them as in those codes.

**201.4 Terms not defined.** Where terms are not defined through the methods authorized by this Chapter, such terms shall have ordinarily accepted meanings such as the context implies.

### **202.1 General definitions.**

1. **AHJ.** Authority having jurisdiction.
2. **Alteration-Level 3.** Level 3 alterations apply where the work area exceeds 50 percent of the aggregate area of the building, as defined by the Existing Building Code.
3. **Policy.** The term policy shall refer to a general term used to describe the adoption of the document as a resolution, code or ordinance based on the AHJ's established adoption procedures.

## **CHAPTER 3** **GENERAL**

**301.1 Scope.** The provisions of this policy shall apply to:

1. New buildings with a total building area of 50,000 square feet or building additions that cause a building to be greater than 50,000 square feet.
2. All new basements over 10,000 square feet where the design occupant load is greater than 60, regardless of the occupancy classification.
3. Existing buildings meeting the criteria of Item #1 or 2 of this section undergoing alterations exceeding fifty percent (50%) of the aggregate area of the building.

**Exception:** One- and two-family dwellings and townhouses.

**302.1 Fire Barriers, Fire Partitions, and Fire Walls.** For the purpose of this policy, Fire Barriers, Fire Partitions, and Fire Walls as defined in the Building Code, shall not be used to define separate buildings.

**303.1 Submittal process.** Every radio amplification system submitted for review must contain the items required in this section.

**303.1.1 Application.** The plan review application shall include all plans, specification sheets, and an application form. The application form shall be submitted and approved PRIOR to work being started. The Authority Having Jurisdiction, hereafter referred to as the AHJ, reserves the right to conduct an investigation and assess additional fees, as outlined per the AHJ's adopted Fee Schedule, if the above procedure is not followed.

**303.1.1.1 Components.** All system components shall be UL listed or FM approved, and approved by the AHJ. Components shall be installed per the manufacturer's instructions, in locations approved by the AHJ.

**303.1.1.2 Letter of intent.** A letter of intent from the system designer, which explains the capabilities and limitations of the system being installed, shall be submitted to the AHJ.

**303.1.1.3 Table of contents and equipment list.** A table of contents and equipment list shall be included to provide for a quick reference during the plan review.

**303.1.1.4 Working plans.** Two complete sets of plans or drawings shall be required before any equipment is installed or remodeled. Deviation from approved plans shall require permission of the AHJ.

**303.1.1.5 Scale.** Working plans shall be drawn to an indicated scale, be on sheets of uniform size, show a plan of each floor, show the grid overlay, and shall show those items from section 309.1 that pertain to the design of the system.

**303.1.1.6 Radio frequency field strength information.** The following information shall be given about the radio strength field tests as a minimum.

1. Location, elevation, date, and time of field strength test.
2. Test conducted by or information supplied by.
3. Other sources of radio frequency field strength information.
4. Map showing all government transmitter locations in relation to the building.
5. Location, height, and distance of all government transmitter locations in relation to the building.
6. List of frequencies and bandwidth calculations to be included in system.
7. Radio frequency field strength test results for each transmitter location.
8. Proposed Grid layout for testing purposes.

**303.1.1.7 Building plans.** The following information shall be provided with all plan submittals as a minimum.

1. Name and address of contractor.
2. Name of owner and occupant.
3. Location, including street address.
4. Point of compass.
5. Full height cross-section, or schematic diagram, including structural member information if required for clarity and

including ceiling construction and method of protection for nonmetallic piping.

6. Location of partitions.
7. Location of firewalls.
8. Occupancy class and use of each area or room.
9. A graphic representation of the scale used on all plans.

**303.1.1.8 System equipment and plans.** The following information shall be provided with all system submittals as a minimum.

1. Make, type, model, and size of all cable, amplifiers, antennas, batteries, etc. (spec. sheets).
2. Location of all cable, amplifiers, battery panels, etc.
3. Type and locations of hangers, sleeves, braces, and methods of securing cable and antennas, when applicable.
4. Battery and battery charging calculations.
5. System design calculations.
6. Where the equipment is to be installed as an addition to an existing system, enough of the existing system shall be indicated on the plans to make all conditions clear.
7. The working plan submittal shall include the manufacturer's installation instructions for any specially listed equipment, including descriptions, applications, and limitations for any cable, amplifiers, antennas, batteries, etc.

