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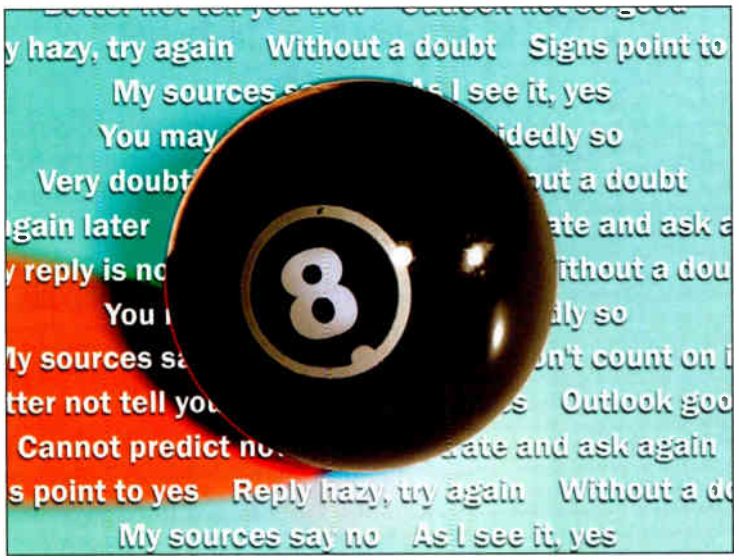

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on the cover

Portrait of a sucessful site. This self-supporting tower hosts five PCS and cellular carriers.

Photo by Thomas Gibson, Studio 1 www.studio1kc.com

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ON 05

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.

A Blithe Biby-blog

Normally, I try to make this column semi-coherent. I'm giving that up for this particular issue. My brain is shooting in many directions after the September PCIA conference and buzzing about new things we want to do with the magazine. Ever read a Web blog? A "blog" is a rambling posting someone posts on their Web site. This is going to be a printed blog.

Hurrah for Hollywood, FL

A great time was had by all at PCIA's WICE conference in Hollywood, FL. It was a serious crowd—the kind I like. I also managed to participate on a panel and not totally embarrass myself.

I had a great time in the mock zoning hearing playing the "RF engineer" (typecasting) in a "typical" zoning hearing. We played it pretty well, showing the audience what happens and why; what to avoid and what to cover; and what and when to get the RF "expert" to present. I answered hard questions for two hours from two sets of attorneys representing the "county" and the "carrier." I've done this 1,000 times, as have all the participating attorneys and the wonderful Liz Hill from American Tower, who graciously agreed to moderate (referee) the session.

Power and the people

I also had a great time at PCIA talking with a few people from power utilities: a nice lady from Everett, WA, and some folks from the Northeast. The utility folks are up against a unique set of problems, such as how to address mandates: the demands of *über* reliability expected of utility companies and commercial pressures from corporate wireless carriers seeking to locate facilities on their transmission poles.

In the August/September *AGL*, we ran an article discussing a difficult utility mounting situation Cingular Wireless encountered in California. I received a few calls about that article. One came from an old friend at Cingular, and a couple from others just interested in the subject. What are we going to do, as an industry, to develop a degree of commonality—standards—so communities and utilities know what it is that they are agreeing to, or even *discussing*, when they say "pole attachment"? This is an important topic for the wireless industry—and for the siting industry. Let's address it promptly.

Whassup with Vanu?

I love Vanu. Is that a religion? No. A new drink? No. Vanu is Vanu *Bose*—son of the "Bose" of audio systems fame. His company name is his name: "Vanu." This guy has taken software-defined radio (SDR) and turned the concept into *products*. What would it mean to our industry if a tower company could deploy a generic radio at the base of its towers and *then* thrash out a deal with a carrier to use the already-installed and ready-to-go base station portfolio. What if it could all be *dynamic*? Far fetched? Not to Vanu, and not to the rest of us, soon. This is a significant technological change for the industry. Imagine "My Major Tower Co, Inc." providing RF services in addition to the vertical real estate. This industry is going to be a lot bigger—*soon*.

Dept. of redundancy dept.

There is more cool stuff the industry could get into. How about shared power backup systems at tower sites? If only those pesky service providers would go for it. Some carriers (the big "V" comes to mind) turn their financial ability to purchase and maintain a completely

Continued on page 29

by Rich Biby, Publisher
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The Way to the Wireless Future

When Is a Site 'Hardened' Enough?

Hurricane Katrina: Concerns about the loss of life, the Gulf Coast residents left homeless and the disruption of livelihoods come foremost, along with the need to drain the floodwaters and rebuild the region's economy. In the face of these misfortunes, discussing wireless telecommunications seems almost trivial.

And yet, the interruption of public safety and commercial communications played a role in the immediate difficulties following the hurricane, and the restoration of wireless service has a part in recovery and reconstruction.

The first question we heard was, "How well did the towers survive?" For most people, "towers" means the *functionality of the system*. For many industry types, "towers" means the *steel*. With few exceptions, the steel survived. *Functionality* sometimes suffered because of power, backhaul and switching-center interruptions. Some equipment shelters flooded, damaging base station equipment, and some antennas were damaged. Sites were out of commission, but usually not because of "tower failure."

In the face of life and property lost in Hurricane Katrina's landfall on the Gulf Coast, followed by the less-lethal Hurricane Rita's second round of flooding, expectations for communications networks ran high—higher than they might have been before.

Here's a list published by Internet author Alexander Flynn, soon after Hurricane Katrina:

- Towers for wireless phones need to have their own automatic power supply that can last for 20 days.
- Towers for wireless phones must be able to route calls without depending on land lines.
- Towers need to be able to continue to work even when base and core electronics are submerged under water.
- Nationwide standards need to be developed indicating the conditions required for wireless phone towers to continue to work, even when surrounding infrastructure fails.
- Existing towers need to be inspected and reviewed to understand if they can continue to work during disasters.
- Cellphones need to have additional standards requiring them to be able to withstand being submerged in water and to be capable of working after being removed from water.
- Public awareness needs to be created about the relative integrity of the communications infrastructure and what will knock that infrastructure out.

That list is one opinion.

An industry group would be in a position to define best practices for tower sites intended to survive high wind, flooding, power loss and possible loss of functionality of the nearest switching center.

The word "hardening" has been used for improvements at cell sites to keep them operating during a disaster. State government, carrier and tower company officials discussed cell-site hardening at PCIA's Wireless Infrastructure Conference and Exposition in September in Hollywood, FL.

Speaking at PCIA (after Hurricane Katrina and before Hurricane Rita), Magnus Ojert, national vice president of Site Development and Logistics at Sprint Nextel, said that the company is spending millions of dollars on hardening cell sites and on redundant landline connections.

"Last year, the focus was on Florida. We wish we had done more in Mississippi and Louisiana. We're spending $100 million on hardening, mainly in the South, against these disasters," Ojert said.

Referring to Hurricane Katrina, Ojert said, "We sustained some damage, but cell sites that were hardened stayed on longer. The ones on generators ultimately ran out of gas, diesel or propane, so ultimately our network was affected. When a site goes down it affects messaging. We've done an unbelievable job. Employees packed up and lined up people from all over the country to help with Katrina. Some sites we can't get to because they are under water."

It's *not* 'Easy to be Hard'

Cell-site hardening can be limited by budgets, zoning restrictions, environmental regulation and neighborhood protests. For example, elevating equipment shelters above possible flood levels could protect cell-site electronics from rising water. Yet many jurisdictions want base station equipment placed *below* ground, or at ground level, with fences or landscaping to screen it from view.

