Signal Booster Codes and Ordinances

A practical discussion of local government codes requiring the use of signal boosters to enhance indoor communications for public safety agency wireless communications systems.

Preface:
Public safety wireless communications has evolved to wireless systems which are highly dependent upon handheld or 'handset' communications.

The use of handsets provide user mobility into any location an individual may go, such as in-buildings, basements tunnels and other places older mobile radio usage was not practical or possible.

Operation of wireless equipment requires a radio path between the handset and the rest of the communications system.

Radio signals are greatly reduced when passing through earthen barriers and dense construction materials making in-building and underground wireless communications unreliable or impossible without taking additional actions.

Radio signals may be re-distributed within obstructed areas by the use of special coaxial cables, fiber optics and indoor antennas> However these signals usually require amplification to overcome the losses of the distribution system to be effective.

The most common solution involves the use of special amplifier devices called 'signal boosters' by the Federal Communications Commission, who has federal jurisdiction of the use of such devices. Other terms such as 'Bi-Directional Amplifier' or 'BDA' are industry jargon for signal boosters, all meaning the same device.

The Implementation of signal boosters within larger properties, both public and privately owned, is becoming a commonplace solution.

The use of signal boosters is critical to the welfare of public safety personnel in the performance of their duties.

There are costs associated with the implementation of signal booster systems which most private building owners naturally resist, so local codes and ordinances have become the vehicle to provide a balance between public necessity and private interests.

This paper examines codes successfully implemented by many local governments and discusses the various components of these codes for the benefit of those authorities interested in developing their own codes.

Necessity of an In-Building Coverage code or ordinance:
Modern fire and police systems use portable radios as their primary communications device. That means ubiquitous coverage is expected wherever handheld radio may be carried; basements, high rise buildings, etc., places older vehicular mounted radios never went.

Reliable wireless communications is an absolute necessity today.
Radios are lifelines for first-responders.

The public expects first responders to provide their services no matter where the citizen may be; on public and private property alike.

Implementing in-building coverage codes is like requiring fire sprinkler systems. And like sprinkler systems many years ago, the adoption of in-building codes is rapidly evolving from a unique requirement to a standard practice.

Impact Upon Private Owners:
There is often considerable discussion of the negative impact such codes may have on the owners of existing and new structures.

The most extreme apprehension is such a code will drive building owners out of the area or put them out of business. However, there is no evidence of such a result occurring in any of the many jurisdictions that have these codes.

The relative costs of most signal booster implementations by private owners is usually negligible when calculated as a cost of doing business. Government officials and administrators should view these costs not as lump sums but as long term property improvements.

Building owner cost Example: Los Angeles area

The typical cost of implementing a signal booster system for a 150,000 square foot are of coverage is about $30,000. ***This is NOT an absolute rule!***

Costs will vary dependent mainly on specific variation of structure composition, floor plans, and radio channels required, but most typically within a range of $0.25 to $1.00 per square foot. *(BOMA calculates as much as $1.50 per square foot.)*

$0.50 per square foot , or $75,000, in this example .

According to the Daum Office Market Report for Los Angeles county, 1st Quarter 2007;

(http://www.gvadaum.com/research/mktreports/01-marketreview/01-LACOFF.pdf)

The average lease rate is $ 2.35 per sq. ft
The vacancy rate is 9.4% average.

Using the average value of $ 2.35, less 9.4% vacancy, we derive an average case monthly lease income of $2.13 per square foot, or $ 319,500 for a 150,000 square foot (usable office space) building.

The cost of a $75,000 signal booster installation is only 24% of ONE months rental income. Assuming at least a 5 year lifetime of the signal booster system, the cost per month is $1,250 or .4% of gross income.

Such low costs should not be a major concern to a building owner.

On the positive side, the installation of a such as system increases the value of the property, improves the properties attractiveness to potential tenants and may even lead to future insurance savings to the owner.

Retroactivity:
It is notable that the very first code, City of Burbank, is retroactive and will be discussed more later.

Most codes include major structure revisions as the same as new construction.

Retroactivity in new codes is highly recommended because;

a. They frequently present greater fire risk than newer structures. Not including these structures will leave first responders in jeopardy for many years.

b. Codes often include exemptions for smaller structures which inherently exempts many older structures.

