

This issue offers common sense about antenna site RF signage (*page 14*) from RF guru **Richard Strickland**. Richard has spent 14 years focused entirely on RF safety issues. His Long Island-based company, RF Safety Solutions, advises companies and government agencies on potential RF safety hazards and safe RF environments. He headed Narda's RF safety products group for 10 years, establishing parameters for RF safety products such as the award-winning (R&D 100) Nardalert XT RF personal monitor. Richard has a BA in physics from Bridgewater College and an MBA from the University of Massachusetts. He is a member of the IEEE International Committee on Electromagnetic Safety and the Association of Federal Communications Consulting Engineers.



More expertise comes from **Richard J. Reichler**, who gives us some insights into the complexities of site management (*page 20*). "Rich" is president of Los Angeles-area company RJR Wireless which, since 1998, has provided consulting and special-projects services to antenna site managers, owners and users. Previously, Rich was general manager of the Southern California Region of American Tower Systems (now known as American Tower). He served for 17 years as vice president of Meridian Communications, a Southern California antenna site and wireless communications operator which was later acquired by American. Rich is a Fellow and board member of the Radio Club of America. He holds a B.S. in Mathematics-Computer Science from UCLA.



Ways that "repurposed" spectrum may expand the universe of site tenants are explored by **Michael L. Higgs Jr.** (*page 34*). Founder of Washington-area Higgs Law Group, "Mike" worked in commercial telecommunications with RAM Mobile Data (now BellSouth Mobility) before entering the law. He has handled legal matters for carriers, broadcasters and SMR clients. In the tower sector, he has created site lease agreements, brokered the purchase and sale of towers, and advised on tower enforcement issues. Mike has a B.S., *summa cum laude*, from the University of Maryland and a law degree from the George Washington University School of Law. He is a member of the Federal Communications Bar Association and the Radio Club of America.



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RF Safety Signs— The Basics



Posting radiofrequency (RF) signage at antenna sites cannot be arbitrary. It requires logic and purposefulness. A leading RF safety consultant examines wrong—and right—approaches to the task.

by Richard Strickland



RF signs—what could be simpler? At first glance it *seems* simple—install a few signs around the site; everybody will be satisfied, and you can move on to doing something *really* important. Unfortunately, that appears to be the prevailing attitude at many broadcast and wireless sites.

The purpose of RF safety signs is to *communicate* useful information. If you install the wrong sign (or even the *correct* sign) in the wrong *location*, the *message* will be wrong.

In addition, if you install signs but do not *control access* in accordance with the information contained on the sign, you have inadvertently communicated something else—that the signs are meaningless.

Horrible examples

Here are some examples of poorly installed signage.

The photo at the left shows a small broadcast site where two television stations transmit from a 500-foot tower. The measured RF field level on the ground is less than one percent of the maximum permissible exposure (MPE) limit for “General Population/Uncontrolled” exposure. Yet there are *both* “CAUTION” and “WARNING” signs on the fence. When interviewed, site workers reported no restrictions concerning access to this area.

Another example, shown in the photo above right, is a large multiple-services antenna farm with television, FM radio and wireless service antennas on five towers. The RF field levels on the ground exceeded the public limits in several places. Dozens of “NOTICE,” “CAUTION,” and “WARNING” signs are scattered *randomly* all over the site. The locations

of the signs *bear no relationship* to the field levels. This picture is one of my favorite illustrations to use in RF safety classes. One of each sign type is mounted next to each other on a fence that surrounds a relatively small area around some electrical equipment. This area has insignificant RF field levels.



Compliance and safety goals

Why install RF safety signs? The purpose should be to:

- minimize the risk to all employees, contractors and visitors.
- comply with all FCC Regulations.
- comply with all OSHA Regulations.
- comply with all state and local regulations.
- minimize liability risk.

The idea is to serve these purposes at minimum cost. Costs include not only the installation cost of hardware, such as signs and barriers, but also the impact on productivity.

Understand the environment

You cannot properly install RF safety signs if you do not know what areas have significant RF field levels or you do not have a reasonable understanding of the magnitude of these field levels. How do you identify the RF field

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levels? There are three ways:

1. Measure them.
2. Analyze them using special software and/or using formulas and tables provided by the FCC. (The formulas and tables cover FM radio and television broadcast, but do not cover the multitude of wireless service antenna systems.)
3. Have somebody who knows about antenna systems and RF radiation patterns look at the site. Believe it or not, it is often possible to learn a great deal about the RF environment without making extensive measurements or calculations.

Cellular tower sites are a good example of a quick study. If the tower contains *only* wireless service antennas, and the bottom of the lowest antenna is at

What signs are available?

The signs that I recommend to customers follow the guidelines of the American National Standards Institute.



Each sign indicates a “signal word” with a corresponding color banner across the top of the sign: blue for “NOTICE” (left), yellow for “CAUTION,” orange for “WARNING” and red for

“DANGER.” Each signal word denotes a particular threat level. Each sign also has a safety symbol that signifies the type of hazard. The two main symbols that you

The three most common signs that I use relate to RF *field levels*. The message panel texts of these “NOTICE,” “CAUTION,” and “WARNING” signs all start with “Beyond this point: Radio frequency fields at this site...” with the remainder of each message declaring a different field level. It is important to know and understand the differences:

- “NOTICE” ...*may* exceed the FCC *general public* exposure limit.
- “CAUTION” ...*may* exceed FCC rules for *human* exposure.
- “WARNING” ...*exceed* FCC rules for *human* exposure.