Environmental regulations may not allow placing enough fuel on a site to sustain generator operation for lengthy periods, even if it were practical to store so much. Many carriers prefer using portable generators. They deploy them as needed, but when roads are blocked by water, trees or downed power lines, transporting generators or refueling them can be delayed or made impossible. Looting (or "borrowing") is also a factor.

"It's problematic that generators *are* portable because sometimes people take them if they need them," Robert Smith, national zoning compliance manager at Crown Castle International, said.

Tower owners and wireless carriers should implement the lessons learned from Hurricanes Katrina and Rita in their operational models, continuing as they did following the series of hurricanes that traversed Florida last year. Let us hear your suggestions, too. agl

by Don Bishop, Exec. Editor
dbishop@agl-mag.com

Healthy, vibrant—and *critical*

Bright financial metrics and public safety highight infrastructure's role.

by Jeremy Denton
PCIA Director of Industry Affairs

An annual conference typically affords participants the opportunity to ponder the immediate and the long-term future of the industry. September's PCIA Wireless Infrastructure Conference and Expo provided several opportunities to do that. The "Titans of Towers" keynote offered insights from the chief executives of the largest tower companies in the nation. The "Wireless Investors' Conference," a half-day seminar, featured industry CFOs and Wall Street analysts, and was hosted by PCIA's new chairman, SBA Communications President Jeffrey Stoops. The resounding opinion from these forums: The state of the industry is healthy and vibrant.

New Orleans, LA, communications specialists from across the country, and FEMA'S Mobile Emergency Response Support (MERS) install antennas on the roof of the 54-story Place St. Charles. *Photo by Bob McMilland, FEMA*

One impressive metric is that the market cap of the publicly traded tower companies has roughly doubled in the last year. The industry is tightly focused on serving the need of its customers. Customer needs are increasing as minutes of use of existing mobile services increase dramatically each year and additional mobile services continue to be introduced. On the costs side, operating expenses and the cost of debt have been reduced significantly. Consolidation among carriers has strengthened their ability to expand service offerings, too.

The trend for carriers to transfer the infrastructure part of their business to tower companies is likely to continue. As one example, Global Signal recently secured the exclusive right to lease or operate about 6,600 communications towers from Sprint for the next 32 years. The wireless carriers seem to be branding their robust *networks*, a—significant portion of which are managed by PCIA members—and emphasizing quality and reliability of service as keys to their efforts to expand market share.

Wireless voice and data traffic, driven by a consistently upward trend in wireless service subscribership, continues to grow as evidenced by increasing minutes of use and data application adoption by consumers. Meanwhile, the number of strong new tenants continues to grow, as 3G services are expanding beyond the top markets and even more advanced service offerings are being contemplated. Non-traditional tower tenants, such as mobile broadband providers, could quickly become additional customers, providing other revenue sources and expanding tower companies' client portfolios.

The critical nature of mobile communications infrastructure has been made crystal clear in the wake of Hurricanes Katrina and Rita. This may help local authorities better understand the role that infrastructure plays in assuring desperately needed services in their jurisdictions. If so, it could help them strike more appropriate balances in zoning and other regulations on sites, facilitating faster and more economical build-outs for the tower companies—and better service for the user public.

With strong capital markets and industry action, we will soon realize the vision of having wireless communications fully integrated into our culture. **agl**

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Want to Shake the Magic 8-Ball?

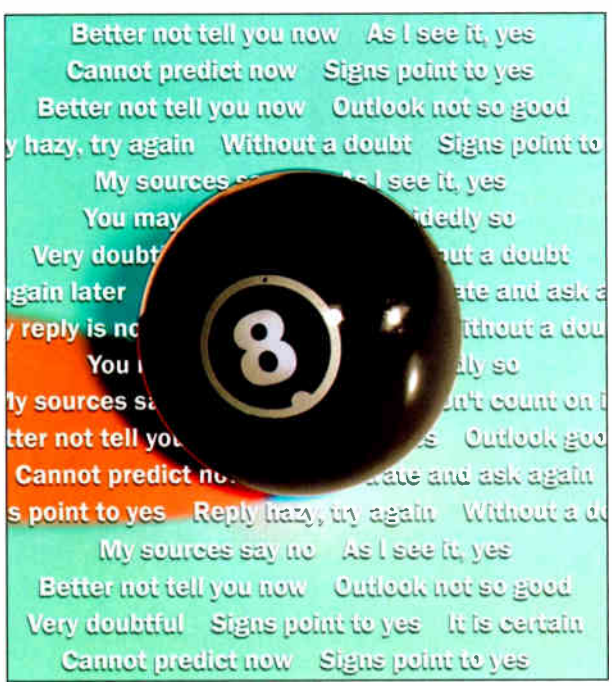
by R. Clayton Funk

We're going to take a brief break from the saga of our tower-developing idol, "Johnny Multiple," whose adventures we'll be detailing again in the next issue of *AGL*. This month's column, instead, is focused on what 2006 could look like for the tower industry.

As the calendar year 2005 winds down, many people wonder if next year will be similar, or if we will see some changes in the market.

To recap, the period from late 2004 through year-to-date 2005 has seen a dramatic rise in the tower cash-flow multiples being paid for tower assets. Carriers continue to build out their networks either by deploying new sites or by adding equipment to existing sites.

There is also access to capital, with favorable borrowing terms from lenders, that allows buyers to continue to acquire sites from sellers. The public stock prices for American Tower, Crown Castle, Global Signal and SBA have all risen, and wireless carriers have also seen a rise in their valuations as the nation continues to go "wireless" through more voice and data usage.



Occasionally, one can accurately determine what the future will hold by shaking a Magic 8-Ball, but there are more dependable trends to keep an eye on that will give you a sense of the future of the tower industry in the upcoming year.

Trend #1: Carrier spending

By several analysts' accounts, the large, nationwide wireless carriers are projected to add roughly as many sites in 2006 as they have done in 2005. What does this mean? Tower acquisition values are driven in part by new sites and additions to existing equipment.

If the forecasts are correct, then carrier spending—a key trend to watch—will remain consistent. That's a good sign for the tower industry.

Trend #2: Interest and capital

Somewhat intertwined, the ability to borrow lots of money at a low cost-of-borrowing has given some tower acquirers the ability to pay higher prices than they would if they had trouble raising money or if they had to pay higher interest rates. Keep an eye on interest rates and listen if rumblings signal that investors are losing confidence in the tower industry. A rise in rates and an inability to access capital would cause merger-and-acquisition (M&A) values to drop and activity to slow.

Trend #3: Carrier numbers

This is a classic chicken-and-egg scenario, meaning that for carriers to access capital to build out their networks and to offer a better product (i.e., "service"), they must continue to show growth in terms of number of subscribers ("subs") , revenue per user ("RPU"), and minutes of use ("MOU"). However, consumers *won't* increase their MOU if service is poor or unreliable, and that would undercut the RPU. The tower industry is driven by the financial health of the wireless carriers. Observe their fortunes, and you will get an insight into where the tower industry is going.

Trend #4 – Consumer trends

Analysts have also raised questions as to how large, macroeconomic developments and spending habits will affect the wireless industry (and thereby the tower industry). Will rising gasoline prices mean fewer people paying for newer cellphones or spending more money on expanded wireless services? Conversely, might some corporate telecommuting programs launched as a response to rising fuel prices have the opposite effect? Will the effect of the fall hurricanes be that dollars which carriers planned to spend in New England or the Pacific Northwest will now be diverted to re-establishing and improving service along the Gulf Coast? Will any sort of "pop" in a rumored real-estate bubble somehow affect consumer spending and reliance on wireless services? There are plenty of arguments on both sides of all these issues as to why—or why not—these events could affect the wireless and tower industries, but to ignore them entirely would be foolish.