Local Agency Structure funding.
Most codes also apply to public owned structures, especially fire codes, unless specifically exempted.

Funding to implement public safety communications within structures owned by the authority may include federal (i.e. DHS) grants as well as traditional tax based sources.

Existing Codes:

(Copies of many additional codes and ordinances may be downloaded from www.RFSolutions.com/fcc.htm.)

Some examples of codes that have been successfully enacted and enforced are attached and will be referring to the following discussion.

The oldest known ordinance was adopted by the City of Burbank in 1991, over 16 years ago. It was the only such code for many years but now there are many and hundreds more are in development.

Almost all in-building codes are derivatives of the Burbank code, so it is appropriate to examine its construction to understand the newer versions.

Construction of Codes

The Burbank code is the core essence of what codes need to include;
1. The purpose of the code.
2. What constitutes compliance to the code.
3. What remedies to achieve compliance are acceptable.
4 Applicable Federal Communications Commission rule compliance.
5. Methodology used to verify and maintain compliance.
6. Penalty for non-compliance
7. Exemptions

Additionally, some codes include;
8. Authority citations.
9. Additional equipment specification requirements.

Expanding upon these topics:

1. Purpose of the code is self-evident in most of the various codes. Typically it simply says the code is to insure adequate communications to local pubic safety agencies (fire and police) from within applicable structures.

2. What constitutes compliance to the code varies from minimal to onerous and lengthy technical details;

a. Frequency Bands:
The Burbank ordinance is somewhat technically ambiguous about the frequencies of interest but it has served their purposes well. Note they operate in the UHF frequency band. In-building systems operating in the UHF and VHF

frequency bands are generally harder to define due to lesser standardization of the individual channels approved by the Federal Communications Commission.

Most codes state two bands of frequencies, such as "806 to 824 and 851 to 869 MHz", one set being those frequencies to be received inside the structure (or the "downlink) and the other set those frequencies to be transmitted from inside the structure (or the 'uplink').

In amore recent draft for a state-wide code in Virginia, an element of compatibility to future frequency requirements is suggested; (VA Uniform Standard Building Code) "The frequency that must be supported shall be 850 to 824 MHz and 851 to 869 MHz and adaptable to other appropriate emergency frequencies (700 MHz or greater".

Some equipment providers may find enforcement of frequency "adaptability" burdensome or take exception, however the inability of a manufacturer to comply with the intent of this in a definite, definable manner, is a choice made by that manufacturer and characteristic of minimal, lowest cost consumer grade product designs. There is no technological constraint on compliance to this hardware requirement and this capability has been provided in many products for several years.

In this case, citing and enforcing 746 to 869 MHz frequency adaptability for future public safety frequency usage protects the in-building equipment owner's investment from obsolescence and such specifications are not exclusionary except to lower grade products.

It is important to understand for technical reasons the optimum specified frequency band is the smallest band that is used, an excessively wide band of frequencies will increase the probability of interference.

b. Interference Rejection:
In recent years many public safety systems have experienced interference from commercial users, such as Nextel, operating on nearby channels in the 800 MHz band. In addition to specifying the optimum frequency band, 'rejection' of adjacent frequencies may also be specified.

This is most notable in those codes addressing the use the 866 to 869 MHz band. This is a public safety only band (named "NPSPAC") lying between Nextel and cellular channels.

The latest NPSPAC signal booster specifications cite;
"The signal booster shall include filters to reject frequencies below 865 and frequencies above 870 MHz by a minimum of 35 dB."

It should be noted the FCC has mandated a 'retuning' of Nextel 800 MHz band frequencies to eliminate the current interference problem. That effort is nit expected to be completed for several years and shuld not be used as an excuse to defer public safety in-building communications systems. Since existing public safety equipment affected by this change mush also be 'retuned' to other channels, a code that includes a frequency flexibility protects all parties when the retuning becomes a reality.

c. Signal levels, percentage of coverage and reliability percentage.

These specifications are interrelated and impact upon the complexity and cost of a signal booster system. The ideal of 100% coverage and 100% reliability is not practical economically and almost impossible to achieve.

A good code will specify adequate signal levels and areas of coverage while not being excessively demanding.