The sign that I recommend most often is one that I refer to as a “tower caution” sign. The message panel on this sign states “On this tower: Radio frequency fields near some antennas may exceed FCC rules for human exposure” (right).



Other commonly used RF safety signs warn of the burn hazard from touching a hot AM tower or hot guy wires (*below, right*).



What do the signs mean?

The above-described “NOTICE” sign states that the field levels in areas beyond the sign *may* exceed the *public limits*, whereas the “CAUTION” sign states that the field levels *may* exceed the limits for *human exposure*. The limits for human exposure refer to the FCC’s MPE limits for “Occupational/Controlled” exposure. The “WARNING” sign states that the field levels do *exceed* the limits for human exposure.

Used correctly, “NOTICE” signs should identify all areas where the RF field levels may exceed the public limits, but are below the human or occupational limits.

FCC RF safety regulations

FCC Regulations provide for two sets of MPE limits, one for “Occupational/Controlled” (occupational) exposure and one for “General Population/Uncontrolled” (public) exposure. The MPE limits are frequency dependent, with the greatest restrictions occurring in the human resonance region from 30 MHz to 300 MHz in which humans absorb the most energy. The public limits are only one-fifth of the occupational limits for all frequencies above 3 MHz.

A common misconception is that the so-called “public” limits apply only to the “general public.” Nothing could be further from the truth! Although this area could be the subject of an entire article, the basics are that a *controlled* environment is an area covered by an *RF safety program*. As part of an RF safety program, qualified workers are allowed to enter controlled areas. Qualified workers, per the FCC Regulations, are *fully aware* and *able to exercise control*. Fully aware workers have received both written and verbal instruction in the area of RF safety and are able to exercise control over their exposure by using appropriate equipment such as RF personal monitors and RF protective garments.

So, all the various trades people who might visit a rooftop RF environment—HVAC, elevator repair, window washer, building maintenance (and even some electronics types)—cannot possibly be classified as fully aware and able to exercise control.

It is difficult to control an entire rooftop, but fairly simple to control a tower. This is important to realize because this will influence the types and locations of signs that you should use. RF exposure is also an issue for the Occupational Safety and Health Administration (OSHA), just as for any other risk. There is an expectation that a company will have a program in place to manage these hazards. This means that you need a *written* policy, and your workers must receive training.

least 20 feet above ground level (AGL), then the RF field levels on the ground will be *below* the FCC’s MPE limit for “General Population/Uncontrolled” exposure, even under worst-case conditions.

will see around RF sites are the RF *radiation hazard* symbol and the RF *burn hazard* symbol. The bottom part of each sign contains the “message panel,” which describes the nature of the hazard and how to avoid injury.

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Technically, only qualified workers should be allowed past this point, although this is a gray area. Many treat the “NOTICE” sign as a “pre-warning.”

A “CAUTION” sign is meant to identify an area that has RF field levels that generally exceed the *public limits*, with a few *isolated* hot spots that exceed the *human or occupational limits*. Only *qualified* workers—workers who are *fully aware* and able to *exercise control*—should be allowed to enter these areas.

Used correctly, a “WARNING” sign identifies areas where the RF field levels exceed the human or occupational limits. One should never enter such areas without shutting systems off and/or reducing power, and having equipment such as an RF personal monitor to verify that the field levels have been reduced below the human limits.

Recommendations

It is important to consider *other* factors beyond the FCC Regulations when installing RF safety signs. Factors such as liability and the desire to discourage trespassers may influence your decisions. Here are a few general guidelines: Don’t “over-sign” the area. Don’t put “CAUTION” signs around the perimeter of a wireless tower site that has insignificant RF field levels *on the ground*. When you consider liability and trespassers, in addition to the FCC’s rules, the best approach is to use “NOTICE” signs on the perimeter fence and a tower “CAUTION” sign at the *base* of the tower.

- Realize that you need to *heed* the signs. If you put up “WARNING” signs on a fence, even though there are insignificant RF field levels, and then let workers and visitors inside the area without additional precautions, you have, in effect, established that you do not have any RF safety procedures. If the RF field levels are truly above the human limits, then you must have *procedures* that *specify* what must happen before anyone is allowed into the area defined by the sign.
- Make it clear what “beyond this point” *means*. Countless sites have signs installed in a manner making it literally impossible to identify what area they

are referring to. In large, open areas, something as simple as a chain, with the sign hanging from the chain, clarifies what “beyond this point” means.

- AM sites require *two* types of signs. AM radio sites present two potential dangers and are a sore spot with FCC inspectors. AM sites should have *both* RF field level signs and “DANGER” signs that warn of the serious potential for RF burns should one

contact the tower or feed line.

Posting RF sites is not simply a “check off” task. When done properly and in tandem with appropriate site access control, proper posting will promote safety and reduce liability. agl

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