The tower industry remains a fundamentally solid, fantastic business characterized by predictable recurring revenues, barriers to entry, a creditworthy customer base, short- and long-term foreseeable growth, and high profit margins with relatively low fixed and variable costs.

Let's hope all the trends continue in the right direction for 2006. agl

Funk is vice president of Media Venture Partners, San Francisco.

Handling Insurance Claims

by David Saul

Pictures and video of damage from the Gulf Coast hurricanes and the West Coast wildfires remind us how quickly accidents or disasters can deprive us of facilities and property. Even the best-run business can experience accidents, thefts or other losses. You can take these steps to ease a future claims process and to protect your business.

Have important information ready

Being prepared *before* you have a loss is an important step in the claim process. It can save a great deal of time, effort and stress in the event you need to make a claim.

- *Inspect and inventory your property.* Make a physical inventory of all your property, and take photos or videos to supplement written records, if possible. Being able to verify ownership of your property is key to any property claim. Inspect your property regularly to document its conditions, inside and out.
- *Keep insurance information handy.* Have your insurance policy number and claims contact information easily accessible. Keep one copy of this information at your business site, and one copy off-site.

In the event of a loss

Having specific procedures in place in case of an accident or other emergency will smooth the claims process. Here are some practical actions to take when such an incident occurs:

- *Provide medical help.* If there is a medical emergency, get immediate medical help for any injured person.
- *Collect information.* Obtain the contact information of anyone who witnessed the incident, and share it with the proper authorities. Show genuine concern, but *never* discuss liability or fault. That is the job of your insurance carrier.
- *Take a picture.* Pictures of possible defects or other property damage can sometimes make a big difference in adjusting a claim. Take a picture or make a video of the place where the incident occurred. Note possible contributing factors, such as weather (rain, wind, fog or lightning).
- *Protect the scene.* Secure the accident scene to prevent people from entering the area. Redirect people away from affected walkways or parking areas.
- *Prevent further damage.* Make sure no further damage can take place. For example, cover windows broken in a storm with plywood as soon as you can to prevent vandalism, rain damage and further loss of value of your property.
- *Secure defective equipment.* If a defective product or machine is involved in the claim, protect it so that it can be examined later. Make sure that no one can use it, remove it, tamper with it or alter it.
- *File the claim.* Call your insurance company or agent immediately to report the incident. Claims professionals are experienced in helping businesses recover from a loss. They can provide helpful advice about your loss and guide you through the claim-filing process.

No one expects to have an accident, but by being prepared—before and after the unexpected happens—you can help to protect your business and make your claim as easy and straightforward as it can be. agl

David Saul is vice president of Atlantic Risk Management Corp., Columbia, MD, and an accredited advisor in insurance. His email is *dsaul@atlanticrisk.com.*

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

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 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.

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.

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 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.

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.

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

Strickland is president of RF Safety Solutions LLC, South Setauket, NY. His email address is: *RStrick@RFSafetySolutions.com.*

AGL TOWER OF THE MONTH

OCTOBER-NOVEMBER

MANUFACTURER:
Rohn Products
Division of Radian
Communications Services, Inc.

TOWER TYPE:
SSV Self-Supporting

HEIGHT:
199 feet

APPLICATION:
Cellular

LOCATION:
Two Rivers, Wisconsin

Photo provided by WTRW, Two Rivers, WI.

Providing outstanding antenna site management

Talent, coupled with care, is the key to a smoothly run venture.

by Richard Reichler

Exemplary and cost-effective antenna-site management supports the best use of wireless telecommunications systems. Knowing key management responsibilities and techniques is not just necessary for those who, own, operate, manage (or *use*) antenna sites. Understanding and appreciating the site management *process* is also useful to those involved in other aspects of telecommunications, including regulation, legal affairs, hardware design and marketing—even accounting.

Good site management helps cellular, two-way and broadcast systems users enjoy high-quality communications at the lowest-possible competitive costs. Site managers handle many disciplines, from the technical to the mundane. These range from understanding radio propagation and intermodulation to supervising painting and pest control.

Site management covers everything from site development issues to operational details, and it requires a dose of economic pragmatism. As the site operator, or operator's representative, the site manager balances the amount to be invested at a given site against the revenue value of the anticipated uses.

Antenna sites are increasingly shared by many users. Multiple use of a site minimizes costs and diversifies revenue, but it opens the door to challenges. For example, RF interference is one of the most important issues that a site manager tackles. Managers address that challenge starting with the development of the site and continually thereafter as site's uses change.

Site management encompasses all activities and property associated with the tower and equipment. *Photo by Sabre Communications*

Planning and coordination

Development usually begins with the location and coverage needs of the anticipated users. The interference issue quickly comes to the forefront, along with choices about the type of structure to be constructed. *Height* is right up there in the top tier of decisions.

Extending the area being covered by the radio signals is not the sole reason a height is chosen. Increased height also plays a vital interference-prevention role. It allows more antennas to successfully share the limited resource of a given tower. *Vertical separation* of antennas is usually more effective than horizontal separation in reducing RF interference between the various radio systems sharing a structure. The site manager locates each antenna to ensure a viable balance between successful coverage and interference avoidance.

The process of developing a well-designed facility usually starts with trying to predict the types and number of users that might need or want to use the planned site (and what antennas they will deploy). Today, a larger number of antenna sites are designed and managed by independent owners for *collocation*—for the benefit of a variety of independent uses. The facility must be designed to serve for a long time, even as the users change.

Over the years, technology has caused remarkable changes, from propagation enabled by new antenna designs to changes in size and weight of equipment, so this adds complexity to long-term modeling. Physical reductions, coupled with technological improvements, allow more systems to share a facility, thus reducing the cost per system and increasing the number of possible revenue sources.

What tenants *want*

Operators of cellular, two-way radio, paging and broadcast systems want many things from site facilities. *[For a list of examples, see "Site Selection Guidelines" at the right.]* These requirements can be positively influenced by a site manager who, with a caring attitude, brings appropriate talent and understanding to the management process.

Users will rent or lease space at a facility where they can keep their costs low and meet their coverage and reliability requirements. When leasing, system operators want a facility that has low installation costs, low initial rent and an expectation of reasonably low future costs (rent, equipment maintenance and other fees).

Besides coverage and reliability, tenants want access and safety. Site managers need to provide, if possible, for all-weather, anytime entry. A strong, well-sized antenna-support structure will be planned with such items as a safe climbing ladder, an orderly cable ladder and an efficient grounding system. The shelter will need to be as weatherproof as possible and include good electrical distribution (including courtesy outlets), cable routing and lighting.

Managers see to it that facilities are equipped with standby power, electrical grounding, lightning protection, security, fire suppression, air conditioning, and remote site monitoring. Regulations will be followed and good managers consider local zoning matters, historic preservation concerns and, where applicable, tribal authority issues.

Radio systems operators also appreciate technical support from site managers. Tower charts with technical data (e.g., frequencies and effective radiated power) about each antenna on (or planned for) the tower help the selection of antenna positions to prevent any interference issues. Computer programs will be run to look for and eliminate any predicted intermodulation interference. Plot plans of the site will be provided. Information needed for, and assistance with, governmental licensing and permitting is provided, as is help with coverage prediction. The site manager's coordination with the users makes for a more successful operation.