It is appropriate to use minimum signal level values that are similar to what is acceptable for the outside coverage.

Most ordinances set RF signal levels near -95 dBm, which is sufficient to inherently approach 95% reliability, the two factors being related.

Signal levels used for other wireless devices such as WLAN, cellular and paging are different because their operation, frequencies and technologies are different and not directly applicable to public safety radio systems.

In a draft proposal for a State-wide Arizona ordinance, different signal levels are cited between analog and digital modulations. The intent appears to be an allowance for legacy VHF/UHF analog systems used smaller communities versus APCO P-25 800 MHz systems used in urban areas. We respectfully submit that the signal levels in urban areas should always anticipate the evolution to digital modulation and the code should state 'digital compatibility'.

Bayside Wisconsin code stipulates an RF level of -101 dBm for 95% of the area with a Delivered Audio Quality (DAQ) of 3. Likewise, in the Village of Schaumburg Illinois code, a " DAQ of 3 " standard is employed.

This is a universal standard often cited in Motorola system designs and to a lesser degree by other radio system providers. In this case, the DAQ is used instead of measured signal strengths, making the standard somewhat subjective.

Delivered Audio Quality Definitions

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.

DAQ based standards are subjective and subject to some interpretation.

Alternately, most system engineers recommend -95 or -100 dBm signal levels, 95% of the area and 95% reliability for as an proven, achievable and measurable balance of function versus cost. (Note. -95 dBm is a stronger signal than -100 dBm)

The code should also state the signal booster must be 100% compatible with analog or digital modulations after installation without additional adjustment or modification.

d) What remedies to achieve compliance are acceptable.
Typically a statement similar to this is used;

Buildings and structures which cannot support the required level of radio coverage shall be equipped with any of the following in order to achieve the required adequate radio coverage: a radiating cable system or an internal distributed antenna system (DAS) with or without signal boosters as needed.

e) Applicable Federal Communications Commission rule compliance.
(reference FCC Rules: 47 CFR Part 90.219)

A very important statement used in most codes is;
"AMPLIFICATION SYSTEMS ALLOWED"

The FCC rules restrict the right to operate signal boosters to duly authorized (FCC licensed) system owners, or others the licensee may give explicit permission to do so. This statement serves the legal purpose of authorizing others the use of signal boosters on the agencies frequencies to meet the code requirements.

Equally important is the mandatory use of "FCC certificated" equipment.
(In the past this was called 'FCC approved' or FCC accepted' and the terms were somewhat interchangeable. "FCC certificated" should be used in new codes.)

As the licensee, you are responsible for compliance to the FCC rules and those rules require you to use FCC certificated equipment. The agency will still be liable for FCC rule compliance even though they did not purchase or install the equipment.

There are some products illegally being advertised and sold without FCC certification. It does not matter if those sources promises to get certification later, legally certification must exist when the equipment is placed into operation.

It is important that to use legal and well designed equipment to avoid fines or orders to cease operations due to interference caused by unstable designs.

f). Methodology used to verify and maintain compliance.
This is an area of great differences between many ordinances.
Several methodologies are included in the attached examples.

This is also the area where some codes become onerous and difficult to comply with due to excessive quantities of measurements, overly restrictive measurement technique details and documentation.

The most universally accepted method is generally the 'grid' measurement approach because most agencies have the capability to perform the measurements and the tests can be accurately repeated to confirm corrective actions and archived for future reference.

For example:

" Acceptance Test Procedure
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 on each floor of the building is a minimum of 95%.

Each floor of the building shall be divided into a grid of approximately 20 equal areas. A maximum of 1 nonadjacent areas will be allowed to fail the test. In the event that two of the areas fail the test, in order to be more statistically accurate, the floor may be divided into 40 equal areas. A maximum of 2 nonadjacent areas will be allowed to fail the test. After the 40-area test, If the system continues to fail, it will be the building owner's responsibility to have the system altered to meet the 95% coverage requirement. The test shall be conducted using a agency approved calibrated portable talking through the agencies radio communications system as specified by the agency.

A spot located approximately in the center of a grid area will be selected for the test, then the radio will be keyed to verify 2-way communications to and from the outside of the building through the agency radio system. Once the spot has been selected, prospecting for a better spot within the grid area will not be permitted.

