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"Can You Hear Me Now?"

by Dean K. Wilson, P.E.

I am the lead fire alarm system technician at our very extensive multi-building public warehouse complex—over 2.5 million square feet of floor space with some buildings having basements and multiple floors. The property owner has assigned a particularly vexing problem to me to solve. In essence, we have found sufficient funds in these difficult economic times to begin construction of a new major multi-tenant warehouse. However, the building code official and fire inspector now say that we can begin the work, but they will not grant an occupancy permit unless we comply with the portion of the *International Fire Code*-2012, which states that the emergency responders must have radio coverage in all parts of not only our new building, but in our "existing buildings" as well.

Apparently, their Emergency Communications Center (ECC) can hear radio transmission from the emergency responders' hand-held two-way radios. But, when the emergency responders work in the basement of a building, they cannot hear ECC.

We have offered to install a radio repeater on the roof of our tallest building. But, the building code official and the fire inspector want us to place a repeater on top of each one of our buildings. This request apparently stems from expected problems from an anticipated relocation of their ECC to another town several miles distant from the current location.

We do not feel that such a relocation is our problem. However, it appears they intend to hold our building permit hostage until we do exactly what they ask.

We do not want to jeopardize the safety of anyone, let alone emergency responders. Now that we have sufficient funds to upgrade the medical office building in question, we will certainly spend a portion of those funds to meet these specific requirements of the *IFC*. However, we want to spend our money wisely.

We would appreciate your take on this matter.

You have become caught in the middle of a very important issue. As technology has become more and more important to fire ground operations, the ability of fire fighters to transmit and receive tactical information to each other and to the dispatch center has become increasingly important.

Actually, the building code official and fire inspector have made reference to the *International Fire Code*-2012, Section 510. Emergency Responder Radio Coverage. This section of the *IFC* reads as follows:

SECTION 510
EMERGENCY RESPONDER RADIO COVERAGE

510.1 Emergency responder radio coverage in new buildings. All new buildings shall have *approved* radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

Exceptions:

1. Where *approved* by the building official and the *fire code official,* a wired communication system in accordance with Section 907.2.13.2 shall be permitted to be installed or maintained in lieu of an approved radio coverage system.

2. Where it is determined by the *fire code official* that the radio coverage system is not needed.

3. In facilities where emergency responder radio cover age is required and such systems, components or equipment required could have a negative impact

on the normal operations of that facility, the *fire code official* shall have the authority to accept an automatically activated emergency responder radio coverage system.

510.2 Emergency responder radio coverage in existing buildings. Existing buildings shall be provided with approved radio coverage for emergency responders as required in Chapter 11.

510.3 Permit required. A construction permit for the installation of or modification to emergency responder radio cover age systems and related equipment is required as specified in Section 105.7.5. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.

510.4 Technical requirements. Systems, components, and equipment required to provide emergency responder radio coverage system shall comply with Sections 510.4.1 through 510.4.2.5.

510.4.1 Radio signal strength. The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95 percent of all areas on each floor of the building meet the signal strength requirements in Sections 5 10.4.1.1 and 510.4.1.2.

510.4.1.1 Minimum signal strength into the building. A minimum signal strength of -95 dBm shall be receivable within the building.

510.4.1.2 Minimum signal strength out of the building. A minimum signal strength of -95 dBm shall be received by the agency's radio system when transmit ted from within the building.

510.4.2 System design. The emergency responder radio coverage system shall be designed in accordance with Sections 510.4.2.1 through 510.4.2.5.

510.4.2.1 Amplification systems allowed. Buildings and structures which cannot support the required level of radio coverage shall be equipped with a radiating cable system, a distributed antenna system with Federal Communications Commission (FCC)-certified signal boosters, or other system approved by the fire code official in order to achieve the required adequate radio coverage.

510.4.2.2 Technical criteria. The fire code official shall maintain a document providing the specific technical information and requirements for the emergency responder radio coverage system. This document shall contain, but not be limited to, the various frequencies required, the location of radio sites, effective radiated power of radio sites, and other supporting technical information.

510.4.2.3 Secondary power. Emergency responder radio coverage systems shall be provided with an approved secondary source of power. The secondary power supply shall be capable of operating the emergency responder radio coverage system for a period of at least 24 hours. When primary power is lost, the power supply to the emergency responder radio cover age system shall automatically transfer to the secondary power supply.