Site Selection Guidelines

Considerations tenants look for when selecting an antenna site include:

- RF coverage area; RF interference protection and control.
- quality of facility and maintenance (tower, building, security, cleanliness, pest control, neatness, weatherproofing, fire suppression, lighting, electrical outlets and cable trays).
- quality of electrical distribution and grounding system, lightning protection and the availability of backup power (type and reliability).
- quality and reliability of air conditioning (filtering, cooling, heating and humidity control).
- regulatory compliance at facility (use permits, FAA rules for tower marking and lighting, and FCC rules and signage).
- technical and safety standards, and site manger enforcement.
- responsiveness, experience and qualifications of site manager; quality of information and services available from site manager.
- continuity and history of management by the site manager.
- quality of remote site monitoring (for power, temperature, intrusion and tower lighting).
- expectation that the facility will be continually upgraded and expanded, and will be available for future needs.
- site access in all weather conditions; hours of site access.
- terms and cost of lease/license for use of space.
- availability of utility services (electricity, POTS, T1).
- any special requirements, especially permits.
- future construction in the area that may affect coverage.
- availability of antenna systems to share.
- insurance coverage provided and required.
- availability of space to park service vehicles near the facility.
- availability of restroom and first-aid facilities.

Overseeing standards and practices

For the good of the facility and all its users, site managers set and enforce standards of installation and operation. These cover interference, hardware, labeling and other issues. Site management personnel inspect new installations and equipment removal.

Interference-reduction devices will be required, including isolators and cavity filters to achieve minimum isolation levels set by the standards. Well-shielded cable will be necessary, along with proper connections to the grounding system. The mounting hardware will usually need to be stainless-steel or hot-dip galvanized. Hardware standards will also cover safety, tower wind loading and system reliability. In high elevations, ice shields will be required for personnel safety and protection of the building. Proper radomes will be needed to reduce wind loading.

In addition to requirements of the FCC, site-specific equipment identification labeling is necessary. Cables are commonly labeled with a system of multi-color-coded tape at several points, including at the radio equipment, on both sides of the building access port and near the antenna.

Operational management

Keeping systems well maintained is a site manager's routine duty. This ensures low interference levels, site reliability, facility durability and regulatory compliance.

The site in general is inspected to prevent interference. Test gear is used to monitor frequencies and power levels in use, and to check for harmful degradation. Plot plans, tower charts and databases are kept up to date and routinely analyzed to keep facility performance at its peak as conditions change. Computer programs assist in reminding managers to perform certain scheduled or conditional procedures.

Various security systems are checked and evaluated. Fencing, doors, locks and alarms are checked and corrected. The list of individuals authorized to access the facility is reviewed and updated. Site managers periodically review access logs (and security video, if cameras are in place).

Towers are inspected to eliminate interference-causing situations and to check structural integrity. Unused antennas and cables are found and removed, or they are terminated to prevent interference. Tower members, bolts, guy wires, climbing ladders, cable-routing systems, antenna-mounting hardware and other components are inspected and corrected for rust, looseness and overloading. Painting and lighting are checked and corrected to ensure safety, compliance and durability.

The equipment of the users will be externally checked for degradation. The electrical power distribution system will be reviewed for operability and proper loading. The fire suppression system will be inspected. Also, routine light bulb replacement, cleaning, dusting, pest control and waste removal will be performed. To ensure good environmental control, the manager will inspect and correct door seals, cable-port entry holes and the air-conditioning system. These checks help keep the temperature and humidity in the desired range and reduce dust. The settings and capacity of the HVAC system will be reviewed as occupancy changes.

Standby power systems are essential to cover short- and long-term commercial electricity outages. Managers see to it that these systems are placed in dependable locations and that fuel levels are ample to provide power for the duration. Generators will be regularly exercised and tested under full load. Capacity will be increased as needed.

Ready for the future

A site is viable when the revenue from its use exceeds the development and operating costs over the useful life of the facility. The marketplace will determine what users will pay to get siting benefits, and it is up to the site developers and managers to keep costs low and within the means of the users.

Site tenants expect good ongoing site management and facility readiness. Good site managers keep up with state-of-the-art techniques and new regulations and forecast upcoming user needs (especially growth). They plan for and make needed facility upgrades to ensure that the facility will continue to function in optimal and cost-effective fashion. Good managers stay well educated and continually thinking about the needs of the site owners and users. Talent coupled with care is the key to great antenna site management. agl

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AM Collocation–A *Hot* Opportunity for Wireless Sites

New technologies dispel long-held reservations about broadcast and cellular cohabitation.

by Mike Britner

Collocation on radio broadcast towers benefits the wireless industry and broadcast tower owners. In many areas, cellular tower collocation opportunities are scarce. Many AM towers are in urban areas where cellular fill-in facilities are needed. The estimated 10,000 AM towers are an unexploited resource for wireless base station sites.

AM collocation usually requires minimal zoning activity. AM owners are often influential within their communities, which encourages accommodation of their requests.

Old prejudices

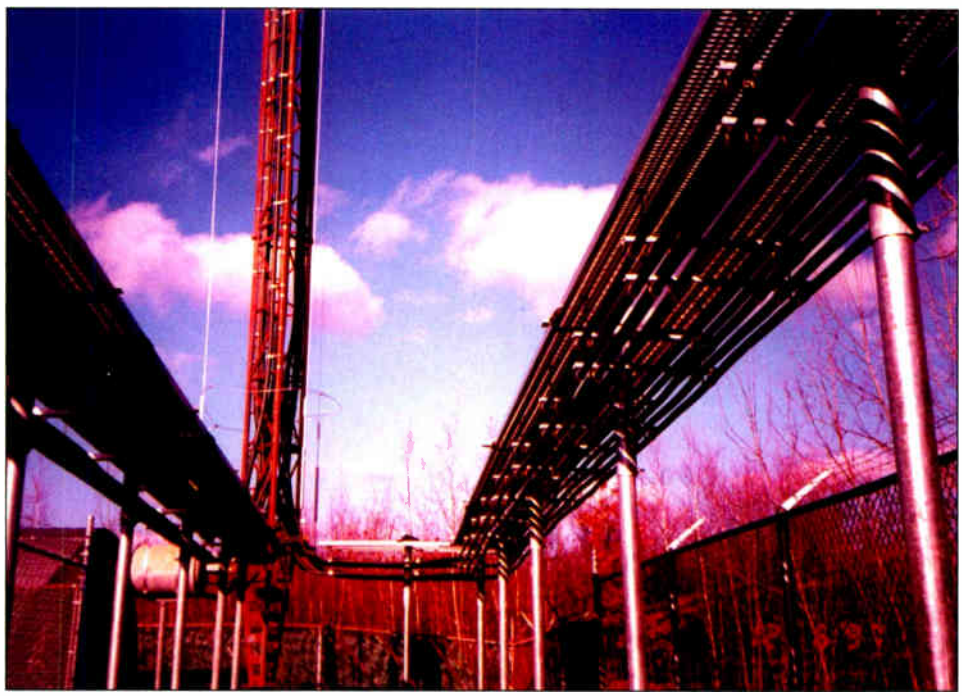
Many in the wireless industry have believed, "If there's a place to stay clear of, an AM radio tower is certainly it." This referred to attaching equipment and to interfering with broadcast patterns. Wireless carriers must prove to the FCC that they have considered and corrected such problems when constructing or modifying any tower within 3 km of an AM station. Substantial costs may be incurred to detune a wireless tower near an AM station.

In the past, AM towers also seemed unsuitable for antenna attachment to cellular, PCS and SMR carriers because of possible grounding difficulties and safety risks. In typical, standalone AM operations, the tower base is fenced to restrict access where high voltages may exist. Access is limited to trained broadcast engineers and technicians. When tower space is rented to wireless users, however, the base area must be accessed by a variety of workers who might not be aware of the dangerous voltages. Lessees must frequently climb the tower to inspect, install or adjust antennas.