**304.1 Approval process.** Following the Fire District review, the permit fee will be assessed and a letter may be sent to the applicant indicating items that require corrections. One approved set of plans or drawings will be returned to the applicant along with the permit card. These items shall be kept on site during construction. The applicant shall be responsible for corrections before receiving final acceptance of the system.

**305.1 Alternative materials or methods.** With **PRIOR** approval from the AHJ, the owner may wait until the building is in the drywall inspection stage to determine whether amplification is needed. Also, with prior approval, alternative materials or methods may be substituted for those outlined in this policy if it is found that the proposed changes meet the intent of the policy. The burden of proof lies with the person requesting approval of the alternate materials or method of construction.

**306.1 Rejection process.** The AHJ may reject the submitted plans if they do not meet the requirements of the application process. A resubmittal fee may be required. See Fee Schedule for details.

**CHAPTER 4**  
**RADIO COVERAGE (PRETEST)**

**401.1 Scope.** Except as otherwise provided in this policy, no person shall maintain, own, erect, construct or modify any building or structure or any part thereof, or cause the same to be done which fails to support adequate radio coverage for Summit County emergency service providers (fire, medical, and law enforcement). A final inspection shall not be approved for any building or structure that fails to comply with this requirement.

**402.1 Delivered Audio Quality.** For the purpose of this section, adequate radio coverage shall constitute a successful communications test between the building interior and the communications center for all appropriate emergency service providers for the building. The performance level is rated using "Delivered Audio Quality (DAQ)." Industry standard DAQ definitions are shown in Table 402.1. DAQ level 3 are commonly specified as the minimum performance level for public safety systems.

**Table 402.1**  
**Delivered Audio Quality Definitions**

<b>DAQ Delivered Audio Quality</b>	<b>Subjective Performance Description</b>
1	Unusable, speech present but unreadable.
2	Understandable with considerable effort. Frequent repetition due to noise/distortion.
3	Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
3.5	Speech understandable with repetition only rarely required. Some noise/distortion.
4	Speech easily understood. Occasional noise/distortion.
4.5	Speech easily understood. Infrequent noise/distortion.
5	Speech easily understood.

**403.1 Enhanced amplification system.** Where buildings and structures are required to provide amenities to achieve adequate signal strength, such buildings and structures shall be equipped with any of the following to achieve the required adequate radio coverage; radiating cable systems, internal multiple antenna systems with a frequency range as established by Summit County Communications Center-with amplification systems as needed, voting receiver system, or any other approved system.

**403.1.1 System monitoring.** If any part of the installed system or systems contains an electrically powered component, the system shall be capable of operation on an independent battery and/or generator system for a period of at least twenty-four (24) hours without external power input or maintenance. The battery system shall automatically charge in the presence of external power input. The amplification system, if powered, will be monitored by the building fire

alarm system. If the system shifts to auxiliary power as stated above, the building fire alarm system will indicate trouble for that dedicated zone.

**403.1.2 Environmental control.** Amplification equipment must have adequate environmental controls to meet the heating, ventilation, cooling and humidity requirements of the equipment that will be utilized to meet the requirements of this code. The area where the amplification equipment is located shall be free of hazardous materials such as fuels, asbestos, etc. The location of the amplification equipment must be in an area that has twenty-four (24) hour, seven (7) day a week access for the emergency service personnel. All communications equipment including amplification systems, cable and antenna systems shall be grounded with a single point ground system of five (5) ohms or less. The ground system must include an internal tie point within three (3) feet of the amplification equipment. System transient suppression for the telephone circuits, ac power, radio frequency (RF) cabling and grounding protection are required as needed.

**403.2 System design.** Radio amplification system design must be coordinated between the property owner, vendor, Fire District, and the Summit County Communications Center. System design must support a VHF conventional 155.000 MHz center-point plus or minus 5 MHz as well as an 800-860 MHz DTR system.

**403.2.1 Frequency changes.** In the event that an emergency service provider modifies its communications equipment in any way that impairs its ability to communicate with an existing system installed in accordance with this part, such building owner shall be responsible for all costs associated with reestablishing communications within the affected building or structure.