510.4.2.4 Signal booster requirements. If used, signal boosters shall meet the following requirements:

1. All signal booster components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet.

2. Battery systems used for the emergency power source shall be contained in a NEMA 4-type waterproof cabinet.

3. The signal booster system and battery system shall be electrically supervised and monitored by a supervisory service, or when approved by the fire code official, shall sound an audible signal at a constantly attended location.

4. Equipment shall have FCC certification prior to installation.

510.4.2.5 Additional frequencies and change of frequencies. The emergency responder radio coverage system shall be capable of modification or expansion in the event frequency changes are required by the FCC or additional frequencies are made available by the FCC.

510.5 Installation requirements. The installation of the public safety radio coverage system shall be in accordance with Sections 510.5.1 through 510.5.5.

510.5.1 Approval prior to installation. Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC shall not be installed without prior coordination and approval of the fire code official

510.5.2 Minimum qualifications of personnel. The minimum qualifications of the system designer and lead installation personnel shall include:

1. A valid FCC-issued general radio operators license; and

2. Certification of in-building system training issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.

These qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the fire code official is provided.

510.5.3 Acceptance test procedure. When an emergency responder radio coverage system is required, and upon completion of installation, the building owner shall have the radio system tested to ensure that two-way coverage on each floor of the building is a minimum of 90 percent. The test procedure shall be conducted as follows:

1. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.

2. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system.

3. Failure of a maximum of two nonadjacent test areas shall not result in failure of the test.

4. In the event that three of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of a maximum of four nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 90 percent coverage requirement.

5. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.

6. 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 during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.

7. As part of the installation a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at time of installation and subsequent annual inspections.

510.5.4 FCC compliance. The emergency responder radio coverage system installation and components shall also comply with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219.

510.6 Maintenance. The emergency responder radio cover age system shall be maintained operational at all times in accordance with Sections 510.6.1 through 510.6.3.

510.6.1 Testing and proof of compliance. The emergency responder radio coverage system shall be inspected and tested annually or whenever structural changes occur including additions or remodels that could materially change the original field performance tests. Testing shall consist of the following:

1. In-building coverage test as described in Section 510.5.4.

2. Signal boosters shall be tested to ensure that the gain is the same as it was upon initial installation and acceptance.

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

4. All other active components shall be checked to verify operation within the manufacturer's specifications.

5. At the conclusion of the testing, a report, which shall verify compliance with Section 5 10.5.4, shall be submitted to the fire code official.

> **510.6.2 Additional frequencies.** The building *owner* shall modify or expand the emergency responder radio coverage system at their expense in the event frequency changes are required by the FCC or additional frequencies are made available by the FCC. Prior approval of a public safety radio coverage system on previous frequencies does not exempt this section.
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> **510.6.3 Field testing.** Agency personnel shall have the right to enter onto the property at any reasonable time to conduct field testing to verify the required level of radio coverage.

And, *International Fire Code*-2012, as stated in 510.2 above, has requirements, as well, for Existing Buildings:

> **1103.2 Emergency responder radio coverage in existing buildings.** Existing buildings that do not have *approved* radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building, shall be equipped with such coverage according to one of the following:
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> 1. Whenever an existing wired communication system cannot be repaired or is being replaced, or where not approved in accordance with Section 510.1, Exception 1.
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> 2. Within a time frame established by the adopting author ity.
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> **Exception:** Where it is determined by the *fire code official* that the radio coverage system is not needed.

This situation presents a complicated issue. As you can see by reading through the detailed requirements above, the *International Fire Code*-2012 has taken care to develop very explicit performance-based steps based on verifiable testing to assure that the owner of a property meets the intent of this portion of the IFC. It becomes imperative for a building owner to meet these requirements for both new buildings and for existing buildings.

In your particular case, you have a special burden that because of your responsibilities to maintain the fire alarm system throughout this large property the owner has extended those responsibilities to address this problem. However, to fulfill this charge, you must either meet the

specific requirements of 510.5.2 or you must hire some vendor that has personnel that can meet this requirement.

