City of Fort Lauderdale Florida

City Ordinance 47-25 Development Review Criteria
Article V – Development Review Criteria

Section 47-25.2 ADEQUACY REQUIREMENTS

A. The Adequacy Requirements set forth herein shall be used by the City to evaluate the demand created on public services and facilities created by a proposed development permit.

B. Communications network. Buildings and structures shall not interfere with the City's communication network. Developments shall be modified to accommodate the needs of the City's Communications network, to eliminate any interference a development would create or otherwise accommodate the needs of the City's communication network within the development proposal.

Editors note: The above is sufficient to require recipients of building permits to take measures to assure radio communications within a structure.

The next page is the cities Radio Signal Booster Specification which provides information relative to adequate signal levels, testing and reporting compliance.

The TX RX Systems model 61-89A-06-OLC-G1 is 100% compliant to the Radio Signal Booster Requirement specifications.

800 MEGAHERTZ RADIO SIGNAL BOOSTER SYSTEM
SPECIFICATION

PURPOSE

This specification describes the requirements of a Radio Signal Booster System which will correct for a reduction in the radio signal to a level below that required to assure the 95% area coverage reliability needed for public safety communications caused by a new building development.

The City of Fort Lauderdale operates a 26 channel trunked, simulcast public safety radio system in the 800 megahertz (MHz) band. The system was designed to provide clear, intelligible, in-building communication from portable radios with public safety speaker microphones mounted at shoulder height with an area coverage reliability of better than 95%. Erection of new buildings affects the radio system coverage. The effect on radio coverage is dependent on location (distance from the radio transmitter and receiver and other buildings in the vicinity), height, projected frontal area and construction materials. If the City's analysis indicates that there may be a reduction in radio system coverage to a level below that considered acceptable for reliable public safety communications, corrective action will be required to assure radio system coverage reliability is retained. At the minimum, a Radio Signal Booster System will be required. In extreme situations, it may be necessary to install a satellite receiver system or a full transmit and receive site.

SYSTEM DESIGN CRITERIA

The Radio Signal Booster System shall consist of an exterior antenna, a bi-directional amplifier system with a backup power supply mounted in a suitable location in the building and an in-building antenna or radiating cable system.

The Signal Booster System shall be designed to operate in the 800 megahertz (MHz) band, specifically 821-825 MHz /866-870 MHz.

The Signal Booster System shall be designed to provide a minimum -80 dBm RF signal level, or a minimum of 10 dB above the RF noise floor, at any point outside of and within the building.

OUTPUT SIGNAL LEVEL

The Signal Booster System shall amplify all signals within the required frequency band. The effective output power per single channel will change as more channels are amplified. The maximum output power level is shared by each input channel. The exact proportion of 'sharing' is determined by the number of channels AND the power level of each channel in relation to all the other input channels. The following chart illustrates the effect of multiple channel amplification.

Number of frequencies in the passband	Maximum output power per single channel
2	24.7 dBm
4	20.0 dBm
6	17.5 dBm
8	15.5 dBm
10	14.1 dBm
20	9.8 dBm
30	7.3 dBm
40	5.6 dBm
50	4.3 dBm

If there is radio frequency interference external to the passband, the affect may be reduced by several means, typically using a more directional antenna to direct the signals to the desired repeater site or installing selective bandpass filters in the signal path coming from the antenna.

INPUT SIGNAL LEVEL

An input signal level of -60 dBm is generally used as the most desirable input signal level for a signal booster system, although the Signal Booster System may operate at a much lower level with the acceptance of a reduced output signal level.

FCC REQUIREMENTS

The Signal Booster System must be FCC type accepted and labeled as such when operating on any frequency regulated by the FCC.

EXTERIOR ANTENNA SYSTEM

The roof top antenna system shall consist of a broadband corner reflector gain antenna with a minimum +25 dB front to back gain ratio, antenna mount, 2 foot superflex coaxial cable jumper from the antenna to the coaxial feedline connector, coaxial lightning surge suppressor and a minimum 1/2" type LDF coaxial cable feed to the bi-directional amplifier. The specific size coaxial cable shall depend on the system design. The antenna gain must be selected to provide minimum required signal level. The antenna shall be directed to the nearest system repeater site. If requested the City will provide the antenna orientation. A coaxial lightning surge suppressor shall be installed in the coaxial cable feed at the building entrance. The coaxial lightning surge suppressor shall be similar or equal to Polyphaser Model IS-50NX-C2, 50 ohm, N-Female termination, flange mounted.

The antenna installation, including the coaxial cable shield, shall be suitably connected to the building's electrical ground system at the base of the antenna and at the coaxial lightning surge suppressor.

If required by FAA regulations, obstruction lighting shall be installed.

The antenna installation shall meet the wind loading requirements of the South Florida Building Code.

BI-DIRECTIONAL AMPLIFIER SYSTEM

GENERAL CONSIDERATIONS

The bi-directional amplifier subsystem shall consist of a bi-directional amplifier, ac power supply, backup power supply and electrical transient voltage surge suppression.

The bi-directional amplifier unit shall be an Automatic Gain Adjusting, or OLC (Output Level Control), type where the gain is automatically set over a wide operating range.

The bi-directional amplifier unit shall contain :

- A gain block (a wide band, linear amplitude amplifier).
- Frequency selective filters/cavities placed at the amplifier's input and output ports
- A special output level control (OLC) circuit.
- A power supply /regulator.

Either non-radiating (common) coaxial cables and/or radiating coaxial cable (leaky coax) can be used to route the RF signal between bi-directional amplifier and the in-building antennas.

Multiple bi-directional amplifiers may be connected in series to provide an acceptable radio signal level in multistory buildings, long tunnels or separated areas of communications.

Electric power for the bi-directional amplifier shall be supplied through a suitably sized Transient Voltage Surge Suppressor and a.c. power supply connected to the building electrical distribution system. Backup electrical power shall contain a battery system or Uninterruptible Power Supply sized to permit minimum four (4) hour run time. The backup electric power unit shall maintain the batteries at the manufacturer's recommended float level and shall also recharge the batteries should the charge be depleted. Alternatively, the backup power may be provided from an existing building UPS and/or generator system.

The bi-directional amplifier unit shall be enclosed in a cabinet with suitable access for servicing the unit. If installed in outdoor or unprotected locations the cabinet shall be weatherproof stainless steel meeting NEMA standards for weatherproof installations. The unit shall be installed in a secured environment to prevent tampering. This requirement may be met by the use of a lock on the cabinet (minimum) or by installing the unit within a secured room (preferred). Only authorized radio communications technicians are permitted to make adjustments to these systems.

The maximum output power of the amplifier shall be set below the amplifier's 1 dB compression point (+35 dBm) to prevent damage to the amplifier and minimize undesirable RF output signal components. This will result in a typical operational output of about +25 dBm for one or two channels input, depending on the specific unit used.

Since the amplifier's output level control (OLC) controls dynamic range, coaxial pads shall be inserted before the electronic attenuator. The addition of coaxial pads will restore the dynamic operating range of the bi-directional amplifier to make the output signal levels more consistent and the coverage more predictable.

The amount of relative attenuation is easily observed by measuring the DC voltage applied to the electronic attenuator control input. A chart of control voltages shall be provided by the manufacturer with the unit.

Decoupled RF test points shall be provided to permit performance testing or alignment while the bi-directional amplifier is in operation.

Since no frequency conversion occurs in a bi-directional amplifier, the RF output must not be close coupled to the RF input to prevent feedback saturation. A good rule of thumb is a minimum output-to-input path loss equal to the maximum operating gain of the amplifier plus 10 dB. For example, an amplifier with 55 dB overall maximum gain should have minimum of -65 dB output-to-input isolation.

IN-BUILDING ANTENNA SYSTEM

The in-building antenna system shall consist of a sufficient number of unity gain, omnidirectional antennas distributed within the building to meet the -80 dBm, or 10 dB above noise floor, design criteria at all locations within the building, coaxial cable splitters to divide the radio signal into appropriate branch circuits and coaxial cable to connect the antennas to the bi-directional amplifiers through the splitters.

The antennas can be mounted in the space above a drop ceiling or in a storage/equipment closet.

The coaxial cable shall be minimum of 1/2" LDF and shall be installed to meet the City Building Code.

Each splitter shall be mounted in a separate junction box located so as to be easily accessible for maintenance while maintaining security from unauthorized tampering.

RADIATORS

The amount of radiation and signals inside the area served by bi-directional amplifiers can be controlled by selecting appropriate coaxial cables (i.e. "leaky coax") or antennas as radiator elements. In some cases both may be used.

Radiating cable provides coverage that can be easily controlled and is especially applicable to tunnels, stairwells, passageways, etc.

Unity gain antennas shall be installed as needed to provide specified in-building coverage.

INSTALLATION INSTRUCTIONS

The bi-directional amplifier and backup electric power housing shall be wall mounted side by side. The equipment room must have access to the building halo or electrical ground system and shall be well ventilated with a maximum temperature of 80 degrees Fahrenheit. An electric circuit breaker panel with two, 117 VAC, 15 amp branch circuits shall be installed in the equipment room to service the bi-directional amplifier unit and backup power supply. All coaxial cable shall be installed in 2-inch conduit. A junction box shall be installed in the equipment room and every 2 floors below the equipment room with a box terminating in the lowest level of the building. The roof end of the conduit must extend 2 feet above the roof deck and be terminated with an electrical wire head.

SYSTEM OPTIMIZATION

Prior to the start of acceptance testing, the bi-directional amplifier shall be optimized to reduce the level of unwanted intermodulation and increase the level of desired signals. Fixed pads shall be used to set the bi-directional amplifier levels.

The bi-directional amplifier's OLC circuits provide consistent operation over a wide dynamic range, typically 30 to 40 dB, depending on the specific unit. When the input level to the bi-directional amplifier is excessive, the bi-directional amplifier no longer operates within its optimum range and undesirable continual limiting can occur. To minimize this, a suitable, fixed value coaxial RF attenuator "pad" shall be inserted at a point provided in the bi-directional amplifier's input circuit.

ACCEPTANCE TESTING PROCEDURE:

The Signal Booster System acceptance test shall be performed by the installing supplier to verify the system has been installed in accordance with these specifications, the system design drawings and meets the system performance criteria. This will include inspection, test and measurements of the D.C. power, the bi-directional amplifier gain, and the signal levels within and outside of the building. All test measurements shall be recorded and made a part of the Acceptance Test Document. A representative of the City shall witness these tests. The City's Technical Compliance Certificate shall be completed for each active amplifier in the system. Diagrams showing equipment placement and routing for antennas, coaxial cables and AC power shall be provided to the City and the developer/owner prior to acceptance testing. The building developer/owner shall receive two complete copies of the system documents. The City shall receive one complete copy of the documentation at the time of the acceptance test. An RF Compliance Certificate shall be provided to the developer/owner by the City's Telecommunications Management Section at the conclusion of the acceptance testing.

D.C. POWER

The power supply voltage shall be measured to ensure specified levels. The manufacturer will supply a bi-directional amplifier functional block diagram, which will show the D.C. check points.

The backup D.C. battery bank voltage level shall be measured to assure it meets the manufacturer's specifications.

BI-DIRECTIONAL AMPLIFIER GAIN

The bi-directional amplifier gain shall be measured by injecting a -60 dBm test signal at the bi-directional amplifier's lower, middle and upper limits of the operating bandwidth and measuring the level at the -50 dBm sample point using a communications service analyzer. The level at this test point shall be 50 dB lower than the unit's output signal level. The measured level shall be recorded in the acceptance test document.

SYSTEM SIGNAL LEVEL MEASUREMENTS

The system signal levels shall be measured throughout the building and in the area outside of the building using a high quality receiver. The RF signal level test point (i.e. RSSI) of the receiver shall have been recently calibrated prior to the start of testing.

The minimum measured signal level, at any test location, shall be -80 dBm, or 10 dB above the RF noise floor.

CITY OF FORT LAUDERDALE

TELECOMMUNICATIONS MANAGEMENT SECTION
100 NORTH ANDREWS AVENUE
FORT LAUDERDALE, FLORIDA 33301
(954) 828-5791

Technical Compliance Certificate

Site Information	
Building Owner	
Building Address	
Contact Name	
Phone Number	

Installing Company Information	
Installed By (company name)	
Phone Number	
Certified By (technician name)	
Date Certified	

System Equipment Information	
Manufacturer	
Model Number	
Serial Number	
Antenna Type	

Active Equipment Location	
Device Number	
Floor	
Room Number	
Describe Area	

INSTRUCTIONS: Print identification information in spaces supplied. Use one form for each active amplifier in the system. Attach a system drawing showing interconnection of installed components. Include location notes for antennas and all active devices. At completion of installation, contact the Fort Lauderdale Telecommunications Management Group at (954) 828-5791 to obtain loaner radios and frequencies for testing. Test for signal strengths as required in the 800 MHz Signal Booster System Specifications. Sign and date the certification statement below. Provide the original to the developer and a copy to the City's Telecommunications Management Section.

*** * * CERTIFICATION * * ***

I, _____, working for _____ certify the installation of the signal booster system identified on this certificate is installed and complies with the specifications provided and City Ordinance Chapter 47-59.2(a).

Signature Title Date