## **CHAPTER 5**

### **PERFORMANCE REQUIREMENTS INBOUND AND OUTBOUND**

**501.1 Scope.** A minimum average in-building field strength of 3.9uV (-95 dBm) throughout 95% of the area of each floor of the building for inbound and outbound signals transmitted from or to the appropriate emergency service radio systems providing coverage for public safety services (law enforcement, fire, and medical ) to the building. If the -95 dBm in-bound signal does not meet the requirements of Section 502.1 below, then noise floor must be determined and the in-bound signal must be 15 dBm above the noise floor determined level, meeting the requirements of current version of TSB88A standards.

**502.1 Reliability.** As used in this regulation, 95% coverage or reliability means the radio will receive and transmit 100% of the time at the field strength and levels as defined in this regulation within 95% of the building's area.

**503.1 Field strength.** If the field strength OUTSIDE the building where the receive antenna system for the in-building system is located is less than the -95 dBm, then the minimum required in-building field strength shall equal the field strength being delivered to the receive antenna of the building.

**504.1 Accessibility.** All essential components shall be installed in a climate controlled room accessible for repair and testing within the structure that is separated from the remainder of the building by not less than a 2-hour fire resistance rated fire barrier constructed in accordance with the most currently adopted edition of the Building Code. The circuits shall be monitored on a supervisory circuit on a fire alarm panel for emergency power and operational readiness of the system in accordance with the applicable provisions of the relevant edition of National Fire Protection Association (NFPA) 72, National Fire Alarm Code, and the Adopted Electrical Code. This installation shall meet the requirements of the R56 Grounding Standards.

## **CHAPTER 6** **AMPLIFICATION AUTHORIZATION**

**601.1 Scope.** Amplification will be allowed to enhance the buildings that do not support adequate radio coverage. The Summit County Communications center will determine if amplification is needed for improvement of signaling in order to comply with ordinance standards.

## **CHAPTER 7** **INSPECTIONS, ACCEPTANCE TESTING, AND SYSTEM CERTIFICATION**

**701.1 Testing procedures.** When an in-building radio system is required, and upon completion of installation, it will be the building owner's responsibility to have the radio system tested to ensure that two-way coverage for the building meets the minimum requirements outlined in Section 402.1 of the inbound and outbound system requirements. Once implemented, an acceptance test plan will be required. The acceptance test conducted by the vendor should include personnel from the Fire District. The acceptance test must be approved in advance. A walk through test should be completed and any discrepancies noted and resolved by the vendor.

**702.1 Qualification of testing personnel.** Personnel conducting radio system tests shall be qualified to perform the work. All tests shall be documented and signed by a person in possession of a current FCC license, or a current technician certification issued by the Associated Public-Safety Communications Officials International (APCO), the Personal Communications Industry Association (PCIA), or the National Association of Business and Education Radio (NABER). The building owner shall retain all test records on the inspected premises and a copy shall be submitted to the Fire District's officials.



**703.1 Acceptance test plan.** The following method will be used to conduct the tests:

1. Tests shall be made using frequencies close to the frequencies used by emergency services.
2. If testing is done on the actual frequencies, then this testing must be coordinated with the appropriate emergency service providers and the Communications Center.
3. All testing shall be done on frequencies that are authorized by the FCC.
4. A valid FCC license will be required if testing is done on frequencies different from the police, fire or emergency medical frequencies.

**704.1 Measurements.** Measurements shall be made using the following guidelines at a minimum.

1. With a service monitor using a unity gain antenna on a small ground plane.
2. Measurements shall be made with the antenna held in a vertical position at 3 to 4 feet above the floor.
3. A calibrated service monitor (with a factory calibration dated within 24 months) may be used to make the tests.
4. If measurements in a location are varying, then average measurements may be used.
5. The inspector for the Fire District will do a hands-on radio test to check areas for proper radio operation/reception as defined in Table 1.

**705.1 Initial testing.** All testing shall be done in the presence of the inspector for the AHJ.

**705.1.1 Signal strength.** Signal strength, both inbound and outbound as defined above, shall be measured on each and every floor above and below ground including stairwells, basements, penthouse facilities, and parking areas of the structure.

**705.1.2 Grids.** The structure shall be divided into 100-foot grids and the measurements shall be taken at the center of each grid. In critical areas as determined by the Fire Districts (Fire Command Centers, elevators, stairwells, protect-in-place areas, lobby refuge areas, equipment rooms, high hazard areas, basements, and underground parking areas) the grids shall be reduced to 25-feet. The size of the grids may also be reduced upon recommendation of the inspector, in areas where displays, equipment, stock, or any other obstruction may significantly affect communications in those areas.