In studying your particular situation, it appears to me that the Authorities Having Jurisdiction (AHJs) have teamed up and chosen this particular occasion to leverage you to meet requirements for all of your buildings when you have only made application to build a single new building. That seems to have an inherent unfairness.

Your public warehouse complex needs to hire a two-way radio system engineering firm capable of providing a very carefully and cost-effective solution.

With regard to the *International Fire Code*-2012, and the action forced on you by the building code official and the fire inspection, please consider the following comments.

If you were to take this matter to court, the jurisdiction would have to prove that they are making this same requirement apply to all buildings within their jurisdiction. They cannot single out your public warehouse complex for this treatment. For example, they must make the meeting of the requirements contained in Section 510 of *IFC*-2012 a contingency for every building permit they issue. Failure to do so would mean that they have singled out your public warehouse complex. This is not permissible under law.

The jurisdiction does not have the authority to dictate ***how*** you meet this requirement. The IFC-2012 gives you three specific ways to provide radio coverage in 510.4.2.1. If the radio engineering firm you hire can prove that the installation of a single radio system repeater located at a central point on the campus will provide the required signal strength of 510.4.1.1 and 510.4.1.2 on all floors of all buildings (including basement levels), such an installation would meet the requirements of *IFC*-2012. It would prove ridiculous and excessively costly to require each building in your complex to have its own radio system repeater.

Your public warehouse complex has no responsibility whatsoever to take any action other than that required by the *IFC*. In other words, just because the jurisdiction is changing the location of its dispatch center, this action does not obligate your public warehouse complex to provide equipment to meet any other needs other than emergency responder communications for their emergency operations at the public warehouse buildings.

Just because the jurisdiction may perceive that it has leverage over your public warehouse complex to compel the owner to provide equipment that will solve some other problem the radio system of the jurisdiction may have, this does make such action either enforceable under law, nor reasonable under the common courtesy that the jurisdiction itself is compelled to provide to the public warehouse as a citizen of the jurisdiction.

You might consider these questions: Does the public warehouse complex pay taxes? Then the jurisdiction must understand that the public warehouse has become a "customer" of the jurisdiction and the jurisdiction must treat the public warehouse complex with the same degree of reasonable accommodation that any customer taxpayer should receive.

In summary, with regard to the specific requirements of Section 510 of the *International Fire Code*-2012:

1. Section 510, does insist that emergency responders have proper radio coverage throughout buildings within their jurisdiction.

2. Section 510.1 specifically exempts the jurisdiction from having to make improvements to their system to meet these requirements. Thus, any improvement falls to the property owner.

3. Section 510.1 also states that the radio coverage within the buildings must be based as follows: "…within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building." Thus, the jurisdiction cannot insist on radio coverage inside buildings that performs better than the performance of the radio system outside the buildings.

4. To insist on the application of these requirements as a condition to secure a building permit, the jurisdiction must make such insistence on all buildings within the jurisdiction that make application for a building permit. Selective enforcement of any universal requirement of the Building Code or Fire Code is not permitted under law.

5. Using the application for a building permit on one building to compel improvements in other buildings represents a very complicated issue under the law. In many cases the courts have ruled that such a practice exceeds the authority granted to jurisdictions. In other cases, particularly where the defendant jurisdiction has proven that failure to upgrade other buildings creates a distinct hazard to the occupants, the courts have sided with the jurisdictions. Nevertheless, it is a borderline practice that most reasonable jurisdictions tend to avoid.

6. The owner of the public warehouse complex gets to choose how the complex will meet the requirements of Section 510. A single two-way repeater located to provide the required signal strength in all buildings of the public warehouse offers an

acceptable means to meet this requirement. Although, as noted in *IFC*-2012, this choice must meet the approval of the jurisdiction, as specified in 510.3 and 510.5.1.

7. Meeting this requirement should be performance based as specified in the *IFC* and verified by the detailed testing requirements as stated in the *IFC*. That is, it should be determined by documented testing and field strength measurements performed by a radio-engineering company hired by the public warehouse complex. These tests should be witnessed by representative(s) of the jurisdiction.

I hope these comments will prove helpful to you in the public warehouse's quest to remain a good citizen of its community and to also be a good steward of the finances that sources have provided the public warehouse complex during these stressful economic times.

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