Construction coordination between the vastly different AM and wireless cultures was frequently slow and painful. The engineering process of integration and demonstrating license compliance to the FCC often required tinkering, delays and costs unacceptable to wireless carriers.

AM station owners have also wanted assurances that the collocation methods proposed by wireless operators were reliable, proven and acceptable to the FCC, and that they would not harm their signal-coverage pattern. In the past, these outcomes could not be easily assured.

Achieving compatibility with the AM tower through electrical integration or isolation of wireless antennas is a challenge for engineers not familiar with both technologies. Many wireless system designers and constructors not conversant with lower-frequency technology have been unaware of techniques available to make wireless compatible with AM.



The AM collocation system at WCCM-AM in Boston handles dozens of antennas and cable runs for Cingular Wireless and T-Mobile.

New technologies

The solution to these problems is straightforward in most cases and can be readily implemented at reasonable cost, by using a qualified consultant and the latest hardware.

The CoLoCoil system isolates multiple wireless coaxial cables with a modular approach that also allows adding more wireless carriers to the system.

One technological approach to AM collocation is a turnkey service package incorporating site selection, pre-planning, engineering and hardware. Our approach, "CoLoSite," was developed through collaboration between two of our subsidiaries experienced in AM broadcast and wireless. This led us to create a package that enables collocation at directional and non-directional AM sites. This systems approach overcomes traditional obstacles to collocation and permits multiple wireless users on most AM towers. This is accomplished in part with a network of isolation features.

This approach makes collocation practical for single-tower and multiple-tower AM antenna systems. After an insulation system is installed, wireless antenna and coaxial cable installations have virtually no effect on the host AM tower(s), and the AM signal has no effect on the wireless antennas.

The hardware components are permanently integrated with the AM system and are designed for "utility-grade" life. Lifecycle monitoring, alarm and maintenance capabilities can be integrated into carrier platforms. Additional antennas and transmission lines can be added to the tower in the future without the use of additional isolation devices. This means the owner can lease additional space to other wireless carriers, limited only by the tower's structural capability and standard interference separation practices for the wireless systems. This type of collocation improves AM facilities at little or no cost and generates a new revenue stream.

Isolating the problems

For non-directional towers, we designed a cost-effective isolation system ("CoLoPole") for direct grounding of the AM tower. Wireless antenna and transmission lines are mounted and bonded directly onto the structure. The system uses a wire-cage impedance transformer. Lower portions of the cage are heavily insulated and spaced away from the tower to allow operational access to the wireless antenna system. The isolation system benefits the AM station with improved efficiency, "air sound" and lightning protection, enhancing the collocation experience.

Directional stations AM use multiple towers to form an FCC-licensed radiation pattern crucial to protecting other AM stations from interference.

This licensed pattern must not be disrupted by collocation. The cost-effective approach to this end is to use specially designed isolation systems between the base station equipment and the AM tower.

The collocation of wireless antennas on AM towers with base insulators frequently requires routing grounded cables across the tower base, which may be at an elevated RF voltage. To accomplish isolation, the cables are typically formed into, or inserted within, a coil which, with associated components, is mounted within a weather-protected cabinet near the tower base.

Previously, multiple cabinets of coils have been required to isolate the many cables. This makes it difficult to put the cabinets themselves at RF ground potential and to place them within the limited area close enough to the base. A jumble of cabinets also detracts from site aesthetics.

The system we designed for this purpose ("CoLoCoil") effectively prevents the wireless transmission lines from affecting the operating conditions of the directional AM towers. Isolation coils are assembled within an expandable modular architecture of compatible cellular cabinets, as shown in the photo on page 24. As future demand requires, cabinets can be stacked in a "wall" that is electrically and structurally unified.

To accomplish this, the cabinets are fabricated like a rectangular "tube" with endplate inserts. The coil, with input and output fittings, is slid in or out of the tube and positioned so that all output fittings are on the tower side, and all input fittings are on the side away from the tower. The four outer edges of each end of the tube are fabricated so that the attachment holes of each coincide with those of any other module.

The modular design accommodates an orderly future expansion of wireless user requirements with minimal effect on AM host facilities or the carrier's compound. The design of the conductive cabinet housings allows expansion as wireless systems are added, and non-conductive cable-support frames can slide within the housings.

For both the directional and non-directional AM collocation technologies, only coaxial cable is used for the cellular or PCS paths. No isocouplers or other devices with a failure potential are interposed within paths to the various antennas. Large-diameter dielectric "tube" sheathing is used to isolate cables, with seamless connections at wire junctures and exposed points so that no RF voltage-carrying conductor is exposed in the base area.

Site development

Planning for AM collocation begins with an analysis of the station facility. Although all AM stations may "theoretically" be used for wireless collocations, practical factors make some facilities economically or technically unattractive to develop.

AM operations can be complex, with different towers, or even different sites, being used for day or night

transmissions and at varying power levels. This may affect costs and operations. For example, selection of a tower used only at night could be a benefit to daytime wireless system construction and maintenance activities.

Normal site factors, such as access and construction convenience, must be evaluated. Structural suitability of the tower and any required augmentations must be considered with an eye on their possible effects on the AM system's operating conditions. Further, each AM tower has beneath it a radial grounding network of miles of copper wire. The FCC requires the network, and it is essential to proper AM operations. The superior lightning protection these grounding systems offer also benefits wireless installations. However, precautions should be taken to protect these systems to avoid disruption or the need for replacement.

Because AM towers operate "hot" at high RF voltages, proper selection of candidate towers is important for cost-effective and operations-supportable collocation. Significant safety and operational issues must be addressed when installing and maintaining wireless equipment near AM towers.

These RF concerns can be managed. For instance, it is not true that AM stations must always be "shut down" for installation and maintenance of collocated antenna equipment. Both the FCC and OSHA permit work on "hot" AM towers with proper power levels and precautions. Alternate operating modes and temporarily deployable AM towers are also available, should a break in service be needed.

The location of the wireless equipment shelter or pad must be chosen to minimize AM interactions, and appropriate shielding and filtering may be needed. Electromagnetic field-modeling techniques allow designers to specify exact locations and outfitting for equipment packages.

The AM collocation integrator should also be involved at the site-acquisition stage. Advance screening of all site candidates can reveal possible AM collocation candidates and avoid unneeded detuning situations.

Creative collocation

AM collocation is not only possible, it has already been successfully accomplished throughout the country for tower service providers and for wireless carriers such as Sprint Nextel, Cingular Wireless, Verizon and T-Mobile. With careful planning, competent project management and the use of quality hardware integrated into the overall site development process, success is certain. Professional interaction with the AM host makes the station a willing and positive partner in a long-term collocation relationship. agl

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If the Earth Were a Perfect Sphere...

by Harold Kinley

If the earth were a perfect sphere, calculating radio coverage would be much simpler. For omni-directional coverage, it would boil down to the use of a simple formula that would result in a perfect circle of coverage area. Assuming the earth *were* a perfect sphere, the surface would be perfectly smooth, as illustrated by the two arcs shown in Figure 1 below. The red arc depicts an arc of the earth where the *K* factor is 1.333. The blue arc depicts an arc with a *K* factor of 1.

The *K* factor is simply the radius of the earth compared to the normal earth's radius. For radio wave propagation, the earth's radius is considered to be 1.333 because radio waves bend around the earth. That is, radio wave line-of-sight (LOS) extends to a greater distance than optical LOS. The formula for optical LOS over smooth earth is determined by:

$$D = 1.23\sqrt{H}$$

where *D* is *distance* to horizon in miles and *H* is tower *height* in feet.

Suppose a lookout tower is 100 feet tall. How far would it be to the optical horizon over smooth earth? The answer is:

$$D = 1.23\sqrt{100} = 1.23(10) = 12.3 \text{ miles}$$

[See Figure 2a]

Two lookout towers, each 100 feet tall, would have optical LOS between them at a distance of twice that of a single tower to the horizon. Thus, the optical LOS between two lookout towers at 100 feet would be 2 x 12.3, or 24.6 miles.

The formula for calculating optical LOS between two towers is:

$$1.23(\sqrt{H_1}+\sqrt{H_2})$$

where H_1 is the height of the first tower and H_2 is the height of the second tower *[See Figure 2b]*.

Remember, though, that the *radio LOS* is based on a slightly different formula because radio waves tend to slightly bend around the earth's curvature. Because the earth's radius (for radio propagation) is assumed to be 1.333, or 4/3, the actual radius, the surface of the earth appears "flatter" to radio waves. The formula for radio LOS then becomes:

$$1.414\sqrt{H}$$

Or, for radio LOS between two towers, the formula becomes:

$$1.414(\sqrt{H_1}+\sqrt{H_2})$$

For the same two lookout towers, the radio LOS becomes 28.3 miles. This represents about a 15 percent increase over the optical LOS.

Now, if the earth were a perfect sphere, we could use a mathematical formula such as the one below to get a good estimate of radio coverage area. This formula is based on the modified Egli model and is described in Edward Singer's *Land Mobile Radio Systems* (2nd ed., Prentice Hall, Englewood Cliffs, NJ, 1994). A perfect circle would enclose the coverage area determined by this formula:

$$d = 10^x$$

where d = estimated range in miles.

$$x = \frac{P_T + A - 117 - S + 20\log H_T H_R - 20\log F}{40}$$

where P_T is transmitter power in dBW, $A = G_T + G_R - L_{TT} - L_{RT} - L_P - L_N$, G_T is transmitter antenna gain in dBd, G_R is receiver antenna gain in dBd, L_{TT} is transmitter cable loss in dB, L_{RT} is receiver cable loss in dB, L_P is reliability factor in dB, L_N is noise degradation factor in dB, S is mobile receiver sensitivity in dBW, H_T is transmitter antenna height in feet, H_R is mobile receiver antenna height in feet and F is frequency in megahertz.

The reliability degradation factors (L_P) are: VHF lowband = 11 dB, VHF highband = 14 dB, UHF (450 MHz) = 17 dB and 850 MHz = 19 dB.

The formula is a bit tedious to execute, so it requires meticulous care in using the calculator. Be especially observant of algebraic signs; otherwise, your results may be totally out of the ballpark.

Let's take an example and plug the variables into the equation. Transmitter power is 100 W, or 20 dBW; transmitter antenna gain is 6 dBd; receiver antenna gain is –1 dBd (this is true for a quarterwave roof-mounted mobile antenna); transmitter transmission line loss is 3 dB; receiver transmission line loss is 1.5 dB; reliability factor is 14 dB; noise degradation factor is 3 dB; receiver sensitivity is 0.3 µV, or –147 dBW; transmitter antenna height is 150 feet; receiver antenna height is six feet; and the operating

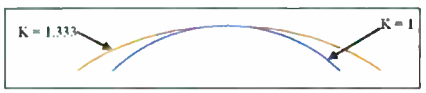

Figure 1. The blue arc illustrates the curvature of the earth at normal radius. The red arc indicates the curvature of the earth with a radius equal to 1.333 times the normal radius.

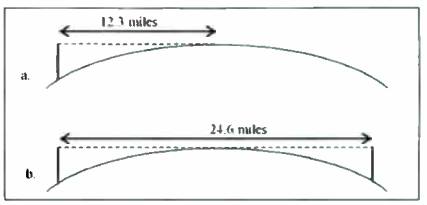

Figure 2. At (a), the distance between the100-foot lookout tower and the optical horizon is 12.3 miles. At (b), a second 100-foot lookout tower is added. The optical line-of-sight distance between these two towers is 24.6 miles.

frequency is 150 MHz.

Plugging these variables into the equation yields a range (*d*) of 16.85 miles. Playing with the variables is quite intuitive. For example, doubling the height of the transmitting tower would increase the range by

$$1.414, \text{ or } (\sqrt{2})$$

Thus, the range increases by the square root of the multiplication factor. Quadrupling the tower height doubles the range.

What about increasing the power? Doubling the tower height is equivalent to a 6d B increase in power. The power would have to be quadrupled to increase the range by 41 percent. The power would have to be increased by 12 dB to double the range. This amounts to increasing the transmitter power by a factor of 16. Thus, to double the range, the power must by increased by a factor of 16 or the transmitter tower height must be increased by a factor of 4.

Stated another way, to double the range requires an increase of 12 dB somewhere—or somehow—in the system. There are several ways to achieve this goal: raw transmitter power, transmitter antenna gain, receiver antenna gain, transmitter antenna height, receiver antenna height, transmitter line loss or receiver line loss (or any combination of the above).

If we double the transmitter antenna height, we get 6 dB. Doubling the transmitter power gives us three more decibels. Increasing the transmitter antenna gain to 9 dB gives us three more decibels. This combination yields 12 decibels and will effectively double the range. This illustrates how all the little decibels add up. Keeping system losses to a minimum will provide optimum range.

Remember, all of this *assumes* that the earth is a perfect sphere. Of course, it is not. Instead, it is composed of irregular terrain, and these irregularities must be taken into account when estimating or modeling radio range. This is why computer modeling software is so important in areas of severely irregular terrain. No simple mathematical formula can calculate range in highly irregular terrain. Such formulas only serve as general guides and ballpark calculations for range prediction and estimation.

This particular formula was developed for gently rolling hills, and the transmitter antenna height is *height above average terrain* (HAAT). So, for the customer's typical question, "How far can I talk?", there is no simple answer. The typical response and best answer might be: "Depends."

Until next time—*stay tuned!* agl

Kinley, a frequent author of radio telecommunications technical articles, is a certified electronics technician and the author of *Standard Radio Communications Manual, with Instrumentation and Testing Techniques.*

Continued from page 8

independent power backup system into a reliability marketing ploy: "Can you hear me now? Good ... I guess I still have diesel at *that* cell site."

What about the greater good? After the Katrina situation, and after some impressive, but less catastrophic, damage from Hurricane Rita (and tonight, as I type this, I'm *still* trying to call my sister in Houston on her cell phone), there are concerns that if the terrestrial network fails, the wireless network is only a few hours behind. What did they teach me about the old Erlang tables in college? If you only have x channels and y calls, and y is much, much greater than x, what happens? "Can you hear me now?" ... Absolutely not.

We, as an industry, are going to need to put a greater emphasis on reliability, and that will include redundancy, capacity and emergency logistics. Sure, when we cook the 99th-percentile reliability numbers, we may have four or five—even *six*—"nines" under best conditions, but can we even hope for a "five" in the first decimal place when the chips are down and the fan is spewing?

Show floor snapshots

Speaking of power systems, there was a major generator manufacturer at the PCIA show with some interesting new products. I went to their booth and asked three people for information and tried to strike up a conversation with them. All three, when they saw my "press" badge, abruptly stopped the conversation and walked away. Wow. I was dumbfounded. They spent a lot of money to go to a trade show. You would think they would like to discuss and publicize their products. No? I hope their customer service is better.

Another friend was walking around PCIA with a picture on his phone that just made me laugh to the point of silliness: A cow had stuck its head through a small lattice tower and was stuck. It could not get out. It did not look happy. Who do you *call* in a case like that? Several people told me they have a photo like that in their collection, somewhere. When we have extra space in future issues, we'll try to sneak in one of those crazy cow-in-a-tower photos. Go find your favorite and send it to us.

Futurama

That leads me into some of the topics for the next issue, and *that* leads us directly into next year. We are including an extra "forward-looking" section in the December *AGL*. Our regular contributors will discuss hot issues for 2006 in their areas of expertise and we'll include articles on issues that will be important to the industry in the near future.

We're having so much fun, and there are enough exciting topics to cover, that we are also going to expand *AGL* to eight issues in 2006.

Please drop me a note with any topics you would like to see us cover. And thanks for all of the supportive comments we've received from so many readers—it *is* great to hear. The virtual door is always open (and the old PCM channel works, too). agl

Former carrier exec, current towerco execs keynote PCIA convention

PCIA drew more than 1,300 participants to its Wireless Infrastructure Conference and Expo in Hollywood, FL, Sept. 13–15, 2005.

"We had a record turnout, and the feedback from participants of the educational sessions, speakers and exhibits was enthusiastic," said Mike Fitch, PCIA's president and CEO.

Message Center Management sponsored the "Carrier Keynote," a speech by Morgan O'Brien, co-founder and most recently vice chairman of Nextel Communications prior to its merger with Sprint. O'Brien said public-safety communications requires redundancy, ubiquity and interoperability. He said the condition of U.S. public-safety first-responder communications is "a total disgrace by any standard."

O'Brien said the solution is not "a monstrous check-writing by the federal government to procure a single system that, when installed, has started to become obsolete." He said that, although he hasn't worked out the recipe for success, he has identified some ingredients:

- 700 MHz spectrum.
- an influx of entrepreneurs.
- software-defined radio.
- smart antennas.
- mobile satellite communications.

"Where it would end up, as a single nationwide network, I can't imagine that's the way it would start. It would start with the nasty, pushy process of many entrepreneurs and their hopes of dreams of riches building like crazy and making mistakes and public safety getting to ride on that investment," O'Brien said.

SiteMaster sponsored the "Titans of Towers" Keynote. Fitch introduced the heads of five large tower companies and led the discussion.

Jeffrey Stoops, president and CEO of SBA Communications, said, "This is one of the most entrepreneurial industries I've ever seen. People can build pockets of excellent towers where large companies can't. They have local contacts. They'll move those assets and build more."

He predicted continuing consolidation in the industry because "The large

consolidators have more efficiency and lower cost of capital, so towers in their hands are worth more. The number of assets grows every day. New towers are being built. We're building some for ourselves and for our customers. You'll see large and small deals all the time. It's an increasing asset base, and there are good financial reasons for that change."

Each of the company leaders spoke of decreased leverage, refinancing at better interest rates and overall improved balance sheets. For example, John Kelly, president and CEO of Crown Castle International, said, "The industry has grown, and we grew along with it. We did what was prudent: We delivered a balance sheet. We had a goal set to refinance the company with investment grade debt and, led by CFO Ben Moreland and Treasurer Jay Brown, we completed the securitization, paying off high interest rate debt and substituting with sub-5 percent debt."

Jerald Kent, CEO of AAT Communications, compared the tower industry with other telecom businesses in saying, "With radio broadcasting showing low growth, cable TV facing capital expenditures and competition among telephone companies, there is no other telecom business with double-digit growth prospects and the free cash flow generation."

James Taiclet, chairman, president and CEO of American Tower, said, "The investor base is more confident and comfortable that the tower model works as advertised. Companies saw great performance over the past couple of years. This lower cost of access to capital should continue. We have ratings upgrades to support debt and new kinds of instruments."

David J. Grain, president of Global Signal, said, "We have a simple way of looking at [the tower business]. It's a real estate business. In that business you care about assets and how you keep those assets fully leased. A large percentage of our tenants were narrowband and were not in good shape. We changed that for the positive. Also the financing structure. We reduced leverage in the industry as a positive thing."

Only one of the five companies is privately held: AAT. Kent said he comments more freely than his counterparts at the public companies. Asked about what may give him pause about prospects for continued growth and success, Kent said, "From a technology perspective, we see nothing on the horizon to affect us. A few things, I worry about. First, that someone will do something irrational, such as overreaching for a major acquisition or investing money in ancillary businesses with a big risk—that can affect capital markets, if someone forgets what happened in 2002 with balance sheets.

"Some said there's a bubble waiting to burst because you [tower companies] have one client [wireless carriers] and revenue stream. I disagree. I view the risk of getting into business you don't know because of the free cash flow. I worry about the capital markets and interest rates, with the federal budget deficit, the Iraq War, Hurricane Katrina recovery and the extension of income tax cut," Kent said.

The AAT executive also said he is concerned about steps taken by local and state authorities to increase taxes on towers.

All of the "Titans of Towers" keynote participants were named at the convention as continuing members of PCIA's board of directors. Additional directors are Thomas "Tam" Murray, founder and managing member of Community Wireless Structures; and David Weisman, president and CEO of Mountain Union Telecom. Stoops was elected as PCIA chairman, succeeding Kelly, who served in the post for three years. Taiclet was elected secretary and vice chairman, and Weisman was elected treasurer.

PCIA has scheduled its next convention for Sept. 19–21, 2006, at the Gaylord Opyrland Resort & Convention Center in Nashville, TN. agl

News releases and photos may be sent to the *AGL* editorial office, P.O. Box 1578, Liberty, MO 64069-1578, or emailed to the editors at *departments@agl-mag.com.*

Universal photo-electric control

The PEC 8014 photo-electric tower lighting control from **Skytec** adapts to most lighting applications and features dual contacts for separate "twi-nite" operations. Factory-calibrated for proper twi-nite switching, the control also has field-adjustable settings. The control is designed with a universal meter socket for four-pin, plug-in mounting. A sun-and-heat shield is incorporated into the unit for environmental durability. The control unit is field-programmable for 64 different tower lighting control combinations.

www.skytecinc.com

Clamp-style connector

An improved EZ-600-NMC-2 (3190-1387) no-solder EZ 2-piece clamp-style connector for LMR-600 coaxial cable is now available from **Times Microwave Systems.** The new connector features a combination hex/knurl coupling nut that allows tightening by hand or with a wrench. The connector assembles with two 15/16" wrenches and is compatible with the standard Times ST-600C prep tool. Designed for low VSWR at high frequencies, the connector can be used for spread spectrum and ISM band applications as high as 5.8 GHz.

www.timesmicrowave.com

Covered-population prediction software

SoftWright has added a new feature to its Terrain Analysis Package (TAP) software for making radio-coverage predictions. The software allows access to several thousand antenna patterns in the TAP antenna pattern library or patterns that the user has imported from antenna manufacturers. The new TAP feature also provides the ability to calculate the population receiving a certain level of field strength. Using the ShapeFiles provided with the original TAP software, a user can calculate the population comparisons between coverage maps. SoftWright has data files from the 2000 census which are available to update previous ShapeFile databases

www.softwright.com

Cellular infrastructure study

IMS Research has released its 6th edition study investigating the cellular infrastructure market. The report includes detailed forecasts of the worldwide installed base and infrastructure market by region. The study also discusses the impact of WiMax on the overall cellular installed base and infrastructure market and outlines cellular infrastructure vendors' market shares by technology.

www.imsresearch.com

Wall-mount air conditioner

The "S" series wall-mounted air conditioner for telecommunications shelters from **Bard Manufacturing** features a multi-step capacity compressor with green refrigerant R410A. Available in 3- to 5-ton models, the S series features EER ratings as high as 11.7 and integrated part-load value efficiency as high as 15.2 BTU/W. The unit includes an ECM indoor blower motor, dual pressure controls, a compressor control module and a step-capacity scroll compressor. Ventilation packages range from Economizer models to an Energy Recovery Ventilator that allows 450 CFM of fresh air to provide the flexibility for a variety of engineered specifications.

www.bardhvac.com

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Love, the Secondary Time Around

by Michael Higgs, Esq.