**705.1.3 Radio testing approval.** The test shall be conducted using a portable radio approved by the Summit County Communications Center, talking through the Summit County Communications Center.

**705.1.4 Testing location.** A spot located approximately in the center of a grid area will be selected for the test.

**705.1.5 Selection of location.** The radio will be keyed to verify two-way communications to and from the outside of the building through the communications center. Once a spot has been selected, prospecting for a better spot within the grid area will not be permitted.

**705.1.6 Grid area testing.** Each grid area will be tested for transmission/reception; a minimum signal strength of  $-95$  dBm shall be measured. If signal strength fails to meet the requirement, the grid area shall be marked as a fail. (A maximum of two nonadjacent grids on any floor will be allowed to fail the test.)

**705.1.7 Gain values.** The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file at the facility and the Fire District so that the measurements can be verified each year during the annual tests. In the event that the measurement results become lost, the building owner will be required to rerun the acceptance test to reestablish the gain values.

**706.1 Annual tests by property owner.** When an in-building radio system has been installed, it shall be the building owner's responsibility to have all active components of the system, including but not limited to amplifiers, power supplies, and backup batteries, tested a minimum of once every twelve (12) months.

**706.1.1 Amplifier testing.** Amplifiers shall be tested to ensure that the gain is the same as it was upon initial installation and acceptance.

**706.1.2 Backup batteries and power supply testing.** Backup batteries and power supplies shall be tested under load for a period of one (1) hour to verify that they will properly operate during an actual power outage. If within the one (1) hour test period, and in the opinion of the testing technician, the battery exhibits symptoms of failure, the test shall be extended for additional one (1) hour periods until the integrity of the battery can be determined.

**706.1.3 Active component testing.** All other active components shall be checked to determine that they are operating within the manufacturers specifications for the intended purpose.

**707.1 Annual testing by emergency response agencies.** The Fire District shall conduct annual tests on all systems. If communications appear to have degraded or if the tests fail to demonstrate adequate system performance, the owner of the building or structure is required to remedy the problem and restore the system in a manner consistent with the original approval criteria.

**707.1.1 Degradation due to building renovations.** If degradation to the system is due to building additions or remodeling, the owner of the building or structure is required to remedy the problem and restore the system in a manner consistent with the original approval criteria in order to obtain a final inspection for occupancy.

**707.1.2 Degradation due to system failures.** Any system degradation or failure not related to the performance of the owners on-site system will be the responsibility of the appropriate emergency service agency.

**708.1 Five year testing.** In addition to the annual test, it shall be the building owner's responsibility to perform radio coverage tests a minimum of once every five (5) years to ensure that the radio system continues to meet the requirements of the original acceptance test.

**709.1 Field testing.** Emergency Services personnel, after providing reasonable notice to the property owner, shall have the right to enter property to conduct field-testing to be certain that the required level of radio coverage is present. Discrepancies from field-testing and recorded tests shall immediately be brought to the attention of the property owner. The property owner is responsible to provide corrective action in response to reported discrepancies.

**710.1 Exemptions.** This ordinance shall not apply to any buildings that do not need any sort of added equipment for public safety to be able to function effectively inside them.

**711.1 Penalties.** Any person violating any of the provisions of this policy shall be subject to a fine, and any continued non-compliance of this policy by any building shall be subject to fines and or penalties as set-forth by currently adopted Fire Codes.

**712.1 Conflict.** This policy/ordinance supersedes all articles or parts of articles adopted prior hereto which are in conflict herewith, to the extent of such conflict.

# ANNEX

# IFC Code Sections

**102.8 Matters not provided for.** Requirements that are essential for the public safety of an existing or proposed activity, building or structure, or for the safety of the occupants thereof, which are not specifically provided for by this code shall be determined by the fire code official.

**104.1 General.** The fire code official is hereby authorized to enforce the provisions of this code and shall have the authority to render interpretations of this code, and to adopt policies, procedures, rules and regulations in order to clarify the application of its provisions. Such interpretations, policies, procedures, rules and regulations shall be in compliance with the intent and purpose of this code and shall not have the effect of waiving requirements specifically provided for in this code.

# IBC Code Sections

**702.1 Definitions.** The following words and terms shall, for the purposes of this chapter, and as used elsewhere in this code, have the meanings shown herein.

**FIRE BARRIER.** A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

**FIRE PARTITION.** A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.

**FIRE WALL.** A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall