



Information for Digital Antenna System (DAS)/ Bi-Directional Amplification (BDA) Systems

(Public Safety/Emergency Responder Radio System)

Orange County Sheriff's Department,
Communications & Technology Division

In conjunction with

Orange County Fire Authority

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PURPOSE

The Orange County Sheriff's Department, Communications & Technology Division (OCC) and the Orange County Fire Authority (OCFA) established this framework to provide guidance to those properties required to provide appropriate emergency radio coverage for first responders. It is intended for use in those communities served by the OCFA and by local law enforcement agencies utilizing the Countywide Coordinated Communication System.

AUTHORITY

The regulatory authorities for the provisions contained within the guide are found in the California Fire & Building Codes. If a local agency (City/County) has adopted a separate ordinance governing in-building emergency radio coverage the provisions contained within that ordinance may also apply. Additional Federal, State and Local requirements may apply as OCSD and OCFA have a joint responsibility in the installation, use and maintenance of emergency radio systems.

This guide shall not apply to the following:

1. Existing buildings or structures for which a building permit has been issued.
2. Elevators.
3. Structures that are three stories or less without subterranean storage or parking and that do not exceed 50,000 square feet on any single story.
4. Wood-constructed residential structures four stories or less without subterranean storage or parking which are not built integral to an above ground multi-story parking structure.
5. Should construction that is three stories or less which does not exceed 50,000 square feet on any single story include subterranean storage or parking, then this ordinance shall apply only to the subterranean areas.
6. Existing buildings undergoing extensive remodel and/or expansion shall be coordinated with the jurisdictions Building Official to determine if the installation of an in-building radio system is needed. If so, OCFA staff will as early in the construction approval process as practical notify the developer/property owner.

NOTE: The owner of any building or structure to which this article applies shall be responsible for all costs associated with the installation, maintenance, testing and compliance with the County of Orange Public Safety Radio System Coverage Specifications.

DEFINITIONS

Amplification System: An in-building public safety radio amplification system composed of FCC-certified bi-directional 800 MHz amplifier(s), associated distribution system, and subcomponents.

FCC Certified Technician: An individual who is qualified with a General Radiotelephone Operator License (GROL/PG), or equivalent, to review design plans and perform tests in affected structures to measure compliance with the specifications set forth in this article.

Countywide Coordinated Communication System: The radio system used by local law enforcement, fire, lifeguard and public works departments within the County of Orange for emergency and non-emergency radio communication on the 800 MHz radio band.

SPECIFICATIONS

The following levels of coverage are required for public safety radio communication on the Countywide Coordinated Communication System:

1. A delivered audio quality of level 3 on each floor of the building or structure, which constitutes audio quality that, makes speech understandable with slight effort with occasional repetition required due to noise or distortion.

DAQ Delivered Audio Quality	Subjective Performance Description
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.

2. A minimum signal strength of (-95dBm) in 90% of the area of each floor of the building or structure from both the Countywide Coordinated Communication System and from within the building or structure.
3. A frequency range supported from the Countywide Coordinated Communication System of 851 - 861 MHz (base transmitter frequencies), and a frequency range supported to the Countywide Coordinated Communication System of 806 - 816 MHz (radio field transmit frequencies) on each floor of the building or structure.

A. Amplification System Specifications.

1. The amplification system shall include filters to reject frequencies above 861 MHz by a minimum of 35 dB.
2. All amplification system components must be 100% compatible with analog and digital modulations after installation without additional adjustments or modifications. The system must be capable of encompassing the frequencies stated above and capable of future modifications to a frequency range subsequently established by the City (County of Orange if within unincorporated Orange County). If the system is not capable of modification to future frequencies, then a new system must be installed to accommodate the new frequency band.
3. All electrical components must be equipped with independent auxiliary battery power or generators to function at full capacity for at least twelve (12) hours. The auxiliary battery systems shall be replaced per manufacturer’s specifications at least every two (2) years.
4. The amplification system shall be designed and installed by an FCC certified technician.

B. Active Device Specifications.

1. Active devices shall have a minimum of -50 dB 3rd order intermodulation protection.
2. All active devices shall be FCC Part 90 Type Certified.
3. All electrical components must be equipped with independent auxiliary battery power or generators to function at full capacity for at least twelve (12) hours. The auxiliary battery shall be replaced per manufacturer's specifications at least every two (2) years.
4. Active devices shall be alarmed with a phone line that will provide dial tone to an alarm device. The alarm device will be programmed to activate a pager on the County of Orange's 900 MHz paging system. Access to the active device is required twenty-four (24) hours a day by City/County and Police/Sheriff Department technicians/engineers. The alarms will indicate loss of AC failure and operational failure. The device shall also have modem access to allow remote monitoring.
 - a. Where these radio monitoring/alarm functions can be performed as described above via the building's sprinkler monitoring or alarm system without interfering with either system's operation, the systems may be permitted to be interconnected.
5. Any AC operated power supplies shall have a UL listing.

C. Conduit.

1. All new building construction shall have a conduit installed between the first and bottom subterranean floor and said conduit shall extend along the center of the building to the roof. At each floor and the roof, an opening shall be made to afford easy access to the conduit from the ceiling. Access in either the form of drop ceiling or conduit shall be made available along hallways and through firewalls. Access in either the form of a drop ceiling or conduit shall be made to access the horizontal branch lines extending from the vertical conduit riser to each antenna. All floors of the subterranean parking garages shall have a similar conduit installation.
2. The radio system, extending from the head-end amplifier to the distributed antennas, is not allowed to be combined with other distributed antenna systems installed in the building. Cable other than radio cable is allowed to comingle in the conduit provided it will not interfere with the emergency responder radio system operation.
3. Where fiber optic distribution systems or other methods are used to extend the radio system throughout the building or to other buildings, the line shall be enclosed in conduit meeting the requirements or otherwise protected as specified above.

Buildings and structures that cannot be constructed to provide the performance specified above shall be equipped with an amplification system or an active device that complies with the following criteria or any other system approved in writing by the OCFA, Building Department and the local law enforcement agency.

DESIGN DOCUMENTATION REQUIREMENTS

1. The FCC Licensed Contractor is fully responsible for the 800 MHz BDA system design and compliance with all applicable code and ordinance requirements.
2. The amplification system shall be:
 - a. Fully Rebandable.
 - b. Supported by manufacturer for seven years after installation.
 - c. Equipped with Uninterrupted Power Supply (UPS) system.
 - d. Equipped with auto-dialer system that is programmed to report the assigned BDA ID to the county 900 MHz paging system.
3. Indoor antennas shall be 700/800 MHz compliant, at a minimum.

4. Indoor tri-band antennas for BDA/DAS and cell phone coverage are optional based on the building owner needs/requirement.
5. BDA system design shall utilize 1/10 couplers, rather than splitters.
6. Drawings shall detail the model numbers for all the proposed equipment (i.e. BDA system, Indoor antennas, Donor antenna, UPS, etc.)
7. Rack layout documentation.
8. Fiber optics layout, and interconnect (if applicable).
9. Provide floor plan showing 20' x 20' signal grid layouts of the BDA system install for each floor.
10. Single page diagram showing the signal levels from the BDA system and indoor antennas.
 - a. Drawing shall show indoor antenna layouts and signal levels, splitter/hybrid layouts, and donor antenna.

PRIOR TO APPLICATION FOR A BUILDING PERMIT

1. Retain a Federal Communications Commission (FCC) certified technician who will review construction plans in order to ensure that such plans meet radio communication criteria specified in the City's Municipal Code (CBC, CFC, Public Safety, etc.);
2. All recommended in-building solution system components; subcomponents, devices and equipment shall be clearly shown in the construction building, mechanical and electrical plans. The technician shall certify the plans by including the technician certification number on the plans prior to their submittal to the OCC/City/OCFA.

PROCEDURE FOR SUBMITTAL

1. The FCC licensed contractor shall submit three sets (two hardcopy sets and one electronic copy in PDF format) of Bi-Directional Amplifier/Digital Antenna System design drawings and documentation to the Orange County Sheriff's Department, Communication & Technology Division at:
840 N. Eckhoff, Ste. 104, Orange, CA or bcobb@ocsd.org
 - a. Drawings must be a minimum size Architectural D (24x36") sheets or similar, with supporting manufacturer documentation on 8.5" x 11" pages. Site plan, floor plan(s) and wiring diagrams must be included.
 - b. After design review, OCSD will assign a BDA system identification number and provide instructions to the contractor for programming the auto-dialer to dial into the county paging system.
2. Once the plans are approved by the OCSD Communications & Technology Division, plans will be submitted to the City's (County of Orange if within unincorporated Orange County) Chief Building Official (and Police Department if applicable) and the OCFA Planning & Development Services Section.
 - a. The submittal to OCFA shall include a photocopy of the approved OCSD plans and documentation and a completed OCFA BDA certification form.
 - b. The submittal to the Building Official shall include a photocopy of the approved OCSD plans and documentation as well as any information required for approval of the electrical systems/tie-ins, details for penetrations through rated construction assemblies, and/or other information as determined by the Building Official.

TESTING AND SYSTEM DESIGN PROCEDURE

1. Initial Tests.

- a. Prior to the issuance of a certificate of occupancy for any building or structure to which these specifications apply, the system shall be tested in accordance with the CFC §510.
 - i. OCSD no longer performs BDA testing. The BDA installing contractor needs to contact a 3rd party FCC licensed BDA contractor (e.g, RF Signalman, RedRock, Leaf Comm, Das Simplified, HCI) to perform the following:
 1. Grid test measurement report, and design certification
 2. Auto dialer test
 3. Isolation test report
- b. Upon successfully satisfying all testing criteria, the FCC certified technician shall provide a copy of the completed test report, a completed OCFA Installation Testing Certification form and, where applicable, as-built amplification plans* to OCFA.
 - i. Test report shall be a bound or stapled document of 8 ½ x 11 sheets (fold out sheets of 8 ½ x 17 may be used for floor plan diagrams). Content shall include:
 1. A summary signed by the party responsible for the testing which includes testing procedures followed, the dates, names of the parties involved in the testing and their respective companies, and the results, i.e. passing or failing of the performance requirements (DAQ), and signal strength requirements.
 2. Floor plans of the building with testing grids and measurements for performance (DAQ) and signal strength.
 - ii. An electronic copy of the information listed above in PDF format

**Note: In cases where the amplification system was designed after the building permit was issued, as-built amplification plans shall be provided that include complete line drawings showing system circuits, equipment specifications, and equipment locations. When required by the Building Official, as-built amplification plans or revisions to approved architectural, mechanical, and electrical plans may be required.*

2. Annual Tests.

- a. Systems shall be inspected and tested annually or whenever structural changes occur including additions or remodels that could materially change the original field performance tests. Tests shall be completed by the FCC certified technician hired by the building or property owner. Such testing shall be in compliance with CFC requirements.

Note: Any first responder may conduct periodic field tests on each floor of each building or structure to which these specifications apply to verify the required level of radio coverage. This test is not intended to replace any required maintenance and testing that is the responsibility of the property owner.

3. Record Retention.

- a. The owner of any building or structure to which these specifications apply shall retain all records of initial and annual tests performed pursuant to this section and shall submit copies to the City's

(County of Orange if within unincorporated Orange County) Chief Building Official, The Police Department and the OCFA within thirty (30) days of completion of such tests.

Applicable Code

California Building and Fire Code (California Code of Regulations, Title 24, Part 2 and Part 9)

Local public safety &/or ordinances

