ABOVE GROUND LEVEL

agl Magazine™

Special Regulatory Issue

New FCC AM Proximity Rules

Pride Goes Before the Fall Tower Regulations

Interview with Ted Abrams, P.E.
Keys to Sparking a Muni Wi-Fi Revival

June 2014 /// Volume 11 /// No. 06

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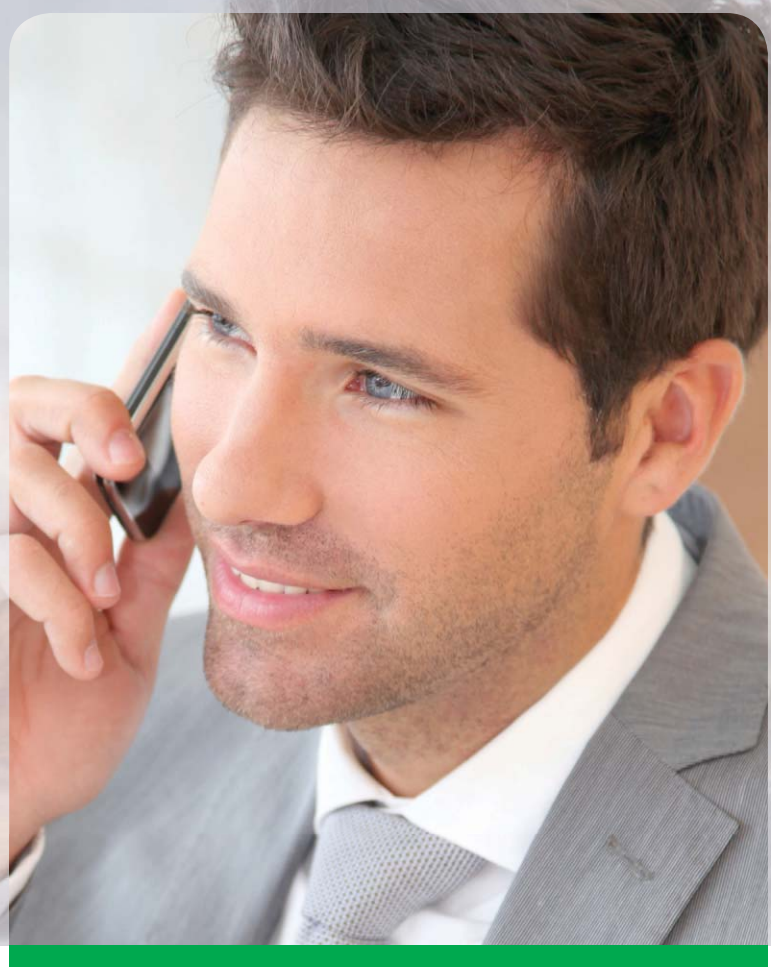

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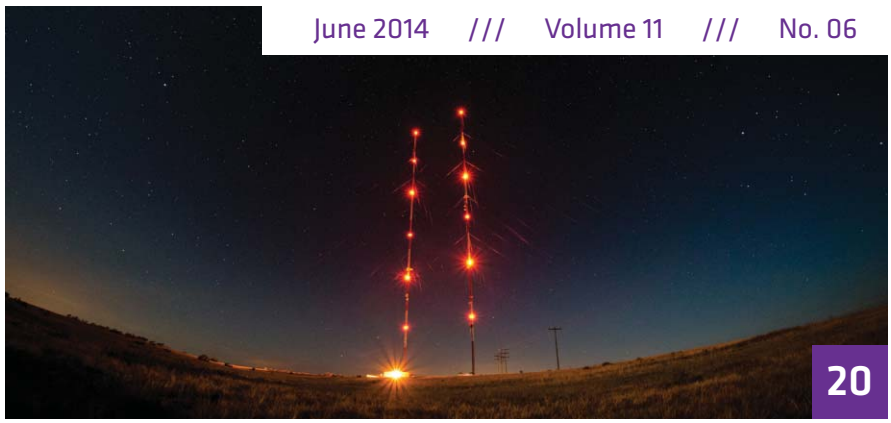

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DEPARTMENTS

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Net Neutrality

Hardly anyone can remember when an FCC action previously drew groups of organized protesters to FCC headquarters, but the May 15 release of a notice of proposed rulemaking about net neutrality — the idea that the Internet should offer equal access to all — did just that. By a 3 to 2 vote, Chairman Tom Wheeler's FCC put out for four months of public comment proposed rules that would allow Internet service providers to offer, for a fee, faster data throughput for some websites than others.

ISPs may now do that because a federal court struck down an FCC restriction earlier this year in *Verizon Communications Inc. v. FCC*. If this means anything detrimental for wireless communications, the largest carriers, AT&T Mobility and Verizon Wireless, are not likely to say. Their parent companies, AT&T and Verizon Communications, favor the FCC proposal. By a 10-to-one margin or greater, lobbyists spend more money on behalf of interests that favor the FCC proposal than those that might not. Leading in money spent lobbying is the National Cable and Telecommunications Association, headed by former FCC Chairman Michael K. Powell, and trailing is CTIA – The Wireless Association, led by former Comcast/NBC Universal lobbyist and former FCC Commissioner Meredith Atwell-Baker. And Chairman Wheeler is a former head of both NCTA and CTIA.

You can obtain a copy of the NPRM here: *fcc.gov/document/protecting-and-promoting-open-internet-nprm*. You have until July 15 to send your comment to the FCC. Reply comments are due two months later.

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Protesters outside FCC headquarters in Washington, D.C., on May 15. *Photo courtesy of Free Press*

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Towers That Mean Business

The art and science of tower management

Truly Great

I just returned from the Wireless Infrastructure Show in Orlando, Florida. What a fantastic event. I've always enjoyed the show — it's the right size, the venues are pretty darned nice, the exhibitors are interesting and completely relevant, and the sessions are first class. However, this year it was truly a great event. This year it all just clicked.

We always write up a number of the sessions and publish them in *AGL Magazine*, and this year will be no different, but it takes us an issue or two to get it all done. This year, we also conducted a number of video interviews. They should be on our website by the time you read this. Check them out— we had a lot of fun conducting them and hope you enjoy watching them.

Rich Biby, P.E., publisher and CEO, *AGL Media Group*, interviews Jonathan Adelstein, president and CEO of PCIA – The Wireless Infrastructure Association, during a video interview at the Wireless Infrastructure Show in Orlando, Florida. *Photo by Vasili Antoniou*

There was a lot of buzz around small cells. Did I say a lot? It was hard to walk around the hallways — well, heck, let's be honest, the restaurants, bars and pools — without hearing the words "small cell." It's funny that no one actually defines a small cell. Also often heard was the prediction of the death of the distributed antenna system. DAS is small cells, just with the RF hardware at the antenna location. It's all in how you define it.

Speaking of small cells, I continue to be involved with them and with deploying software-defined radios. I've written about it a little in this column before; however, we are now ready to pull the covers off of this project and share it publicly. I've had the pleasure of working at CoverageCo, where we've been deploying a physically small radio that runs both CDMA and GSM. We're attaching units to utility poles in very remote areas, initially in Vermont. We are an in-bound roaming company with no customers of our own (keep it simple). People are thrilled to have coverage for the first time in these areas, and giving them the ability to call 911 is rewarding. We're using less than 100 watts of power (that is watts, not kilowatts), and thanks to some interesting patents, we are able to utilize relatively high-latency backhaul, such as cable Internet, DSL and, of course, fiber, where available. It's been a lot of fun to be involved with operating a network for the first time instead of just building them. Check us out at *www.coverageco.com*. Please feel free to give me a call or send me an email if this interests you.

Rich Biby, Publisher
rbiby@aglmediagroup.com

PUBLISHER'S NOTE

Photo by Petty Officer 2nd Class Sandra M. Palumbo, U.S. Navy - Bahrain, November 6, 2007

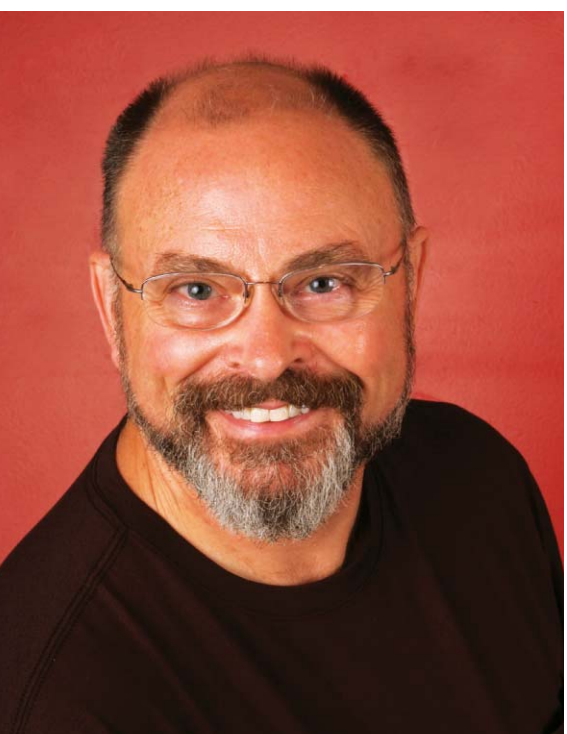
Keys to Sparking a Muni Wi-Fi Revival

By J. Sharpe Smith

In an interview with *AGL Magazine*, Ted Abrams, chief technology officer for WiFi Wireless, a facilities-based telecommunications company, explained how the company's WiFi My City program will be able to deploy successful municipal Wi-Fi networks.

At WiFi Wireless, Abrams oversees three of the network services that WiFi Wireless operates and maintains the Shipping WLAN, the company's VoIP network service Wi-Fly Wings and the municipalities program WiFi My City.

Upon completing his work with American Tower as senior vice president, Abrams started several specialty service companies, including Rural Telecom Services and Wireless Analytics. Through the service businesses, Abrams was executive vice president for VTel Wireless and is CTO for WiFi Wireless.



Ted Abrams, P. E.

What follows are excerpts from Abrams' remarks, edited for length and style.

AGL Magazine: What would you say to critics who bring up the history of failed muni Wi-Fi projects?

Abrams: Municipal Wi-Fi systems are mostly known for their failures. Major metro areas, including Philadelphia, San Francisco, Anaheim, Calif., and Portland, Ore., set out to provide Wi-Fi service to their citizens. Within years, sometimes months, the efforts were abandoned. Was this a flawed optimistic utopian gesture? The reason for their failures is more complex.

Equipped with the best intentions, but without the right tools, these projects didn't develop into sustainable ventures. If you look at Philadelphia's efforts, it was spearheaded by experts — hardworking, skillful professionals, proficient in IP routing and Internet service-providing — everything to do with the legacy approach to Internet access, but not the right business model, not the right partnership.

AGL Magazine: What is different now or better than it was in the past?

Abrams: Now, technologies and market conditions are favorable for an innovative business model in combination with a partnership between the city, organizers of the project, technology vendors and wireless professionals.

AGL Magazine: What is your approach to the municipalities?

Abrams: WiFi Wireless is busy in several areas of the nation, teaching communities what they can do to rationalize the chaos of public spectrum and make citywide wireless Internet work. WiFi Wireless believes that Internet access is as important to modern society as any public utility. As with any other public utility, cities must be involved. For the benefit of their residents, the starting point for each city is a partnership agreement with the Wi-Fi provider. Founded on that principle, the WiFi Wireless

Professional RF engineers can optimize multiple spatial paths with multiple frequencies and multiple protocols at every antenna location. Across public spectrum, users can experience air link data rates above 50 megabits per second.

business model offers free Wi-Fi for every resident of the city, without ads.

AGL Magazine: How is Wi-Fi service evolving?

Abrams: Voice services, carrier offload, location-based services, and sponsorships combine with the right business model to define a very positive future for public spectrum. Facebook's recent acquisition of WhatsApp reflects a strategy to launch voice service, rumored to be implemented later this year. WiFi Wireless began offering voice service in the form of voice-over-Wi-Fi several years ago.

AGL Magazine: Why is RF engineering so important?

Abrams: Expertise that sustains Tier I licensed wireless connections sets the standard. Engineers and equipment vendors such as Alcatel Lucent or Ericsson make the magic of wireless a daily reality. Projects that didn't start with RF, didn't consider the air link and network performance the way a wireless carrier does, the way traffic moves across the physical layer. Radio system functionality in the physical environment was either glossed over, or manufacturers' claims were accepted at face value.

System design must incorporate plans for continuous improvement, evolving to keep pace with spectrum availability and technology evolution. Today, a starting point might be 802.11 u, ac, n and other standardized protocols, managed and maintained with the latest revision. Passpoint-certified equipment is the smart way to go for carrier offload capability.

Now, technologies and market conditions are favorable for an innovative business model in combination with a partnership between the city, organizers of the project, technology vendors and wireless professionals.

A successful citywide public spectrum project grows from a solid relationship with the municipality, follows a professional RF engineering design and uses state-of-the art wireless equipment. Finally, the business model must be innovative and pay off for all of the stakeholders.

Professional RF engineers can optimize multiple spatial paths with multiple frequencies and multiple protocols at every antenna location. Across public spectrum, users can experience air link data rates above 50 megabits per second. Attaching to every antenna location, gigabit Ethernet backhaul can guarantee that high speed wireless does not hit a bottleneck. Personal cell technology recently in the headlines and in video demonstration depicts LTE user experiences that WiFi Wireless designs can achieve with public spectrum.

AGL Magazine: How can citywide Wi-Fi be monetized?

Abrams: Through an innovative business model. While it is important that no one is blocked from access, tiered plans incorporating sponsored speed zones allow the provider to get paid. Every resident of the city would be authorized for basic service; no charge to the user, no advertising. Users who intentionally opt-in for sponsored service get a turbo boost in trade for an ad from that sponsor. Subscription plans integrated into the model offer users VPN, or specialized services, or higher speeds without sponsorships. Carriers' subscribers would have access without ads through roaming agreements between the carriers and the Wi-Fi provider.

WiFi Wireless is busy in several areas of the nation, teaching communities what they can do to rationalize the chaos of public spectrum and make citywide wireless Internet work. WiFi Wireless believes that Internet access is as important to modern society as any public utility.

AGL Magazine: How does Wi-Fi fit into the other trends at work in the wireless world?

Abrams: Wi-Fi and other public spectrum are essential to the network densification going on in the cellular world. There will be a coordinated HetNet integration with LTE and LTE-Advanced. In that mix, Wi-Fi offload is absolutely fundamental. Everything in the Wi-Fi network must be ready for carrier-grade communications, following a BYOD philosophy that is friendly to all the new devices. It must become a part of the Networked Society envisioned by Ericsson, the global mobile Internet ecosystem, Zuckerberg's Internet.org plan for offering free, basic mobile phone access to everyone, and the synergies that those represent.

AGL Magazine: Sum up the keys to success for municipal Wi-Fi.

Abrams: A successful citywide public spectrum project grows from a solid relationship with the municipality, follows a professional RF engineering design and uses state-of-the art wireless equipment. Finally, the business model must be innovative and pay off for all of the stakeholders.

All You Need Is Love

By Iain Gillott

So right now, after reading this title, I would bet that in your head you are singing, "Da da-da da da, all you need is love, da, da-da da da!" I set about to think of a good title, and it occurred to me that the Beatles may have been onto something nearly half a century ago. Basically, the band was saying, "Keep it simple, stupid." In wireless network terms, that translates to "It's the network, stupid."

I wrote this while returning from the Comptel Plus show in Las Vegas. I spoke on a panel there and also got to sit in on a couple of other sessions. One was about the future of the copper network. Opinions varied between "there isn't one" and "limited," depending on who was speaking. What everyone was discussing was the need for more bandwidth, the move to bigger fiber pipes and Ethernet, and the increasing pressure on network performance and quality.

Wireless Network Is King

The view at iGR is that, from now on, the wireless network is king and the carrier that builds the best wireless network wins. This view ties in with the rapid rise of the over-the-top (OTT) service providers and how the mobile operators are being left behind. Follow that argument, and it is clear that the quality of the wireless network offered becomes the differentiator.

I purposely used the word "best" in referring to the network that wins. The best wireless network is the one that best fits the needs of the end user, both consumer and business, for performance and cost. Building the fastest, most reliable network is easy with an unlimited budget and unlimited time, but the customer is unlikely to be able, or willing, to pay the high service charges that would result. The challenge, therefore, is to build a fast, reliable, extensive network at a cost that allows for rate plans that the customer can afford — and feel good about paying for. I acknowledge that this is difficult. If it were easy, every mobile operator would already be doing it.

Network Focus

Of course, a focus on the network is not new. Some mobile operators around the world have made this focus a part of their market messaging for years (yes, I am talking about you, Verizon Wireless). In the recent past, competitors have tended to focus on availability of specific devices, lower prices, alternative network technologies or specific applications and services as their market differentiators. Some mobile operators have been more successful than others at this.

But this now will change (and is changing). In a world where the apps and services come from OTT providers and not from the mobile operators, the mobile operators must have robust networks available at competitive prices — this is how they will differentiate. Although the LTE network architectures are flatter and simpler than previous 2G and 3G versions, ironically, the best network will be more complex and harder to manage. The best network will incorporate the use of macrocells and all versions of small cells, plus it will seamlessly hand off traffic to authenticated Wi-Fi and private networks. And each radio element will be backed by appropriate, high-quality backhaul.

"Best" also means providing customers with data throughput speeds sufficient to do what they need to do. Notice I did not say "fast speeds all the time." The trick will be to provide consumers with enough bandwidth to accomplish their desired tasks without overloading the network. If I want to stream a movie on Netflix, I will get the bandwidth to do that, while my neighbor at the coffee shop may just want to send a few messages on WhatsApp. Managing the network to this degree is complex, and to be realistic, probably not yet possible. But the industry will get there.

Time and Dedication

Building the best network will take time and dedication. It will not happen overnight, and there will be missteps. But the successful mobile operators in the 2020s will be those that succeeded in realizing the correct vision of "best."

Iain Gillott is the founder and president of iGR and iGR Semiconductor Research. His email address is iain@iGR-inc.com.

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The Attributes of a Good Tower Worker

By Craig Snyder

Good tower workers have intelligence, social and mechanical skills, and a respect for and not a fear of heights. They also can cope with long periods away from home. And when I use the word "good" in describing a tower worker, I also mean great or excellent. At our office, the subject of what attributes make a good tower worker came up in conversation when we discussed the demands that the telecommunications network build out places on tower companies.

In response to these demands, a few large companies have chosen to grow their in-house tower crews rapidly. The acronym TCAP (tower crew augmentation program) has been used to describe the effort to quickly ramp up a tower crew while maintaining or improving the quality of work and, I would assume, safety on the job. TCAPs make me wonder whether it is possible to have such rapid crew expansion without some sacrifice in quality or safety, and if so, how it could be done.

I reflected on how it is with our tower crews at Sioux Falls Tower. During our 25 years in business, we've evolved in the way we do things. It's not easy building good tower crews. I'd like to think we found some secrets to success through experience. I'm proud of our crews. They are exceptionally productive. They meet high standards for quality of work. They have been loss-time injury-free for many years, and individual workers stay with us for what I consider to be a long time. And best of all, they are great people.

Quality of the Worker

The very best tower workers seem to possess the five attributes I mentioned at the outset. Take away any one of these attributes and the quality of the worker begins to taper quickly, and there is a strong likelihood they either will not be hired or will not last long as an employee. (Attention lady tower workers: I say "he" in what follows for simplicity in reading. The same attributes apply to both women and men.)

Intellect: A good tower worker is smart. He's a thinker, not just a doer. He doesn't have to be schooled or have academic degrees, but he is intelligent. Intelligence lends itself well to common sense. He can figure things out without a lot of guidance. Out of the gate, he doesn't make dumb mistakes.

Social IQ: Living with a crew for days or weeks at a time requires the ability to get along. A good tower worker knows when to talk and when to be quiet. He's a good communicator. He can read people and respond appropriately in any given setting. He's a friend even to those with whom it is hard to get along, including customers. He's never belligerent, he uses appropriate language, and he does not abuse substances, including drugs and alcohol.

Heights: Typically one of the first things we ask applicants is whether they have a fear of heights. The desired response is something like, "I can't wait to get up there!" A good tower worker respects heights and protects himself against the danger of falling, but he does not fear being up high. In fact, he is the one on the crew who would give up his spot on the ground any day for a spot on the tower.

Mechanical: Having innate mechanical skills is pretty important in tower work. This is not a job that comes with a lot of on-the-job learning time. Tower workers are busy enough with the physical exertion of climbing and keeping themselves protected from falls without having

Craig Snyder

to learn how to use tools once they get up there. To make it in tower work, a new employee either needs to have mechanical experience or needs to be a quick study with a rope, wrench, tape measurer and knife.

Travel: The second most common question asked of job applicants usually pertains to their ability to travel and be away from home for long periods. A good tower worker enjoys the traveling crew lifestyle. This attribute is possibly the most tricky to find, because even if he possesses all four of the other attributes, he can't do this job if he can't travel. I've watched some of the best applicants walk out the door because they knew that being away from home wouldn't work for them.

So if you agree that finding people with these attributes is key, can the industry ramp up to meet the present and future demands and still maintain quality and safety? From personal experience, I believe it will be a challenge, especially for those who want to do it quickly. I believe that if it is possible, it will have to come from hiring individuals who possess the five attributes mentioned. Harvesting them from the workforce and then training them takes time. The industry would do well to exercise some patience in the process.

Photo courtesy of Sioux Falls Tower & Communications

Craig Snyder is president of Sioux Falls Tower & Communications and is a past chairman of the National Association of Tower Erectors and the Telecommunications Industry Association committee responsible for writing the TIA- 222 tower standard.

RF Poses an Invisible Danger to the Safety of Tower Workers

The use and supervision of safe RF practices can save lives. Personal protective equipment and RF monitors can help workers to avoid overexposure. RF suits can help, but they have their drawbacks.

By Dr. Bridgette Hester

When it comes to understanding the effects radio-frequency (RF) energy may have on the human body, workers who climb towers as part of their jobs fit into a few categories. Some don't know anything about it. With others, what they believe they know is wrong. A third group is well versed on the topic.

RF energy is not to be taken lightly. Exposure to RF is an element of the technician's job that is just as dangerous as the climb itself, if not more so. The following information deals with both the actual effects of RF and the myths about it that perpetuate in the field.

RF and fall protection go hand-in-hand because RF can contribute to numerous hazards.

Arc and Burn Potential

Induced and contact current burns are actual problems in areas with high RF potential. These types of burns take months to heal and lead to possible secondary infections. In addition to causing burns, RF can lead to the failure of safety climbs and pelican hooks by acting as a welder, resulting in unusable cables and hooks. In some incidents, RF welded pelican hooks together so that they would not open. Climbers had to choose between removing their safety equipment and climbing down or calling for rescuers. Neither alternative is preferable. Instead, education regarding high RF hazards could have prevented such incidents.

In another incident, an employee lost his feet because he grabbed an antenna that shorted through his steel-toed boots. This reflects the need for employers to properly assess the workplace and decide what personal protective equipment (PPE) is appropriate on the worksite. Steel-toed boots are not appropriate for workers exposed to RF.

Cellular sites with AM detuning skirts can cause RF burns. There have been incidents in which workers were left with burns on their foreheads after walking into guy wires carrying RF-induced currents.

A transmitter with high RF can reradiate and heat such things on sites as chain link fences, gates, doors, ladders, HVAC equipment and electrical boxes. High-RF environments also can cause arcing from climb cables, guy wires, riggings, winches, gin poles and cranes. High RF can present so many hazards, it's imperative anyone on-site knows how to work safely in spite of expected RF hotspots.

The Use of RF PPE

The RF suit is composed of 25 percent stainless steel. There have been several incidents in which suits have sparked or burned, startling the wearer. An RF suit can limit worker mobility if the fall protection equipment doesn't fit properly over the suit. This distracts the climber

Exposure to RF is a real and present danger to the workers in the field. Knowledge is power, and information and the institution of safe RF practices can save lives.

Myths and Facts about RF

Myth: **Exposure to RF is not permanent.**
Fact: RF cooks you from the inside out. Being in a hot field for too long will boil the fluid in your eyes, cook the genitals of both sexes and cause sterilization. At low doses, the effects may be minor, but injury from prolonged or repeated exposure is irreversible and is being linked to liver damage, genital damage, vision loss and cancer, although studies have been inconclusive.

Myth: **RF can't damage your body.**
Fact: RF exposure heats the body from the inside out. It's equivalent to cooking yourself in a microwave oven. At high power, a microwave oven will boil water. Used at a lower power, as for electronics, microwave energy can be Wi-Fi. Lower power means less effect on the body, or some would argue the same effect but over a longer period.

Myth: **RF monitors offer protection from strong RF fields.**
Fact: PPMs are not designed to take measurements, and the use of monitors requires proper training. OSHA reminds workers that PPMs do not protect them from the RF hazard, they only provide a means of warning. RF monitors can be useful, but may give you a false sense of security. You should never rely entirely on an RF monitor, but instead you should use it in conjunction with your knowledge of RF safety.

Myth: **I know all about RF; I've worked with it all my life and have the burns to prove it.**
Fact: You may know how to obtain the best signal with RF, but if you have burns, you do not know how to work around it safely. RF safety requirements change. Because RF is a harmful physical agent, according to OSHA CRF 1910. 1020c13, employees must be trained and have the right to know about the RF to which they are exposed.

because the suit is cumbersome.

RF heats the body, and tower climbing is very physical work; therefore, the use of an RF suit while climbing raises the heat exponentially. It can increase the possibility of heat stress or heatstroke, depending upon the health and fitness of the wearer.

There have also been incidents of workers receiving severe burns from wearing the suit but not the gloves. In this situation, the climber acts as a ground for the RF, and the RF exits the body where it comes in contact with the tower, causing the burn. Typically, it's an exit wound, and these have primarily been seen on the wrist. The burns take nearly a year to heal.

The best option and one that should be considered first to control RF is lock-out/tag-out, but it seldom is used because clients demand that their transmitters stay on air. This is why training is critical. Employees must understand RF and must be trained to work safely in an RF environment. CFR 1910.132 requires employers to ensure the combination of equipment works properly together and on the site. An example of incompatible PPE could be a climber's steel-toed boots sparking or the overload capacity for the PPM is too low to work with an RF suit.

RF Affects Electronics

High RF could interfere with signals of communications equipment and affect the ability of workers on the tower to communicate with ground crews or signalmen. It could also interfere with backup sensors or reverse video monitors, causing an accident. Anti-two blocks are affected, as shown in an incident with a crane where the electronic hydraulic system and relays running the equipment were burned shut, making the crane uncontrollable. Any time a load is uncontrollable, there is a serious safety problem. This particular tower crane trolley shot 250 feet to the end of the boom. It happened on repeated occasions before anyone correlated the problem with high RF coming from a nearby communications site.

Band name	Abbreviation	ITU band	Frequency & wavelength in air	Example uses
Tremendously low frequency	TLF		< 3 Hz > 100,000 km	Natural and artificial electromagnetic noise
Extremely low frequency	ELF		3–30 Hz 100,000 km–10,000 km	Communication with submarines
Super low frequency	SLF		30–300 Hz 10,000 km–1,000 km	Communication with submarines
Ultra-low frequency	ULF		300–3000 Hz 1,000 km–100 km	Submarine communications, communication within mines
Very low frequency	VLF	4	3–30 kHz 100 km–10 km	Navigation, time signals, submarine communications, wireless heart rate monitors, geophysics
Low frequency	LF	5	30–300 kHz 10 km–1 km	Navigation, time signals, AM longwave broadcasting (Europe and parts of Asia), RFID, amateur radio
Medium frequency	MF	6	300–3000 kHz 1 km–100 m	AM (medium-wave) broadcasts, amateur radio, avalanche beacons
High frequency	HF	7	3–30 MHz 100 m–10 m	Shortwave broadcasts, citizens' band radio, amateur radio and over-the-horizon aviation communications, RFID, over-the-horizon radar, automatic link establishment (ALE) / near-vertical incidence skywave (NVIS) radio communications, marine and mobile radio telephony
Very high frequency	VHF	8	30–300 MHz 10 m–1 m	FM, television broadcasts and line-of-sight ground-to-aircraft and aircraft-to-aircraft communications, land mobile and maritime mobile communications, amateur radio, weather radio
Ultra-high frequency	UHF	9	300–3000 MHz 1 m–100 mm	Television broadcasts, microwave ovens, microwave devices/communications, radio astronomy, mobile phones, wireless LAN, Bluetooth, ZigBee, GPS and two-way radios such as land mobile, FRS and GMRS radios, amateur radio
Super-high frequency	SHF	10	3–30 GHz 100 mm–10 mm	Radio astronomy, microwave devices/communications, wireless LAN, most modern radars, communications satellites, satellite television broadcasting, DBS, amateur radio

Band name	Abbreviation	ITU band	Frequency & wavelength in air	Example uses
Extremely high frequency	EHF	11	30–300 GHz 10 mm–1 mm	Radio astronomy, high-frequency microwave radio relay, microwave remote sensing, amateur radio, directed-energy weapon, millimeter-wave scanner
Terahertz or tremendously high frequency	THz or THF	12	300–3,000 GHz 1 mm–100 µm	Terahertz imaging – a potential replacement for X-rays in some medical applications, ultrafast molecular dynamics, condensed-matter physics, terahertz time-domain spectroscopy, terahertz computing/communications, sub-mm remote sensing, amateur radio

RF could potentially be so high that a winch or a crane bearing could be destroyed resulting in the equipment falling apart. The new crane standards require equipment to be grounded, but RF can flow through the crane, burning bearings and cutting the crane apart like an arc welder. High RF accelerates corrosion of guy wires, anchors of tower bases that lack cathodic protection. The corrosion could cause a tower structure to fail.

Let's examine a worst-case scenario. There is a crew working on a guyed tower. The RF is so high at the site, the anti-two block fails on the crane. The pelican hooks burn closed, PPE and PPM don't work correctly together, and the communications equipment doesn't work at all, so the climber can't radio for help. The climber is stuck on the tower, the steel-toed boots are arcing, and he's touching the tower and receiving shocks and burns. How can anyone rescue the climber? What if a firefighter with an oxygen tank tries to climb the tower for a rescue? This is an explosive situation. It is unlikely for all the worst problems to happen at once. But any one of them could be catastrophic.

Incidents of RF wiping out the memory of a pacemaker and heating metal medical implants have also been reported.

Disorientation

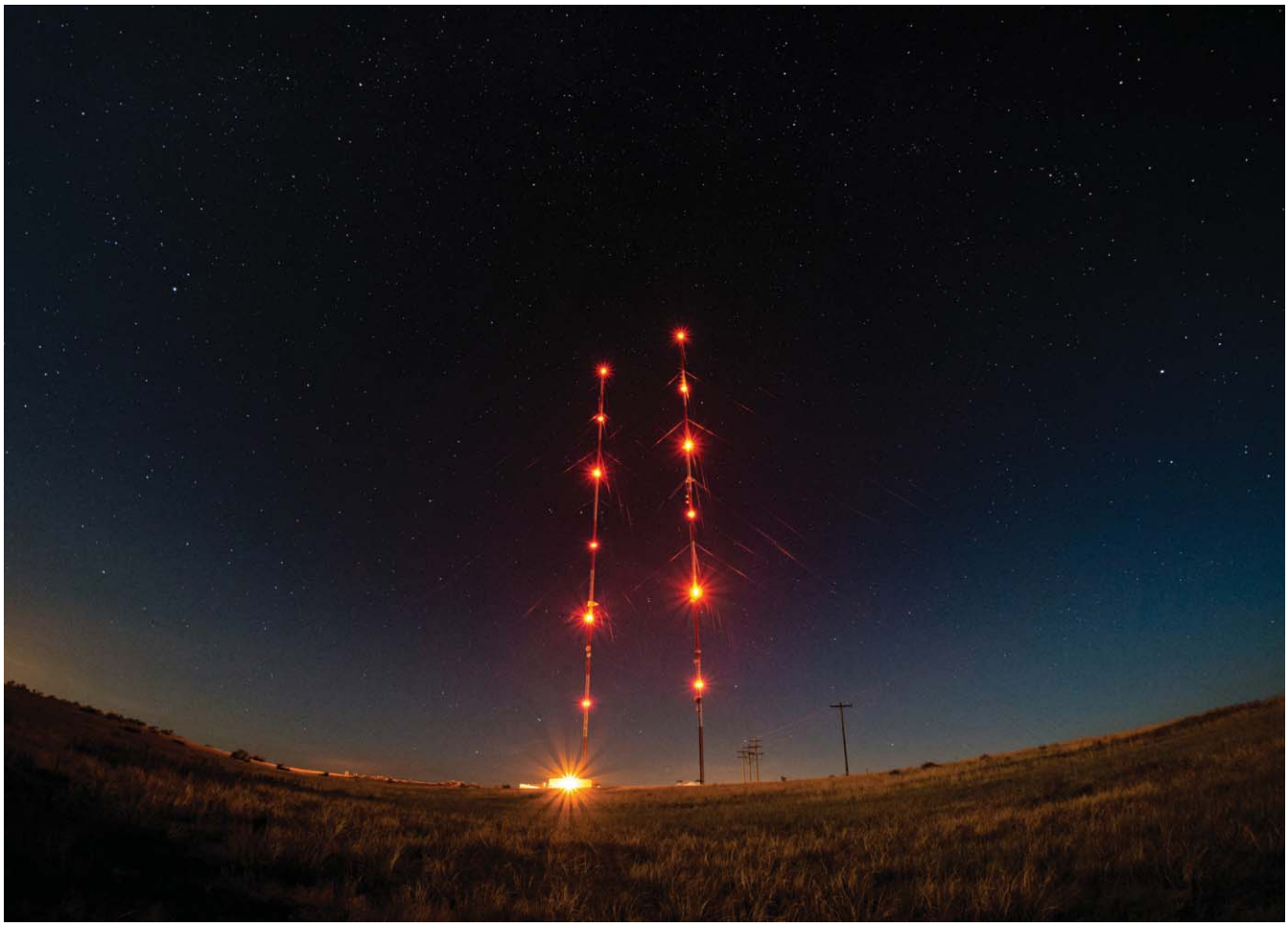
RF heating in the body can cause disorientation or the inability to think clearly. If a climber fails to latch a pelican hook, slips or drops something from the tower, the result could be tragic. Although what could happen may not happen, the point is that RF requirements are often overlooked, but RF is as dangerous as it is invisible.

You can see from the chart on page 18 that exposure to RF is a real and present danger to the workers in the field. Knowledge is power, and information and the institution of safe RF practices can save lives. There is an immense amount of info regarding RF. I want to address your concerns and questions in future articles. Please send me your questions, information you might care to offer, and descriptions of experiences from both workers and managers.

Hubble Foundation Research

The Hubble Foundation is conducting academic research on climbers' perceptions of their fall risk. To participate in the study, send an email to Dr. Bridgette Hester at *bridgette@hubblfoundation.org* to receive a consent form and a link to the online survey tool. Participants must be at least 18 years old and either currently active climbers in the industry (40 hours a week) or active climbers in the past five years.

Bridgette Hester, Ph.D., is a family and workplace strategist. She is the founder and president of the Hubble Foundation, which is dedicated to promoting the safety of tower workers, site crews and all workers at heights. Her email address is bridgette@hubblefoundation.org. A contribution to this article was made by Wade Sarver, www.wade4wireless.com.



Automating Tower Light Management

Intelligent site management for aircraft warning lights and other aspects of a tower site delivers worthwhile operational, capital and technician-related savings while maximizing network quality and availability.

By Ben Stump

The past 15 years have seen a huge number of cell towers constructed. The proliferation of towers has created safety problems for aircraft pilots, especially when towers are on hilltops, in the vicinity of an airport or near aircraft flight paths. Because of public and aviation safety concerns, many regulatory agencies worldwide require aviation obstruction lighting on towers and other antenna structures that exceed a designated height.

It isn't as simple as just having a light installed, however. Owners of structures find that automated tower light monitoring and management are becoming extremely important because regulatory agencies require proof of proper lighting operation, towers are often in distant and hard-

to-reach locations, and preventive maintenance procedures are often frequent and necessary.

U.S. Regulations

In the United States, the Code of Federal Regulations (CFR) spells out the general and permanent rules and regulations issued by departments and agencies of the federal government. Part 17, Title 47 (Section 17.47), Subpart C of the CFR specifically refers to obstruction marking and lighting of antenna systems and associated control equipment.

Either visually or with an automated alarm system, the owner of an antenna structure is required to verify that the light is functioning at least once every 24 hours. All automatic or mechanical control devices, indicators and alarm systems associated with the antenna structure lighting must be inspected at least every three months to confirm their proper functioning. Additionally, if a top, steady-burning light or any flashing aviation obstruction light is not functioning properly or if it has extinguished and hasn't been restored to operation within 30 minutes, a report must be filed.

Remote Management

For towers in remote or rural areas, fixing a problem may be a time-consuming and sometimes dangerous task. Implementing an aircraft warning light (AWL) management system to monitor tower lights for safety and regulatory compliance — without a site visit — is often desired. A comprehensive AWL management system remotely monitors a light's performance from virtually anywhere. Successful tower management raises alarms when problems arise. Problems with any one of several aspects of the lighting should raise alarms, and the management system should provide information about the lighting status. Examples include:

- Communications with the tower light system
- Controller function
- Power failure
- Tower lighting system (often requiring a tower climb)
- Tower lighting mode (day/night or red/white)
- Remote access (someone currently working on the tower light functions remotely)

Some of these alarms can involve service-affecting problems that require the owner to file a Notice to Airmen (NOTAM) with the relevant aviation authorities. A NOTAM alerts pilots of potential hazards such as a tower light outage along a flight route or at a location that could affect the safety of a flight. Other alarms, such as power and controller, help to indicate the location of the problem to identify the best course for resolution.

If a problem occurs with the tower light, the AWL solution sends an automatic notification to the relevant personnel. For example, if there is an AWL outage or if the light is in the red night mode when it should be in the white day mode, the management system automatically notifies the tower operator or responsible party. The management system often is located in a network operations center (NOC). The management system also sends an alarm to the appropriate field or management personnel. The automatic notification enables the owner or operator to identify and remotely investigate the alarm to fix the problem quickly.

Quarterly inspections are time consuming and expensive, but in the United States, they are mandatory per CFR 17.47(b). However, if an AWL management solution is installed, the FCC may waive the quarterly inspections requirement. The information that can be provided from a management system to help with obtaining a waiver includes a timeline view displaying the recorded outcomes from specific diagnostic tests. The management system retains the historical test results for a predefined period, which is important if a future audit occurs.

Key performance indicators (KPIs) should also be available. Tracking the number of flashes per light for a designated period is a KPI that the party responsible for the lighting can use to demonstrate regulatory compliance. Standards for certain lights and beacons define how many times they must flash per minute, and the tracking KPI gives evidence that the standard was met. The number-of-flashes KPI can also show a trend in the light's performance. For example, if the flash rate decreases significantly over time, the light probably will soon fail. When this trend is identified, the owner or the NOC can have a replacement light installed before an outage occurs.

The management solution should be able to remotely initiate diagnostic tests and then log the results of the operational status of the aircraft warning light system. When problems are identified, in some cases they can be fixed remotely. An example would be a failure of the lighting to change from night mode to day mode or vice

versa. Other problems may require a site visit, but with the information obtained from the management system, the technician could know what replacement parts to bring to return the lighting to full service. The results of the diagnostic tests and the associated response time also determine whether a NOTAM needs to be issued to the relevant authorities in the event of a lighting system outage.

Non-intelligent aircraft warning light systems typically consist of a flasher, a photocell and one or more lights that may be incandescent, quartz, halogen or LED. A management system should monitor the individual components to provide the operational status of the light and assist in diagnosing a lighting system failure.

Figure 1 is an example of what an AWL solution should monitor. This includes monitoring whether the light is functioning correctly or whether any alarms are active (Failure – green when there no alarms), whether the controller is configured correctly (Configuration – green when everything is configured correctly), what mode is running (Mode – day when the photocell is operational), and the status of diagnostic testing (Testing – no when not currently testing).

An AWL management solution can also help to determine whether a problem on a tower requires someone to climb it to fix it. For example, if an alarm indicates a communications problem between a controller on the ground and a light on the tower, this can be reviewed without a site visit. The review can determine whether it can be fixed remotely or if a technician must visit the cell site. However, if an alarm indicates that an LED light is no longer functioning on the tower, the repair may require a climber and team support.

AWL Management Benefits

Aircraft warning light management can seem like a daunting and expensive task, especially if there are thousands of towers in the network. However, with a comprehensive monitoring and control solution in place, understanding how the system is functioning and fixing site issues can become easy, and steps often can be completed without a site visit.

AWL management can significantly reduce operating costs. For example, assume a U.S. tower operator owns 10,000 towers. If 5,000 of them have tower lights that must be monitored per CFR 47.17, the towers must be inspected quarterly. That is 20,000 site visits per year. If the tower owner or operator has a comprehensive AWL monitoring and management solution installed and if the FCC waives the quarterly inspection requirement, only 5,000 site visits are required for what then becomes annual compliance testing. Assuming it costs $200 per site per visit, a waiver of quarterly inspections reflects an operational savings of $3 million annually — just by eliminating the unnecessary site visits.

AWL management also can improve technician efficiency. Remote monitoring, management and control capabilities can reduce site visits for problems that can be fixed remotely, such as changing the mode of the intelligent controller. If a site visit is required, the owner or operator will know beforehand whether

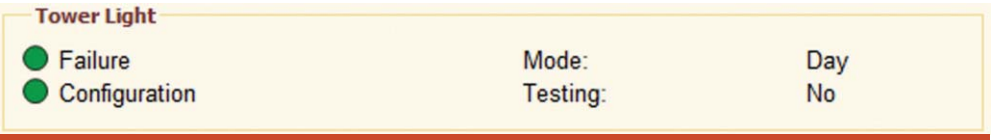


Figure 1. This example of what an aircraft warning light management solution should monitor includes whether the light is functioning correctly or whether any alarms are active (Failure – green when there are no alarms), whether the controller is configured correctly (Configuration – green when everything is configured correctly), what mode is running (Mode – day when the photocell is operational) and the status of diagnostic testing (Testing – no when not currently testing).

someone has to climb the tower to fix the problem. This helps to ensure that the dispatcher sends the correct workers with the correct equipment on the first visit. Because an AWL solution monitors tower lights remotely and can send automated notifications identifying when a light or its accessories experience a problem, the number of maintenance visits is reduced.

With the dramatic increase in wireless data and voice communications, towers have become a common sight, even in the most remote locations. Understanding tower lighting systems is critical to ensure aircraft safety and avoid costly fines. A comprehensive aircraft warning light management system gives tower owners and operators the ability to remotely manage the entire lighting infrastructure to minimize operating costs, improve technician efficiency and ensure tower light availability.

Beyond AWL Management

Aircraft warning light management is one component of a comprehensive site management solution. Ideally, a tower owner or operator can use the same technology to intelligently monitor and control other aspects of a tower location including the following:

- **Power systems:** site batteries, commercial power, generators including fuel supply, and hybrid power alternatives such as solar panels and wind turbines
- **Environmental conditions:** heating, ventilation and air conditioning (HVAC) monitoring, HVAC control and environmental monitoring such as indoor and outdoor temperature and humidity
- **Security:** site access, asset tampering and video surveillance

By implementing an intelligent site management solution that manages aircraft warning light systems and other aspects of the site, the owner or operator can obtain significant operational, capital and technician-related savings while ultimately maximizing network quality and availability.

Ben Stump is senior vice president and chief technology officer of Westell Technologies where he provides vision and leadership in defining strategy for Westell products and technology. He has more than 15 years of telecommunications experience specializing in operations support systems and technology, operations and engineering for operators worldwide.

Aviation Obstruction Warning Lighting: Certified versus Compliant

The difference between certified and compliant lighting affects your tower and the safety of the airspace it occupies. Check datasheets and ask about independent accredited laboratory certification documents.

By Terry Zarnowski and Thad Fink

In the United States, the Federal Aviation Administration (FAA) is the regulatory body that sets the requirements needed to ensure that aviation obstruction warning lights are designed to be sufficient to protect the safety of U.S. airspace. In other parts of the world, many countries have adopted the International Civil Aviation Organization (ICAO) standards for their aviation warning light requirements. For Canada, Transport Canada's Canadian Aviation Regulations set the requirements. For Mexico, the Secretariat of Communications and Transport's Directorate General of Civil Aeronautics set the requirements.

Although some regulatory bodies such as the ICAO only require "compliant" solutions, others such as the FAA require the use of "certified" lighting solutions. It is important to know the difference when it comes to your tower and your responsibility to the safety of the airspace it occupies.

In today's global economy, it is possible to buy lighting solutions from virtually anywhere. To see for yourself, conduct a Web search using the phrase "obstruction lighting" in quotes. Scores of suppliers from countries including China, India, Germany, Italy, the United Kingdom and the United States will show up.

Most of these suppliers are touting their products as compliant with one or more of the regulatory authorities, including the FAA. If you're constructing a tower or upgrading your lighting systems in the United States, compliant may sound like a professional and legal solution, and compliant solutions may save you a few bucks. But in reality, the word "compliant" can buy you a load of trouble if you are lighting a tower in the United States. According to the FAA, a product must be FAA certified in order to meet all of the FAA regulations.

"Compliant" simply means that the manufacturer read and interpreted the regulations, designed and built its products based on that interpretation, and offers them for sale while claiming the products meet regulatory requirements. Sounds like the wolf guarding the sheep, doesn't it?

"Certified" takes one more hugely important step over being compliant. To be certified for the U.S. market, the product must be tested by an independent, accredited testing laboratory to verify that it meets the regulatory requirements. Once the product has passed numerous tests, the laboratory issues a certificate indicating the manufacturer and the certified part numbers. The product, once certified, is also listed as an

To be "certified" for the U.S. market, the product must be tested by an independent, accredited testing laboratory to verify that it meets the regulatory requirements. Once the product has passed numerous tests, the laboratory issues a certificate indicating the manufacturer and the certified part numbers.

acceptable product on the FAA website. As a result, there is no ambiguity or confusion over an interpretation (whether for plain language or technical specifications) of the FAA requirements. There is no worry as to whether the supplier has done its homework. The system meets the regulatory requirements, it has been issued a certificate granting FAA certification, and it is listed on the FAA website — period.

No one wants to write NOTAMs or, worse yet, carry any liability when it comes to an aviation accident. (A NOTAM — Notice to Airmen — alerts pilots of potential aviation hazards.) If your structure requires lighting as determined by the FAA when you registered it, then choose suppliers that offer certified solutions. Check their datasheets and ask whether they provide the independent accredited laboratory certification documents. You can also check the FAA website. A good, reputable supplier knows the regulations and will be able to guide you to the correct lighting configuration based on your specific tower location. It is better to be sure now than to stress later.

A good, reputable supplier knows the regulations and will be able to guide you to the correct lighting configuration based on your specific tower location. It is better to be sure now than to stress later.

For more information, visit www.faa.gov for a copy of AC 150/5345-43G, "Specification for Obstruction Lighting Equipment, and www.fcc.gov/antenna for information about its Antenna Structure Registration program.

Terry Zarnowski is director of business development, and Thad Fink is sales manager, at Unimar.

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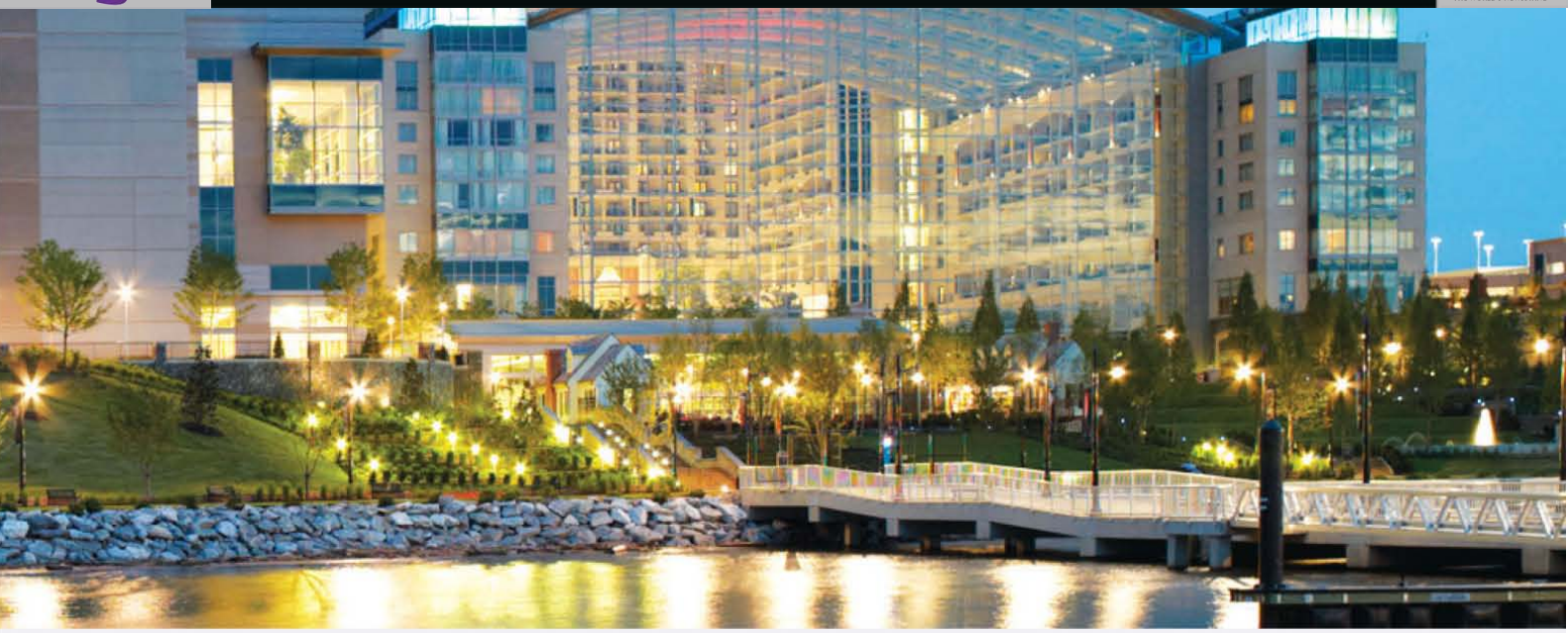

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MONOPOLE

HEIGHT
98.4 FEET

CARRIER
INWI

LOCATION
MARRAKESH, MOROCCO

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AGL TOWER OF THE MONTH

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ABOVE GROUND LEVEL

JUNE 2014

AGL TOWER OF THE MONTH

What You Need to Know about Tower Regulations

It's a jungle out there. Properly navigating multiple regulatory requirements goes hand in hand with other steps taken to ensure the success of new tower construction and collocations of antennas on existing towers.

By Michael L. Higgs Jr.

As part of *AGL Magazine*'s ongoing commitment to keep you informed of the latest regulatory developments affecting the telecommunications infrastructure industry, the following information offers an overview of regulations pertaining to new tower development and antenna collocations.

State and Local Authority

Section 332(c)(7) of the Communications Act preserves state and local authority over zoning and land use decisions for wireless facilities, but it also spells out some limitations on that authority. Specifically, state and local governments may not unreasonably discriminate among providers of functionally equivalent services, may not regulate in a manner that prohibits the provision of personal wireless services, must act on applications within a reasonable period of time, and must issue any denial of an application in writing, supported by substantial evidence in the written record. The statute also pre-empts local decisions based on the environmental effects of RF emissions.

The "reasonable period of time" referred to in the limitations remains ill-defined and subject to potential abuse and shenanigans. Unfortunately, when an applicant is dealing with unreasonable people, the applicant may still face unreasonable delays.

As for RF emissions, clever zoning authorities often find ways to deny projects where the only complaints involve unsubstantiated fears of RF radiation. The fallback position for the zoning authorities often involves a perceived decline in property values that some presume

Key Regulatory Elements

- Section 332(c)(7) of the Communications Act
- Section 6409(a) of the Middle Class Tax Relief and Job Creation Act
- Nationwide Programmatic Agreement for the Collocation of Wireless Antennas
- 2009 FCC Declaratory Order interpreting Section 6409(a)
- Notice to the Federal Aviation Administration and registration with the FCC
- Section 106 of the National Historic Preservation Act of 1966, implemented in the FCC's NEPA rules
- Tower Construction Notification System and E106 filing system
- National Environmental Policy Act
- Endangered Species Act

would accompany the construction of a new tower.

In 2012, Section 6409(a) of the Middle Class Tax Relief and Job Creation Act was enacted into law. It limits state and local authority over antenna collocations that do not "substantially change" the physical dimensions of a tower or its base station. Several ambiguities and undefined terms leave the law open for debate. In an effort to clarify the application of this law, the FCC in January 2013 issued nonbinding guidance on the interpretation of Section 6409(a). Regarding the definitions of the phrases "substantial increase in the size of the tower," and "wireless tower or base station," the Commission deferred to the definitions provided in the Nationwide Programmatic Agreement (NPA, discussed later). In determining how much time a state or local zoning authority has to consider applications for collocation, the Commission relied on a 2009 Declaratory Order in its interpretation that Section 6409(a) requires that collocation applications must be acted upon within 90 days.

Under Section 106 of the NHPA, federal agencies are required to consider the effects of federal undertakings on historic sites.

New Towers

The National Environmental Policy Act (NEPA) requires all federal agencies to implement procedures to make environmental consideration a necessary part of an agency's decision-making process. The FCC complies with NEPA by requiring licensees and applicants to review their proposed tower and antenna siting actions for environmental consequences. If a licensee's proposed action falls within one of the categories listed in Section 1.1307 of the Commission's rules, which include proximity to officially designated wilderness areas or wildlife preserves, or the potential to affect threatened or endangered species, then the licensee must investigate the potential environmental effects from its construction of antenna facilities and must

Tower Collocations — Under the National Programmatic Agreement, The FCC's Environmental and Historic Filing Requirements Are Waived If:

- The structure height is not increased by more than 10 percent or by more than 20 feet plus the height of the new antennas
- The tower width is not substantially increased
- No more than one new equipment shelter is added
- No more than one new equipment shelter is added
- There are no excavations outside of the tower site

Under the NPA, any tower adding new lighting or modifying its lighting to a "less preferred" method must also submit a new EA prior to any collocations being permitted.

The NPA defines "tower" as any structure built for the sole or primary purpose of supporting antennas used to provide FCC-licensed services. This important distinction places utility poles, water towers, rail catenaries and other structures in a different category for Commission review. Such facilities are exempt from the Section 106 review process if they are:

- Less than 45 years old
- Outside of a historic district or within 250 feet of a historic district but the new antennas would not be visible from ground level anywhere within the bounds of the historic district
- Neither listed, nor eligible for listing, in the National Register of Historic Places
- Not the subject of any actual complaints received by the FCC

Note that the NPA does not apply to tribal lands. Any applications for collocation within the exterior boundaries of any Indian reservation or dependent Indian communities must go through the applicable tribal authorities for approval.

disclose the effects in an environmental assessment (EA) filed with the FCC.

The Commission then solicits public comment on the EAs and assists licensees in working with the appropriate local, state and federal agencies to reach agreement on the mitigation of any potential adverse effects. An EA is also required when a proposed facility may have a significant effect on historic properties.

The Endangered Species Act requires applicants to determine whether any proposed facilities may affect listed, threatened or endangered species or designated critical habitats, or are likely to jeopardize the continued existence of any proposed threatened or endangered species or designated critical habitats (as embodied in the Section 1.1307 checklist). Applicants are also required to notify the FCC and file an EA if any of these conditions exist.

The National Historic Preservation Act of 1966 (NHPA) is also implemented in the FCC's NEPA rules. Under Section 106 of the NHPA, federal agencies are required to consider the effects of federal undertakings on historic sites. Commission licensees and applicants must comply with NHPA procedures for proposed facilities that may affect sites that are listed or eligible for listing in the National Register of Historic Places. This process includes consultation with the relevant State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Officer (THPO) to consider whether the

proposed facility may create an adverse effect on an eligible or listed historic property.

Towers that meet certain height and location criteria (generally towers more than 200 feet in height or located near an airport or heliport) will require notice to the Federal Aviation Administration and registration with the FCC. Prior to completing registration with the Commission, an antenna structure owner must have notified the FAA (via FAA Form 7460-1) and must have received a final determination of "no hazard" from the FAA. The FCC's TOWAIR program can be used to determine if a proposed construction meets these FAA notification and FCC registration requirements. If it is determined that the proposed facility may interfere with the aircraft or airport operations, the Commission may require that the structure be painted or lighted in order to make it more conspicuous to aircraft.

If you are not required to file an EA or file with the FAA, then you are not required to register your tower or antenna facility with the FCC. Applicants registering structures with the FCC are required to certify as to their compliance with each of the laws and regulations described earlier. Although registration of the structure does impose another regulatory hassle, it also makes the structure easier to find for carriers searching for collocation opportunities.

Although registration of the structure does impose another regulatory hassle, it also makes the structure easier to find for carriers searching for collocation opportunities.

Antenna Collocations

On March 16, 2001, the FCC entered into the Nationwide Programmatic Agreement for the Collocation of Wireless Antennas (known as the

Any applications for collocation within the exterior boundaries of any Indian reservation or dependent Indian communities must go through the applicable tribal authorities for approval.

NPA), modifying the Section 106 review process for facilities covered by the NHPA. Towers constructed prior to the date of enactment are exempt from the NHPA's preclearance review process and can accept collocations with impunity. For towers constructed after that date, applicants can only collocate on the structure if it has undergone a Section 106 review and received a finding of "no adverse effect" on historic properties, or if the tower has an agreement in place to mitigate any such adverse effects.

For "tower" collocations (a distinction clarified in the next paragraph) under the NPA, the FCC's environmental and historic filing requirements are waived if the structure height is not increased by more than 10 percent or by more than 20 feet plus the height of the new antennas and if the tower width is not substantially increased, if no more than one new equipment shelter is added, and if there are no excavations outside of the tower site. Under the NPA, any tower adding new lighting or modifying its lighting to a "less preferred" method must also submit a new EA prior to any collocations being permitted.

The NPA defines "tower" as any structure built for the sole or primary purpose of supporting antennas used to provide FCC-licensed services. This important distinction places utility poles, water towers, rail catenaries and other structures in a different category for Commission review. Such facilities are exempt from the Section 106 review process if they are less than 45 years old, if they are outside of a historic district or within 250 feet of a historic district but the

Limitations on State and Local Authority Imposed by Section 332(c)(7) of the Communications Act

- May not unreasonably discriminate among providers of functionally equivalent services
- May not regulate in a manner that prohibits the provision of personal wireless services
- Must act on applications within a reasonable period of time
- Must issue any denial of an application in writing, supported by substantial evidence in the written record
- May not base decisions on the environmental effects of RF emissions

new antennas would not be visible from ground level anywhere within the bounds of the historic district, if they are neither listed, nor eligible for listing, in the National Register of Historic Places, and if no actual complaints have been received by the FCC. Note that the NPA does not apply to tribal lands. Any applications for collocation within the exterior boundaries of any Indian reservation or dependent Indian communities must go through the applicable tribal authorities for approval.

The FCC requests that all new tower construction proponents and non-exempt collocation applicants file with the FCC's Tower Construction

The TCNS is used to provide notice to interested Tribal Historic Preservation Officers of construction that may affect areas of cultural significance.

Notification System (TCNS) and E106 filing systems, and it requires such filings when an EA is necessary. The E106 system is used to share information with applicable State Historic Preservation Officers and other interested parties. Concurrent with the E106 filing requirement, an EA requires the proponent or applicant to provide "local notice" of the project, which usually involves the placement of one or more advertisements in local newspapers.

The TCNS is used to provide notice to interested Tribal Historic Preservation Officers of construction that may affect areas of cultural significance. This includes not just current tribal lands, but any areas that tribes may have settled in or traversed at some point in the past. THPOs often request fees for the review of proposed projects, and they have the authority to demand that a tribal representative be present for any excavations. They can also demand alternative excavation methods, such as digging by hand, when they believe that artifacts may be damaged by use of machines. Note that the project proponent is liable for the expenses associated with such tribal oversight.

If anything in this overview is news to you, please consult with regulatory counsel to review and revise your new tower and collocation methodologies.

Michael L. Higgs Jr. is a member of the telecommunications and cybersecurity law practices at the Shulman Rogers Gandal Pordy & Ecker law firm in Potomac, Md. His email address is mhiggs@shulmanrogers.com.

Pride Goes Before the Fall: OSHA's Emphasis on Fall Protection

Your attention may focus on protecting workers from fall hazards on towers because your business involves towers, but OSHA looks deeper into fall protection than that, and you should, too.

By Mark A. Lies II and Kerry M. Mohan

Ever since Sir Isaac Newton's book *Philosophiæ Naturalis Principia Mathematica* was published in 1687 quantifying the principles of gravity, there has been no question that falls caused by the invisible force of gravity can result in personal injury. This hazard is greatly magnified in the workplace because of the nature of work at heights and employee exposure to falling from platforms, catwalks, equipment and structures onto other equipment or structures. Despite this well-known hazard, employees frequently and tragically expose themselves to this hazard because they either arrogantly or mistakenly believe that they can avoid a fall by their actions. It is the employer's responsibility to prevent such careless conduct.

OSHA

During the past several months, OSHA has again targeted its crosshairs on fall protection and is forcefully reminding employers of actions they should take to prevent injuries and deaths related to fall hazards. For instance, on Feb. 14, 2014, OSHA issued a letter specifically addressed to the communications tower industry, "reminding" employers of their duties to ensure employees are trained and fully protected from fall hazards (OSHA Letter to Communication Tower Industry Employer). More recently, on March 19, 2014, OSHA issued a national "stand-down for fall prevention in construction" to raise awareness among employers and employees about fall hazards (OSHA Announces National Stand-down for Fall Prevention in Construction). By taking these actions, OSHA has placed all employers on notice that it will more closely scrutinize employers' fall protection programs and probably will issue more severe citations and penalties for violations of OSHA's regulations. Further, although OSHA's recent announcements have focused largely on the construction-related industries, employers subject to OSHA's General Industry standards should be prepared to face similar scrutiny. The following information addresses OSHA's fall protection requirements and the potential issues employers may face related to fall protection.

Fall Protection Standards

Section 1926.501 of OSHA's construction regulations provides that all employees walking or working on a surface with an "unprotected side or edge which is 6 feet (1.8 m) or more above the lower shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems." Further, Section 1926.105 provides that "[s]afety nets shall be provided when workplaces are more than 25 feet above the ground or water surface, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical." Although these two standards

Any employer that engages an outside contractor to perform work is potentially exposed to liability if it does not confirm that the outside contractor employees are protected from fall hazards.

SAFETY

OSHA has placed all employers on notice that it will more closely scrutinize employers' fall protection programs and probably will issue more severe citations and penalties for violations of OSHA's regulations.

require different forms of protection, the common denominator is that employers in the construction industry are required to provide employees fall protection if employees are exposed to a fall hazard of 6 feet or more. In addition, there are extensive fall protection regulations relating to steel erection and residential construction.

General Industry Standards

OSHA's General Industry regulations also require employers to ensure employees are protected from fall hazards. In Section 1910.23, OSHA provides that "every wall opening from which there is a drop of more than 4 feet" or "every open-side floor or platform 4 feet or more above adjacent floor or ground level" shall be guarded by a standard railing or other means of fall protection.

In addition to citing employers under the 4-foot rule, OSHA has often utilized its personal-protective equipment (PPE) standard, Section 1910.132, which requires employers to conduct a hazard assessment and provide appropriate PPE, including fall protection, if fall hazards exist in the workplace. Thus, in the event OSHA finds a violation under Section 1910.23 for failing to provide fall protection, OSHA may also cite the employer under Section 1910.132 for failing to conduct an appropriate hazard assessment to determine that fall protection should have been provided and thereafter to provide the PPE.

Innocuous Situations

It is generally understood by all employers that employees working at significant heights must be provided some form of fall protection, whether it be by guardrails, a personal fall arrest system, safety nets, or something else that is equally effective. However, employers subject to OSHA's General Industry standards can sometimes overlook how OSHA's fall protection requirements apply to more than just employees working at such heights. For instance, because OSHA may consider almost any place an employee can stand on to be a "working/walking surface," OSHA has issued citations to employers because employees were not provided fall protection when they were on loading docks, beds of flatbed trucks, hoods and tops of motor vehicles, machinery housings, scissor lifts, storage racking systems, and roofs and parapets.

In all of these situations, although the risk of falling may appear to be minimal, employees can often be exposed to falls of 4 feet or more. Thus, employers must conduct a fall hazard assessment to evaluate all potential surfaces employees may access and determine whether the employees are exposed to a fall of 4 feet or more and, if so, what type of fall protection must be provided.

Multi-employer Worksites

Because we live in a world of specialization, many employers often have subcontractors at their facilities to perform any number of jobs. In such a situation, OSHA will evaluate employee exposure to hazards and violations under the multi-employer worksite doctrine, whereby a host employer can be issued a citation even when its employees were never exposed to the hazard. The host employer's citation can be based on

Potential Fall Protection Issues from Seemingly Innocuous Situations

Because OSHA may consider almost any place an employee can stand on to be a "working/walking surface," OSHA has issued citations to employers because employees were not provided fall protection when they were on:

- Loading docks
- Beds of flatbed trucks
- Hoods and tops of motor vehicles
- Machinery housings
- Scissor lifts
- Storage racking systems
- Roofs and parapets

Employers must conduct a fall hazard assessment to evaluate all potential surfaces employees may access and determine whether the employees are exposed to a fall of 4 feet or more and, if so, what type of fall protection must be provided.

the claim that the host employer controlled the hazard, created the hazard, or failed to correct the hazard.

In a 2011 OSHA Review Commission decision, OSHA expanded the application of its fall protection requirements to a host employer, even when its employees were never exposed to the hazard. In *Secretary of Labor v. Ryder Transportation Services,* OSHRC Docket No. 10-0551 (ALJ, February 28, 2011), the employer, Ryder Transportation Services, owned a facility that it used to rebuild automotive equipment for its vehicles. Since 2006, no Ryder employee had been on the roof and the roof was classified as a restricted area where employees were forbidden access. In 2009, Ryder requested an outside electrical contractor, M.C. Dean, to install exhaust fans in the facility. After the fans were installed and failed to function, the Dean employees decided to access the roof to determine why the fans, which protruded through the roof, did not function. While on the roof, a Dean employee fell to his death through an unguarded skylight.

Although none of Ryder's employees had accessed the roof and were never exposed to the hazard, OSHA cited Ryder under the multi-employer worksite doctrine as the controlling employer for failing to protect the Dean employee from the hazard. The administrative law judge found that the multi-employer workplace doctrine applied and that Ryder was the controlling employer. But he vacated the citation on a narrow finding that Ryder had "neither actual nor constructive knowledge that an employee would be exposed to unguarded skylights that were *remote* from his work area" (emphasis added). OSHA has appealed the decision.

This decision graphically demonstrates how any employer that engages an outside contractor to perform work is potentially exposed to liability if it does not confirm that the outside contractor employees are protected from fall hazards. This will require the host employer to confirm that subcontractors are aware of potential fall hazards, have provided their employees fall protection, and have properly trained their employees on how to use fall protection.

Recommendations

To avoid potential liability based on fall hazards, an employer should consider the following actions:

- Conduct a job hazard analysis of its facility to determine whether fall hazards exist.
- Once the job hazard analysis has been completed, consider what type of fall protection is required and feasible for employees (and outside contractors) who may be exposed to the fall hazard.
- After the feasible means of fall protection are identified, develop a written procedure that incorporates these measures and also sets out under what circumstances authorized employees can work in areas with fall hazards and what type of fall protection will be required.
- Conduct documented training for the authorized employees who access work near the fall hazards, monitor their compliance and discipline the employees who are non-compliant.
- When the employer is utilizing an outside contractor to perform work in areas that contain fall hazards, conduct and document a meeting with the outside contractor and provide the outside contractor with information on the presence and location of any fall hazards.
- Confirm and document that the outside contractor has been informed of these hazards and that the outside contractor has the means and methods to provide the necessary fall protection for its employees and that it will supervise, monitor and enforce compliance with its fall protection program.

If an employer undertakes these actions, it will minimize its potential liability for fall hazards for its own employees and those of the outside contractor.

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How to Use the New FCC AM Proximity Rules

A telecommunications antenna structure placed near an AM station antenna may produce re-radiation that triggers an FCC requirement to mitigate predicted distortion of the AM station signal pattern.

By Ben Dawson, P.E.

FCC policies on protection of AM antenna system operation have been confusing and not entirely consistent over the past several decades, but new rules adopted in August 2013 and now in effect provide comprehensive policies and procedures for evaluating the effect a new telecommunications facility antenna support structure may have on any nearby AM antenna system.

The history of the FCC's concern about the presence of nearby communications antenna towers on the operation of AM antenna systems dates back at least to the 1960s. More generally, it's based on the "last in" responsibility for the licensee of a new facility to protect pre-existing ones from interference, which itself dates back to the 1940s.

But the FCC's policies and rules about this have never been clear or even completely consistent — until now.

On Aug. 14, 2013, in the Third Report and Order and Second Order on Reconsideration in MM Docket 93-177, the FCC adopted new rules that apply to all services licensed by the agency. The new rules have two parts: first, a threshold test to determine if a study of the possible effect of a new or modified facility is necessary, and second, a method for making that study.

The litmus test is also twofold: how far the structure is located from the AM antenna, and how tall it is (or how tall the modification is if it's an existing structure).

If the new structure is within one wavelength of a nondirectional antenna, and if it's taller than 1/6 of a wavelength, then it requires study. A wavelength has an inverse relationship to frequency. Because electromagnetic waves travel at the speed of light, 300,000,000 meters per second, and because AM station frequencies can be defined in megahertz (1 MHz = 1,000 kHz), the wavelength can be calculated very simply:

wavelength in meters = 300/f in MHz (or 300,000/ f in kHz)

(It's really 299,792,456 but 300,000,000 is close enough for "government work," i.e., most engineering purposes.)

As an example, the wavelength of an AM station using 1430 kHz = 209.79 meters. And because 1 meter = 3.28 feet, the wavelength is 688.3 feet, and 1/6 wavelength or 60 degrees is 114.7 feet, and 1/10 wavelength or 36 degrees is 68.8 feet (see Figure 1).

For a directional AM antenna system, the litmus test is more complex. If the new structure is within the lesser of 10 wavelengths or 3 kilometers (9842.5 feet) of the reference coordinates of the AM antenna and is taller than 36 electrical degrees (1/10 wavelength), then it requires study (see Figure 2).

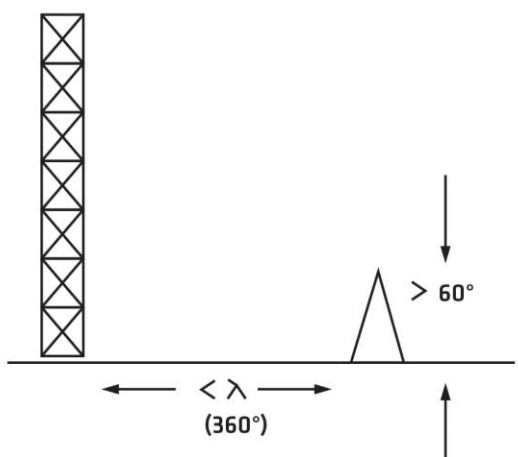

Figure 1. A threshold test for a nondirectional antenna.

The FCC has a convenient website, which uses its accepted formulae for distance calculation: *www.fcc.gov/encyclopedia/distance-and-azimuths-between-two-sets-coordinates.*

But there are some things about use of this utility that need to be considered. First is the fact that broadcasting station geographic coordinates are referenced to the NAD-27 datum, while tower registrations and other FCC licenses use NAD-83 datum values. There's a convenient website for this conversion, too, from NOAA: *www.ngs.noaa.gov/cgi-bin/nadcon.prl*.

The FCC has also provided a utility to locate nearby AM antenna systems and to advise whether a proposed structure would fall within the restrictions of the new rule: *http://fcc.github.io/am-tower-locator.*

This utility is a bit difficult to use, however. It requires that you enter the coordinates of your proposed structure in decimal degrees. It does include a link to a conversion program from degrees/minutes/seconds for that purpose, but it uses the international standard, which calls for longitude as a negative number in the western hemisphere. That requirement isn't included in its instructions, so if you end up with a location somewhere in Asia, go back and make your longitude figure negative. It does the conversion of the AM antenna coordinates from NAD-27 to NAD-83 automatically, however.

Although most AM antenna towers are required to be registered, it's generally better to obtain the location of the AM antenna from the FCC's AM engineering database rather than the tower registration database, particularly because the AM database gives the array center coordinates that are called for in the new rules if the antenna is directional.

This URL will allow you to obtain those coordinates and other information necessary for the analysis: *www.fcc.gov/encyclopedia/am-query-broadcast-station-search*.

Entering the call letters of the AM station will extract its technical parameters from the FCC's Consolidated Database System database and will give the information you need for the next part of the process if your proposed new structure falls within the threshold tests for distance and height.

Performing an Analysis

The new rules call for an analysis of the re-radiation potential of the new or modified antenna structure using a technique called the method of moments. The method of moments is a mathematical technique that allows the computation of currents flowing in a wire conductor, such as an antenna tower. That in turn allows the calculation of the electromagnetic fields generated by an antenna or a re-radiating object because those fields are completely dependent upon the currents.

It's not necessary to be a math whiz to use this technique. There are a variety of computer programs that use the moment method technique, that have data entry that's straightforward and that produce equally straightforward results. The most commonly used program for AM antenna analysis — and the one that has been used by engineers analyzing possible re-radiation almost since its

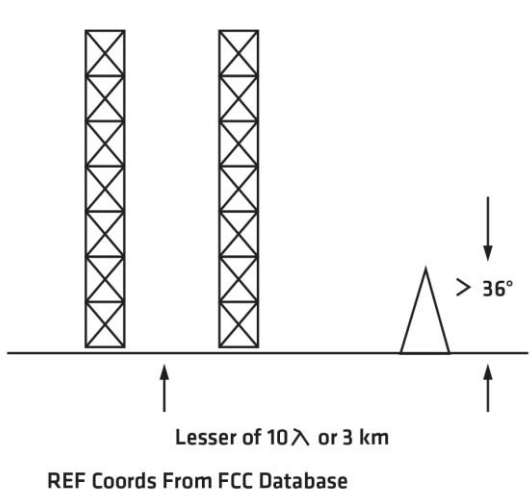

Figure 2. A threshold test for a directional antenna.

first publication — is MININEC. (See The Mininec System: Microcomputer Analysis of Wire Antennas by J.W. Rockway, J.C. Logan, D.W.S. Tam, and S.T. Li, published by Artech House in 1988.) There is a version of this program specifically configured for AM antenna problems, MININEC Broadcast Pro. (See Mininec Broadcast Professional for Windows by J.W. Rockway and J.C. Logan, published by EM Scientific in 1996.)

A variety of other programs can be used, such as versions of NEC, including some commercially available versions such as Ez-NEC and programs tailored for the antenna and EMC design market such as Wipl-D. Those choosing to use NEC (developed for the U.S. Navy and in the public domain) can benefit from a good textbook for its use for AM antenna problems, Basic NEC with Broadcast Applications by J. L. Smith, published by Elsevier/Focal Press in 2008.

The first step is to obtain the data on the horizontal plane radiation pattern

Tower Information:

Tower No.	Field Ratio	Phase (deg)	Spacing (deg)	Orientation (deg)	Electrical Height (deg)	Twr Ref.	-No (#0)	Top Loaded or Sectionalized Tower(s)-				Antenna Structure Registration Number
								A	B	C	D	
1	0.550	-118.00	120.00	270.00	196.00	0	0	0.00	0.00	0.00	0.00	1037777
2	1.000	0.00	35.00	285 .00	196.00	0	0	0.00	0.00	0.00	0.00	1037776
3	0.610	60.00	120.00	90.00	196.00	0	0	0.00	0.00	0.00	0.00	1037778

Figure 3. FCC tower data for a directional antenna.

of the AM antenna. This can be done by copying the information from the FCC's website access to the CDBS database, as described previously.

The FCC's Radio Tools utility for AM data is available at *www.fcc.gov/encyclopedia/am-query-broadcast-station-search*. Simply enter the call letters in the call sign box and ask for detailed output, and it will return the data.

The data for a nondirectional antenna is simple. The database gives the tower height in degrees, the power and the inverse distance field at 1 kilometer, among other things.

The additional data for a directional station obtained from the FCC database shows the electrical and physical parameters of each of the towers in the antenna. An example is shown in Figure 3.

Figure 4 shows the field strength values computed from the antenna parameters. These field strength values represent the inverse distance field at each azimuth (in 5-degree intervals) for the basic theoretical pattern; the FCC's standard or "allocation rules" pattern, which is the theoretical pattern with some specific fudge factors, and, if applicable, the augmented pattern, which is a "tire-patch" for a case in which the measured pattern exceeded the standard pattern but no interference problems resulted. The data also shows the radiation values at pattern maxima and minima as well as at 5-degree intervals.

The theoretical pattern is calculated by a specific formula contained in the FCC rules. There are some simplifying assumptions in that formula, however, and as a result the pattern for an AM antenna calculated with the moment method will not be identical, and in some cases may be quite a bit different. However, our task is not to calculate an absolute value of signal strength, but instead to calculate the effect of the possible re-radiating antenna or tower.

What is needed, then, is a comparison. And this is made by making a moment method model of the AM antenna and the possible re-radiator and calculating the ratio between the results of the model with and without

Azimuth	E_{min}	Azimuth	E_{max}
74.2	183.6	126.2	409.6
147 .1	228.1	222.0	4685.9
273 .4	3968.9	317.3	4431.1

Azimuth	$E_{theoretical}$	$E_{standard}$	$E_{augmented}$
0.0	2364.54	2483.94	
5.0	2002.31	2103.80	2103.80
10.0	1665.67	1750.61	1750.61
15.0	1373.15	1443.82	1443.82
20.0	1138.19	1197.53	1197.53
25.0	964.68	1015.78	1015.78
30.0	843.69	889.15	889.15
35.0	756.10	797.56	797.56
40.0	681.13	719.23	965.61
45.0	604.01	638.78	831.72
50.0	518.36	549.59	750.45
55.0	424.77	452.48	632.37
60.0	328.90	353.66	553.01
65.0	240.89	264.17	470.37
70.0	177.48	201.35	504.74
75.0	159.62	184.13	1004.12

Azimuth	$E_{theoretical}$	$E_{standard}$	$E_{augmented}$
180.0	2335.75	2453.72	2453.72
185.0	2773.41	2913.08	2913.08
190.0	3185.26	3345.40	3345.40
195.0	3554.50	3733.00	3733.00
200.0	3867.78	4061.89	4061.89
205.0	4116.29	4322.78	4322.78
210.0	4296.11	4511.56	4511.56
215.0	4408.22	4629.26	4629.26
220.0	4457.90	4681.42	4681.42
225.0	4453.83	4677.15	4677.15
230.0	4406.97	4627.95	4627.95
235.0	4329.40	4546.51	4546.51
240.0	4233.25	4445.56	4445.56
245.0	4129.83	4336.99	4336.99
250.0	4029.03	4231.17	4231.17
255.0	3938.92	4136.57	4136.57

Figure 4. An example of field strength data from a directional antenna.

the re-radiator. Thus, the results of the moment method model calculation of field at each azimuth can be examined to determine the maximum and minimum values. For the non-directional case, when the ratio of the two values, with and without the re-radiator, is converted to dB and exceeds 2.0 dB, then the possible re-radiator should be arranged so that it can be detuned when constructed.

In the directional antenna situation, it's somewhat more complicated. The moment method model for the case without the re-radiator needs to be compared with that for the case with the re-radiator. Then, at each azimuth, the ratio of those two values with and without the re-radiator should be multiplied against the theoretical pattern data from the FCC database.

If at every azimuth (those at 5-degree intervals from zero to 355 degrees azimuth and at the azimuths of the pattern maxima and minima shown in the FCC database information) the result does not exceed the standard pattern or (if applicable) the augmented pattern values, the possible re-radiator need not be detuned. If at any azimuth it does exceed, then the possible re-radiator should be detuned when constructed.

All of the values for radiation from AM antennas in the FCC database are for the assumption of perfect conductivity and at a distance of 1 kilometer from the antenna, and the FCC calculation formula assumes that at that distance, the electric and magnetic fields are in their far-field relationship of 120 π. In reality, that's fairly often not the case, and the moment method calculation, based as it is on assumptions much closer to the real physics of the situation, will show that. The moment method calculation, however, as with the FCC inverse distance field values, does assume perfect conductivity so that field strength values diminish as 1/R. As a consequence, the comparison calculation using the moment method can be done at a greater distance, say, 10 kilometers, where the E/H ratio will be related by 120 π because the ratio of the pattern with and without the re-radiator, not absolute value, is the determining factor in the analysis. This is particularly helpful when the potential re-radiator — your new tower project — is located close to a 1-kilometer radius from the AM antenna, which is often the case.

Figure 5 is a spreadsheet showing the results of an analysis where a substantial re-radiating communications tower is located less than 1,000 feet from a three-element directional antenna. The results show that the re-radiation is significant enough to result in pattern distortion values that exceed the standard or augmented values in most directions. This communications tower clearly needs to be detuned.

Some additional parts of the new rule are helpful in some cases. If a new antenna is to be mounted on an AM tower, there are specific rules for the new measurements that are required on the AM antenna, and these are all consistent with the basic AM antenna technical rules and now are clearly codified. The new rules also establish thresholds for the study of nearby AM antenna patterns when new construction or significant modification is to take place on an existing structure, and for structures

	Mininec	Mininec with Reradiator	Ratio	FCC	FCC	FCC Theo	If Theo *Ratio > Std/Aug
AZ	mV/m km	mV/m km	C/B	Theo	Augmented	x ratio	Over
0	778.9125	944.1892	1.212189046	805.62	846.50	976.56	OVER
5	667.2182	829.1488	1.242695118	690.10	725.30	857.58	OVER
10	560.8904	663.9324	1.18371147	580.12	610.00	686.69	OVER
15	466.9833	470.3284	1.007163211	483.00	508.10	486.46	OK
20	394.0137	317.8866	0.806790728	407.52	429.10	328.78	OK
25	349.8442	314.7455	0.89967334	361.84	381.30	325.54	OK
30	336.3035	406.6837	1.209275848	347.84	384.60	420.63	OVER
35	345.5956	471.6280	1.364681726	357.45	376.70	487.81	OVER
40	365.0928	472.9260	1.295358331	377.61	397.80	489.14	OVER
45	384.2873	422.5852	1.099659552	397.46	418.60	437.07	OVER
50	397.0504	359.6979	0.905925041	410.67	432.40	372.04	OK
55	400.9386	331.2987	0.826307819	414.69	436.60	342.66	OK
60	396.1025	351.4679	0.887315531	409.68	431.40	363.52	OK
65	384.4722	390.8243	1.016521611	397.66	418.80	404.23	OK
70	369.1517	421.8231	1.142682263	381.81	402.20	436.29	OVER
75	353.8397	436.8627	1.234634497	365.97	385.60	451.84	OVER
80	342.1169	440.6614	1.288043356	353.85	372.90	455.77	OVER
85	336.5789	441.2723	1.311051584	348.12	366.90	456.40	OVER
90	338.0922	444.4691	1.314638729	349.69	368.60	459.72	OVER
95	345.6397	451.9190	1.307485801	357.49	376.70	467.41	OVER
100	356.8876	462.2916	1.295342287	369.13	388.90	478.15	OVER
105	369.0634	473.2478	1.282294045	381.72	402.10	489.48	OVER
110	379.6551	482.7287	1.271492731	392.67	413.50	499.28	OVER
115	386.7728	489.3340	1.265171698	400.04	42 1.20	506.12	OVER
120	389.2722	492.2458	1.264528523	402.62	424.00	509.12	OVER
125	386.7728	491.0790	1.26968339	400.04	42 1.20	507.92	OVER
130	379.6551	485.8266	1.279652506	392.67	413.50	502.48	OVER
135	369.0635	476.9380	1.292292519	381.72	402.10	493.29	OVER
140	356.8876	465.4976	1.304325508	369.13	388.90	481.47	OVER
145	345.6397	453.3166	1.311529318	357.49	376.70	468.86	OVER
150	338.0922	442.5101	1.308844451	349.69	368.60	457.69	OVER
155	336.5789	434.1294	1.289829517	348.12	366.90	449.02	OVER
160	342.1169	426.2519	1.245924712	353.85	372.90	440.87	OVER
165	353.8397	413.4215	1.168386419	365.97	385.60	427.59	OVER
170	369.1517	389.6660	1.055571463	381.81	402.20	403.03	OVER
175	384.4722	355.8283	0.925498124	397.66	418.80	368.03	OK

Figure 5. An evaluation of data.

located on existing buildings. These are shown in Figures 6 and 7.

The new rules set forth the timetables for notification to the AM station of the proposed construction. If a structure that passed the threshold tests is perceived to actually cause a re-radiation problem by an AM station, there is a procedure for the station to make an analysis showing the problem and to provide that showing to the tower proponent or owner and to the FCC for the latter's determination of appropriate action. There is also a provision for an AM station to provide a showing to the FCC that a tower constructed prior to the adoption of these new rules is adversely affecting its radiation pattern, for possible FCC action. The new rules also allow a traditional field measurement or partial proof of performance before and after construction of a new tower if the AM antenna in question was licensed with a traditional fieldstrength measurement proof of performance.

Conclusion

In addition to the adoption of analysis methods that are much more scientifically defensible than the field measurement requirements of the previous rules and case law-based policies, the new rules provide a far more straightforward and clear-cut set of requirements for antenna structure proponents to follow.

Ben Dawson, P.E., is the managing partner of Hatfield & Dawson Consulting Engineers, Seattle.

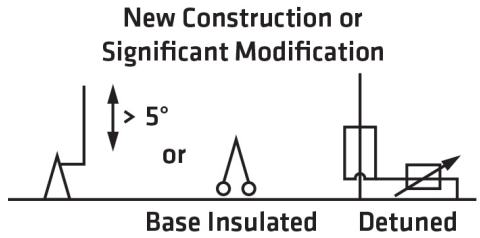

Figure 6. Existing structure changes requiring study.

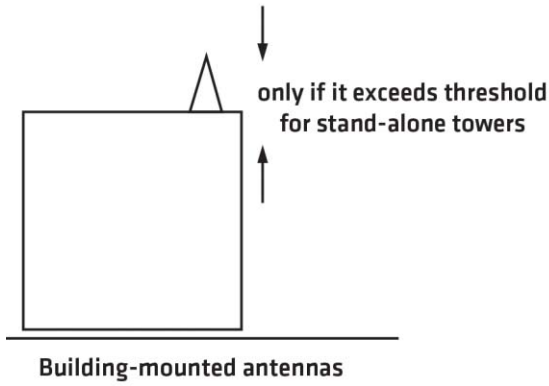

Figure 7. Construction on buildings requiring study.

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www.flashtechnology.com

LED OBSTRUCTION LIGHTS

The H&P Horizon line of American-made, medium-intensity, strobe LED-based obstruction lights from **Hughey & Phillips** suit daytime and nighttime lighting on tall structures such as communications, television and radio towers. The series is available in L864 (red), L865 (white) and L864/L865 (red/white). Intertek (ETL)-certified and FAA-approved, the lights provide both daytime white and nighttime red illumination. A microprocessor-controlled LED strobe system boasts a self-contained power supply that simplifies wiring and also accepts external signals if necessary. The lights feature a compact design weighing 18 pounds, built-in testing, GPS sync, automatic day/night sensor, wiring compatibility and easy installation. The lighting units are compatible with existing cable systems in most cases, allowing users to retrofit to LED using the existing cable on the structure.

www.hugheyandphillips.com

TOWER LIGHTING MANUFACTURING AND MAINTENANCE

Slatercom-WCD is a national and international lighting distributor and tower-maintenance company offering custom options for LED obstruction tower lighting. The company manufactures and integrates obstruction light controllers, solar off-grid power generators, solar lighting and lighting mounts. It installs its own LED tower lighting systems using its own crew or a network of partnering contractors. It offers solutions for lighting systems and employs sales engineers who provide technical assistance and system layouts.

www.slatercom.com

READY-TO-SHIP OBSTRUCTION LIGHTING

Unimar, an aviation obstruction lighting company specializing in custom and standard aviation obstruction lighting systems, offers a rapid-ship program in which standard system configurations, including FAA types A0, A1, A2, D1, D2, E1 and E2 systems, are prebuilt and packaged ready to ship, often the same or next day, depending on the time of order. These products include the appropriate beacon lights L-864 or L-865, L-810 side marker lights, controller and photocell. Cabling cut to length and installation kits are also available to provide a complete, ready-to-install solution. The systems carry a five-year warranty, and Unimar offers service and support.

www.unimar.com

LED LOW-INTENSITY RED OBSTRUCTION LIGHT

The L810LED1 from **Farlight** is an omnidirectional, red, steady-burning obstruction light designed for marking tall structures such as telecommunications and broadcast towers, masts and other hazards to aircraft. The lights are available in single, double and retrofit configurations. A solar-drive package is optional. A hazardous locations version is also available. The lights are Intertek ETL-certified to FAA Advisory Circular 150/5345-43G (L-810) and FAA Engineering Brief 67. They are suitable for use in Class I, Division 2, Groups A-D, or unclassified locations. The lights are compliant with ICAO Annex 14 (Low-intensity Obstacle Light).

www.farlight.com

TOWER LIGHTING AND TOWER MONITORING SYSTEMS

The L450 dual-LED, FAA medium-intensity tower lights from **TWR Lighting** incorporate advanced optical engineering and LED technology. The products feature a built-in power module that allows for a single-controller and single-cable installation even with multiple flash heads. The design makes the lights easy to install and enables them to operate reliably under harsh conditions. The design is also intended to minimize both the capital cost and total cost of ownership.

TWR Lighting also offers the TWR /Hark DM900/DM32 remote monitoring systems, a product that allows the elimination of quarterly light inspections, potentially saving owners thousands of dollars annually. The remote monitoring systems are designed to interface with all FAA-approved alarmed lighting systems and with other site equipment such as generators or air conditioning units utilizing contact closures or voltage alarms. Remote monitoring options include CDMA/GPRS wireless modems, Ethernet TCP/IP, satellite, POTS line and Windows-based software.

www.twrlighting.com

RED INFRARED OBSTRUCTION LIGHTS

The Vigilant series L-810 red infrared obstruction lights from **Dialight** incorporate infrared LEDs to make the lights more clearly visible to aircraft pilots who use night-vision goggles during flight. Night-vision goggles are commonly equipped with filters that are not sensitive to normal LED light. The use of infrared LEDs, along with standard red LEDs, allows for these obstruction lights to be seen clearly with or without night-vision goggles. With FAA certification for all tower and obstruction types and heights, the obstruction lights have low power consumption, a small size, reduced wind load and less weight.

www.dialight.com

OBSTRUCTION LIGHTING

Specialty Tower Lighting offers a diverse line of Intertek ETL-certified and FAA-approved aviation obstruction lighting products. The SL-2 LED FAA-810 LED double-obstruction light needs no preventive maintenance after proper


"SURE, AT FIRST I WAS A LITTLE TAKEN ABACK BY THE WHOLE PEEING STANDING UP THING. BUT I TAUGHT HIM TO THROW A STICK AND NOW HANGING OUT WITH HIM IS THE BEST PART OF MY DAY."
–EINSTEIN
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A PERSON IS THE BEST THING TO HAPPEN TO A SHELTER PET
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installation. Resistant to heavy rain, corrosion, shock and vibration, the lighting products consume 95 percent less power than incandescent lighting while offering 50 times longer life. The aluminum-based lights have a five-year warranty and are direct replacements for existing incandescent sidelights.
www.specialtytowerlighting.com

MONITOR CONTROLLER AND THE PHOTO ELECTRIC CONTROL

Skytec offers many built-to-order products for high-intensity strobe lighting. Model 8364 monitor controllers and model 8014 photoelectric controls are built to work with a variety of strobe systems. Lightweight and compact, the controller has an easy-to-use, one-dial control. It has no cumbersome menus to work through. Because it is compatible with existing controllers, it requires no expensive board changes. The product features remote-monitor capabilities for all lights and functions. It saves multiple climbs, thus saving time for the crews and money for the end user. The controller is backward compatible to work with most systems dating back to the 1970s. It can act as a master controller, or it can be tied in parallel with the existing control panel to provide additional remote-monitoring capability. The photoelectric controls feature dual contacts for separate twilight and night operations.
www.skytecinc.com

OBSTRUCTION LAMPS

The Task-Master obstruction lamps from **H&H Industries** are independently tested to meet or exceed all FAA regulations. The 116-watt lamps feature strong C-9 filament construction to burn brightly and dependably through shock and vibration for 8,000 maintenance-free hours. The nickel-plated brass base cannot corrode or freeze in the socket. The lamps are available in 120-, 130- and 230-volt models. The lamps come with a one-year free-replacement warranty.
www.lightsbyhh.com

MEDIUM-INTENSITY RED BEACON

Model IFH-1700-000 beacon from **International Tower Lighting** uses the latest LED technology and advanced optics to achieve a compact, energy-efficient, L-864(L) medium-intensity red beacon. The beacon comes ready for installation with a 10-foot cable attached. Designed for durability, the beacon has an aluminum top and base and clear acrylic cover. The beacon is designed for long-term maintainability with field-replaceable LED boards, power supply board and light engine.
www.itl-llc.com

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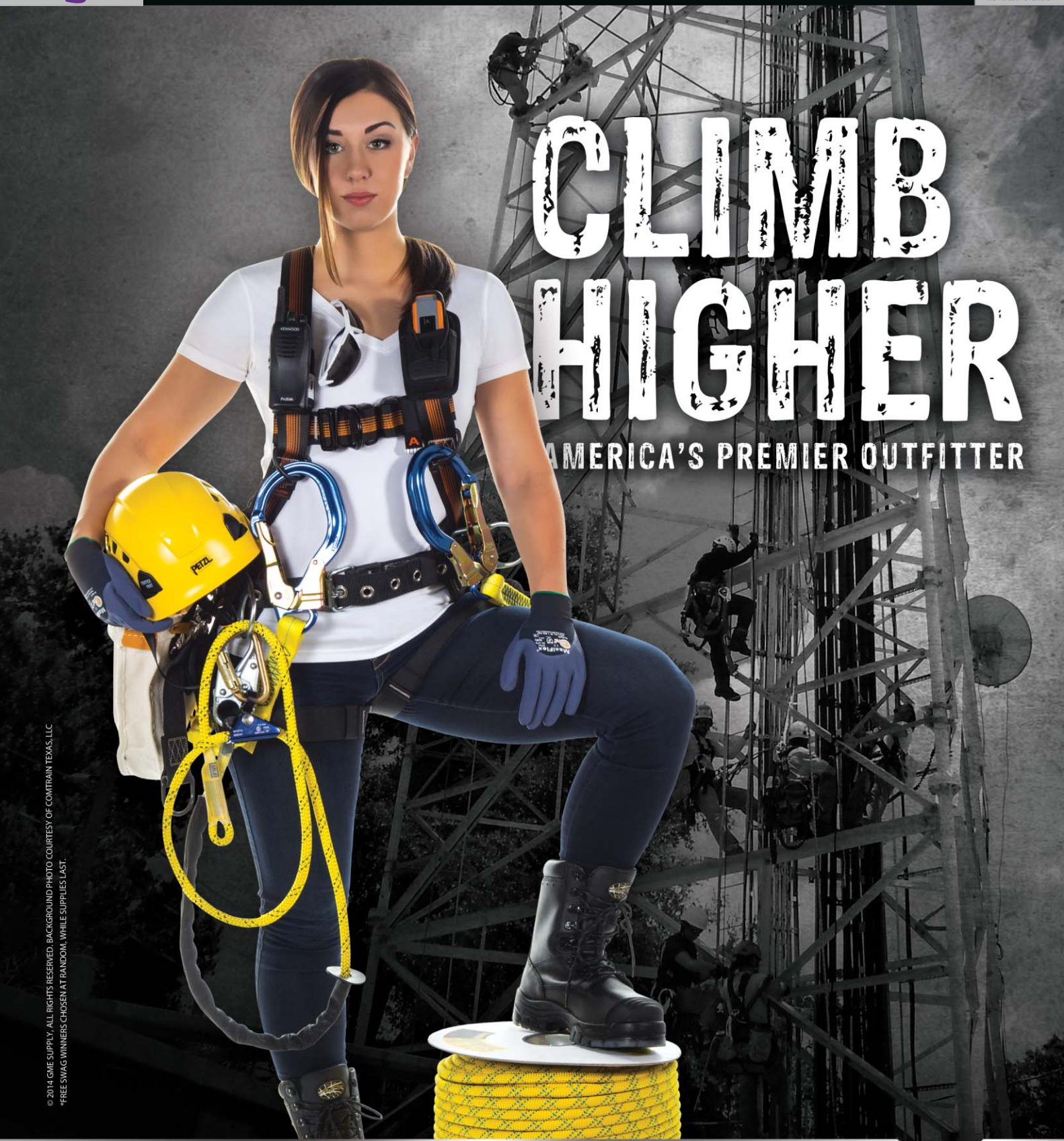

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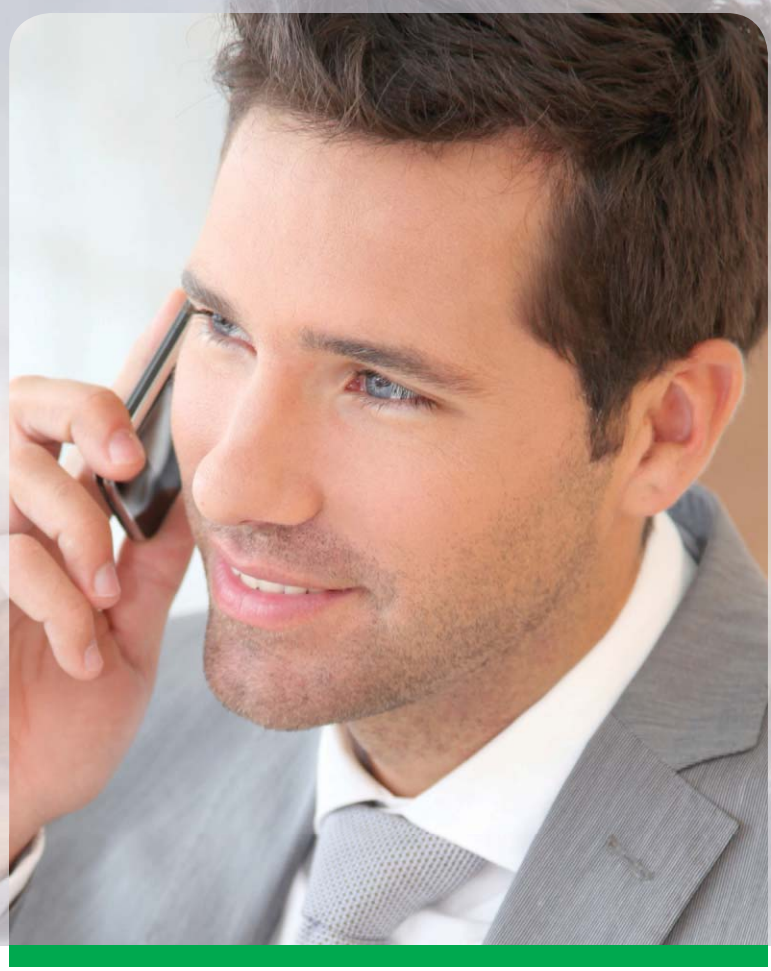

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