The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building owner 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. "

In any case, the performance tests should be performed in a manner the agency is comfortable with, even if that is simply a go-no go portable radio talk test.

g. Penalty for non-compliance.
In most cases the penalty is suspension of the Occupancy Permit to the structure until the code is met following a reasonable period after a citation of non-compliance.

A typical scenario for an existing structure is; the discrepancy is discovered during a routine fire inspection and a citation is issued. Then compliance is required by the next routine fire inspection. The interval may be a year so there is not normally any undue pressure on the building owner to take immediate action. However the building owner should be made aware that the in-building installation process may take 3 to 6 months from start to end.

Some codes, such as Grapevine Texas, include fines and or jail for continued non-compliance. We do not know if any such penalty has actually been imposed.

h). Exemptions
Most residential, (R1, etc) structures are exempted. Buildings less than three stories with less than 50,000 sq. ft. per floor are exempt UNLESS they include below grade basements, metal wall construction or contain hazardous materials.

IIMPORTANT: Elevator coverage is usually exempt since elevators are not in service during emergencies, fires and earthquakes. For the same reason, it is important to include radio coverage within stairwells, which are often inherently shielded from outside radio signals, within the scope of the code within the scope of the code.

i). Authority citations.
Most codes are advanced through routine authority channels, with recommendations, studies, hearings, etc.

The most cited adopted codes are ; NPFA, UFC, IFC, etc.

Two interesting application of uniform codes are;
- Boston linked their in-building codes to NFPA central alarm codes, even requiring an audible failure alarm as part of the signal booster. Now they find recent changes in the NFPA section they used requires the coaxial cables and equipment to meet a 4 hour survivability condition. This is not a problem except for existing equipment and cables that were not always installed in protected areas. In fact, a recent fire inside a high rise trash chute melted a nearby coaxial cable feeding their in-building system. This will not happen following the new standards.

- South Metro FD (Denver) cited sections of the UFC and IFC as the authority to enact their code;

" Section 101.3 of the Uniform Fire Code and Section 104.l of the 2000 International Fire Code authorizes the chief to make and enforce rules and supplemental regulations in order to carry out the application and intent of its provisions. Section 1001.9 of the Uniform Fire Code and Section 102.8 of the 2000 International Fire Code authorizes the chief to require additional safeguards consisting of special systems suitable for the protection of the hazard involved. Therefore, South Metro Fire Rescue requires that a public safety radio amplification system shall be installed within certain buildings and structures within the South Metro Fire Rescue district to provide for emergency communications to and from the emergency communication center. It is the responsibility of the emergency service provider to get the signal to and from the building."

Installation Standards
Recently agencies have found it necessary to add installation criteria to assure good installation practices are followed.

A new code should require compliance to all applicable sections of the NFPA, NEC, etc. that have been adopted by the agency. FCC rule compliance is also necessary.

Some codes require the design and installation personnel to posses an FCC General Radio Operators License (GROL) as well as documented factory certification of training on the equipment being used.

Codes may also require pre-approval of equipment and contractors by the agency. This is intended to prevent the use of inferior hardware and inexperienced personnel.

Accessibility
A new criteria is to include 24/7 accessibility to the in-building equipment without prior approval or the presence of a building representative. In the case of fire services, this code is probably already enacted.

Interference from other in-building systems
With the expanding use of in-building distribution systems for non-public safety radio services, especially in high rise structures, the probability of those systems interfering with public safety communications has increased dramatically.

It is possible for an in-building public safety system that was approved by the agency to become unusable when another system (such as cellular) is added to the structure.

It is recommended that all new codes include a statement similar to this:
In the event the public safety communications within a structure is diminished, interfered with or disrupted by other radio signals distributed by others operating within the structure, the building owner shall be responsible to have the non-public safety system disabled until such time the interaction with the public safety system is acceptable to the agency.

Additional equipment minimum specifications.
There are some additional hardware requirements that are frequently included in the 'acceptable equipment' specifications.

Most ordinances require 12 hours battery back-up power. Typical statement;
"If any part of the installed system or systems contains an electrically powered component, the system shall be capable of operating on an independent battery and/or generator system for a period of at least twelve (12) hours without external power input. The battery system shall automatically charge in the presence of an external power input. "

Most public safety agencies require the use of a water-tight case, typically NEMA-4, which is an industry standard specification for a sealed wall mounted cabinet. The reason for this requirement is the signal booster may be located in an equipment room that may become water soaked or sprayed with fire retardants during a fire. A closed cabinet also reduces tampering.

Those agencies using 800 MHz NPSPAC channels or other closely grouped channels often specify additional adjacent channel rejection ('notch') filters to reduce the negative impact from nearby Nextel and cellular signals. This is highly recommended.

Conclusion:
The use of local codes to assure radio communications for public safety agencies is a proven and acceptable methodology.

As evidenced by the many examples of successful existing codes, the construct of these codes follows common terminology and technology, reducing the necessity of expensive development of a totally new code and the attendant delays of such an effort. In most cases the agency's own communications department can provide the few technical specifics required.

Additional resources and copies of existing codes may be found at www.RFSolutions.com/fcc.htm.

To arrange for copies of this discussion in power point format or a live presentation, contact the author.

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City of Burbank

Section 7-616.1.
Public Safety UHF Radio Amplifications System.

(a) GENERAL

Except as otherwise provided, no person shall maintain, own , erect or construct any building or structure or any part thereof or cause the same to be done which fails to support adequate radio coverage for City emergency service workers, including but not limited to firefighters and police officers. For purposes of this section, adequate radio coverage shall include all of the following:

1) a minimum signal strength of one (1) microvolts available in 85% of the area of each floor of the building when transmitted from the City of Burbank Communications Systems;

2) a minimum signal strength of one (1) microvolts received at the City of Burbank Communications Systems when transmitted from 85% of the area of each floor of the building;

3) the frequency range which must be supported shall be 470.0 MHz to 473.5 MHz; and

4) a 90% reliability factor.

(b) TESTING PROCEDURES.

(1) Initial Tests.

Initial tests will be performed by City of Burbank employees. A Certificate of Occupancy shall not be issued to any structure if the building fails to comply with this section.

(2) Annual Tests.

Annual tests will be conducted by the City of Burbank Fire department in conjunction with inspection procedures.

(c) AMPLIFICATION SYSTEMS ALLOWED.

Buildings and structures which cannot support the required level of radio coverage shall be equipped with any of the following in order to achieve the required adequate radio coverage: a radiating cable system or an internal multiple antenna system with or without FCC type-accepted bi-directional UHF amplifiers as needed. If any part of the installed system or systems contains an electrically powered component, the system shall be capable of operating on an independent battery and/or generator system for a period of at least twelve (12) hours without external power input. The battery system shall automatically charge in the presence of an external power input.

(d) FIELD TESTING.

Police and Fire Personnel, after providing reasonable notice to the owner or his representative, shall have the right to enter onto the property to conduct field testing to be certain the required level of radio coverage is present.

(e) EXEMPTIONS.

This sections shall not apply to: buildings permitted in the R-1 and R-2 zones; any building constructed of wood frame; any building 30 feet high or less; as long as none of the aforementioned buildings make use of any metal construction or any underground storage or parking areas. For purposes of this section, parking structures are included in the definition of "all parts of a building" but elevators may be excluded.

[Added by Ord. No. 3265, eff. 9/21/91.]

STATE OF WISCONSIN

VILLAGE OF BAYSIDE
MILWAUKEE AND OZAUKEE COUNTIES
ORDINANCE NO. 2003- 515

An Ordinance to create Section 14-148 of the Municipal Code
Regarding Public Safety Radio Reception in Buildings and Structures.

The Village Board of the Village of Bayside , Milwaukee and Ozaukee Counties , Wisconsin do ordain as follows:

SECTION ONE: Section 14-148 Adequate Public Safety Radio Coverage in Buildings and Structures.

(a) GENERAL.
Except as otherwise provided, no person or organization shall maintain, own, erect or construct any building or structure which is used for commercial, multi-family, or institutional use or any part thereof or cause the same to be done which fails to support adequate radio coverage to public safety service workers, including but not limited to firefighters and police officers. For purposes of this section, adequate radio coverage shall include all of the following:

1) a minimum signal strength of -101 dBm available in 95% of the area of each floor of the building when transmitted from the Public Safety Radio Communications System; and
2) a minimum signal strength of -101 dBm received at the Public Safety Radio Communications System when transmitted from 95% of the area of each floor of the building, via portable radio with public safety microphone.
3) Channel Performance Criterion (CPC):
   CPC is the minimum performance level in a faded channel, per TSB-88, clause 4.2. TSB-88 is a "Telecommunications Systems Bulletin" published by the TIA, Telecommunications Industry Association.

   The performance level is rated using "Delivered Audio Quality". Industry standard DAQ definitions are shown in Table 1. DAQ level 3 is commonly specified as the minimum performance level for public safety systems.

Table 1 – Delivered Audio Quality Definitions

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.

4) The frequency range which must be supported shall be 866.000 to 869.000 MHz from the Trunked System Communications base stations, and 821 to 824 MHz to the Public Safety Radio Communications base stations.

(b) TESTING PROCEDURES.

(1) Initial Tests. Initial tests will be performed by public safety employees or their designees. A Certificate of Occupancy shall not be issued to any structure if the building fails to comply with this section.

(2) Annual Tests. Annual tests will be conducted by the Fire or Police Department in conjunction with inspection procedures.

(c) AMPLIFICATION SYSTEMS ALLOWED.

Buildings and structures which cannot independently support the required level of radio coverage shall be equipped with any of the following in order to achieve the required adequate radio coverage: a radiating cable system or an internal multiple antenna system with or without FCC type-accepted signal booster amplifiers as needed. If any part of the installed system or systems contains an electrically powered component, the system shall be capable of operating on an independent battery and/or generator system for a period of at least twelve (12) hours without external power input. Any battery system employed shall automatically recharge in the presence of an external power input.

The installation of equipment as indicated above can not be detrimental to the operation of the Public Safety Radio System.

In the event that a signal booster is employed it shall be fully encased within a dust and water resistant case.

(d) FIELD TESTING.
Police and Fire Personnel, after providing reasonable notice to the owner or his representative, shall have the right to enter onto the property to conduct field testing to be certain the required level of radio coverage is present.
(e) EXEMPTIONS.
This sections shall not apply to single-family and two-family dwellings not put to commercial or institutional use. For purposes of this section, basements, parking structures and stairwells are included in the definition of "all parts of a building" but elevators may be excluded.

SECTION TWO: This ordinance shall take effect and be in force from and after its passage and publication.

PASSED AND ADOPTED by the Village Board of Trustees of the Village of Bayside this 3rd day of April 2003.

Village of Schaumburg, Illinois

TITLE 9: GENERAL REGULATIONS

CHAPTER 108: PUBLIC SAFETY RADIO AMPLIFICATION SYSTEMS

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§ 108.01 RADIO COVERAGE.

Except as otherwise provided, no person shall erect, construct, maintain 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 village public safety services, including but not limited to police, fire, and public works departments. A certificate of occupancy may not be issued for any building or structure which fails to comply with this requirement.

The frequency range which must be supported shall be 806 to 816 MHz and 856 to 866 MHz, or as otherwise established and required in writing by the village as being necessary for public safety purposes.

For purposes of this ordinance, adequate radio coverage shall include the following:

(1) A minimum signal level of DAQ 3 (Delivered Audio Quality 3) available in 95% of the area as agreed to be in the coverage acceptance test plan by the village and the radio system manufacturer prior to system testing.

§ 108.02 AMPLIFICATION SYSTEM ALLOWED.
Buildings and structures shall be equipped with any of the following, in order to achieve adequate radio coverage:

(1) A radiating cable system or

(2) An internal multiple antenna system with FCC Type Accepted Bi-Directional UHF Amplifiers as needed to encompass the frequency range stated above or frequency range subsequently established by the village.

(3) A system that has been approved by the village as being capable of providing amplification to meet this ordinance requirements.

The system shall be capable of operating on an independent battery and/or generator system for a period of at least 12 hours without external power input. The battery system shall automatically charge in the presence of external power input. There shall be no connectivity between the amplification system and fire alarm system.

§ 108.03 OWNER RESPONSIBILITY.
It shall be the responsibility of any owner of a building or structure which currently holds a certificate of occupancy or allows the building or structure to be used for any purpose other than construction, to be in compliance with this chapter upon its effective date.

§ 108.04 INADEQUATE RADIO COVERAGE.
Any building or structure which fails to support adequate radio coverage must have a plan acceptable to the village police department within 90 days by the owner or his agent to address the inadequate radio coverage. Review of the plan may be extended by the director of police.

The owner of the building or structure shall have the approved plan enacted within one year after approval of the plan.

§ 108.05 ACCEPTANCE TEST PROCEDURES.
Acceptance testing for an in-building radio amplification system is required, upon completion of installation of the system. It is the building owner's responsibility to have the radio system tested to ensure that two-way coverage on each floor of the building is a minimum of DAQ 3.

Each floor of the building shall be divided into a grid of approximately forty equal areas. A maximum of two nonadjacent areas will be allowed to fail the test. In the event that three of the areas fail the test, in order to be more statistically accurate the floor may be divided into eighty equal areas. In such event, a maximum of four nonadjacent areas will be allowed to fail the test. After the eighty area tests, if the system continues to fail the building owner shall repair, replace, alter or upgrade the system altered to meet the DAQ 3 coverage requirement. Talk back testing from site to Village of Schaumburg Communications Center shall use a two watt portable transceiver with speaker/microphone and flexible antenna. A spot located approximately in the center of a grid area will be selected for the test, then the radio will be keyed to verify two-way communication to and from the outside of the building. Once the spot has been selected, use of another spot within the grid area will not be permitted. Field strength testing instruments are to be recently calibrated (within the past 12 months) and of the frequency selective type incorporating a flexible antenna similar to the ones used on the hand held transceivers.

The gain values of all amplifiers shall be measured and the results kept on file with the building owner 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.

§ 108.06 ANNUAL TESTS.
When an in-building radio system is installed, the building owner shall test all active components of the system including but not limited to amplifier, the power supplies, and back-up batteries, a minimum of once every 12 months. Amplifiers shall be tested to ensure that the gain is the same as it was upon initial installation and acceptance. Back-up batteries and power supplies shall be tested under load for a period of one hour to verify that they will operate during an actual power outage. All other active components shall be checked to determine that they are operating within the manufacturers specifications for the intended purpose.

§ 108.07 FIVE YEAR TEST.
In addition to the annual test, the building owner shall perform a radio coverage test a minimum of once every five years to ensure that the radio system continues to meet the requirements of the original acceptance. The procedure set forth above shall apply to such tests.

§ 108.08 QUALIFICATIONS OF TESTING PERSONNEL.
All tests shall be conducted, documented, and signed by a person in possession of a current FCC general radiotelephone operator license. All test records shall be retained at the inspected premises by the building owner and a copy submitted to the Village of Schaumburg within 30 days of when the test has been conducted. In the event the test shall fail to comply with the minimum requirements of the village, appropriate repairs shall be made and additional tests conducted until tests meet the minimum requirements of the village.

§ 108.09 INSPECTIONS.
Village personnel, after providing reasonable notice to the owner or his representative, shall have the right to enter onto the property to conduct field testing to be certain that the require level of radio coverage is present.

§ 108.10 PROPERTY OWNER MAINTENANCE RESPONSIBILITIES.
Upon completion of all the tests to the minimum standards of the village, the property owner shall be responsible for maintenance of the system. A maintenance contract shall be provided the village department of police with name of contractor, who will supply a 24-hour, 7-day emergency response within 2 hours after notification by either the village or the property owner. The maintenance contract shall also contain information as to contact personnel with phone numbers. Property owners shall also submit information to the village police department as to contact personnel with phone numbers for the property owner.

The property owner shall also be responsible for making any repairs, replacement or upgrades to the systems as directed by the village police department, should the system fail or no longer work in the future.

§ 108.11 EXEMPTIONS.
This section shall not apply to buildings less than 5,000 square feet or any single-family detached residential dwelling or a multifamily building or structure less than 5,000 square feet.

§ 108.12 FAILURE TO COMPLY.
Failure to comply with this ordinance shall be grounds for the Director of Building and Code Enforcement to revoke any previously issued Certificate of Occupancy for the building or structure. A written appeal may be taken to the Village Manager regarding the revocation of the Certificate of Occupancy within 30 days of the revocation.

(Ord. 02-179, passed 12-10-02)