Recent mergers and consolidations in the broadband carrier sector have left many tower owners and executives scratching their heads. How do you make up for these lost revenues when fewer companies are competing for space? While the tower industry has not exactly "felt the love" from the FCC lately, it does stand to gain, as an unintended beneficiary, from recent Commission decisions regarding secondary markets. This may be just the ticket to filling up that empty tower space.

The *Secondary Markets Order*

The FCC's Secondary Markets initiative was developed to foster greater spectrum flexibility and efficiency, especially in secondary and rural markets. The FCC's historical rules regarding spectrum ownership, and decisions such as *Intermountain Microwave,* severely curtailed the ability to operate on, or lease, another licensee's spectrum. Licensees of exclusive spectrum can now lease its use to third parties, thus eliminating a barrier to market entry and greatly expanding the pool of potential tower lessees.

The FCC has gone out of its way to encourage such behavior. The regulations allow for both the protection of the licensee's property rights and security for the lessee that expends resources to build out on someone else's license. Applications for spectrum leases are handled on an expedited basis, thereby allowing businesses to take advantage of marketplace demands quicker.

Who will use the *Order*?

The advent of wide-area licensing resulted in carriers purchasing the rights to use spectrum over extensive territories—just to provide service in the few cities they really wanted (and the corridors connecting them). The FCC hopes to encourage auction licensees, which would otherwise not build out systems in areas less profitable than the large cities, to lease those unserved areas to other companies that can find a profitable use in their business plans.

Overly optimistic business models have also led some licensees to bite off more spectrum than they could chew. These licensees may now make use of that fallow spectrum by leasing it to third parties, thus maintaining the license as an asset and providing another stream of revenue. The public receives more service offerings, and new business opportunities are available to entrepreneurs of all stripes.

It used to be that a great idea to deploy a new wireless service was followed by years of effort and resources to procure spectrum. Now, if you have a concept and the hardware, available spectrum may just be the least of your worries.

Towers and time shares

Don't think you are left out just because you do not own any towers in the so-called "secondary markets." These new regulations also allow for an innovation that is sure to land more hardware on towers located in the top markets as well. Spectrum has heretofore been divided among users on the basis of frequency and geography.

By its *Further Report and Order,* the FCC now permits the dividing of spectrum by another dimension: *time.* Soon, two or more operators will provide communications services over the same channels at the same location.

Users can divvy up spectrum between day and night uses, or even on a millisecond basis. The latter approach uses what the Commission refers to as "opportunistic devices." Virtual collocation on the same channel, along with software-defined radio and cognitive radio, are excellent examples of the spectrum flexibility touted by the FCC, and the *Secondary Markets Orders* help bring them all closer to becoming a reality.

Spectrum leasing is still in its infancy. As the concept receives greater publicity, and the law governing it becomes more settled, we predict a dramatic increase in demand for tower space in the coming years due to the *Secondary Markets Orders.*

Thanks for showing the (unintended) love, FCC. **agl**

Higgs is a principal of Higgs Law Group, Rockville, MD. His email address is *mhiggs@higgslawgroup.com.*

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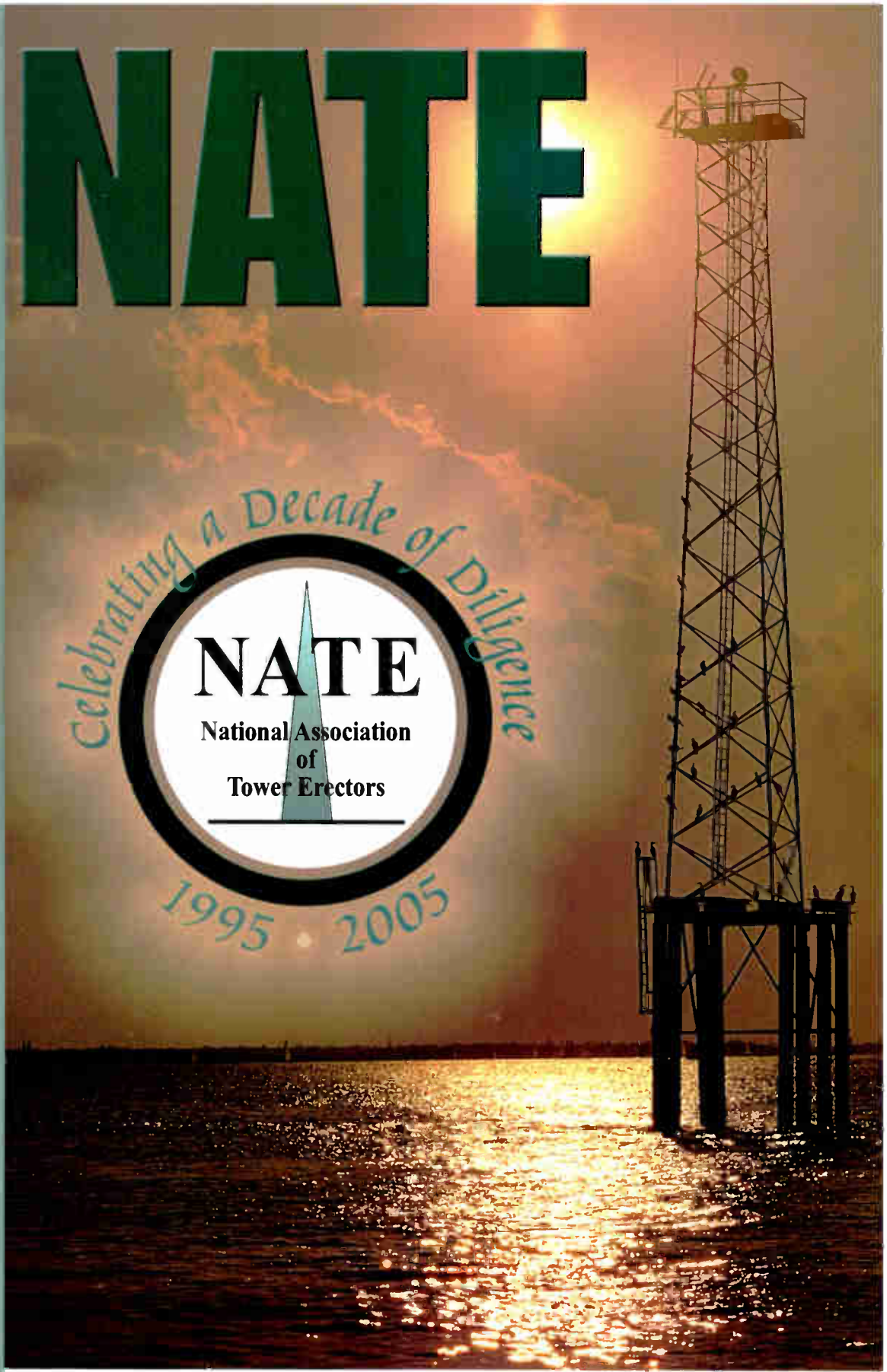

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