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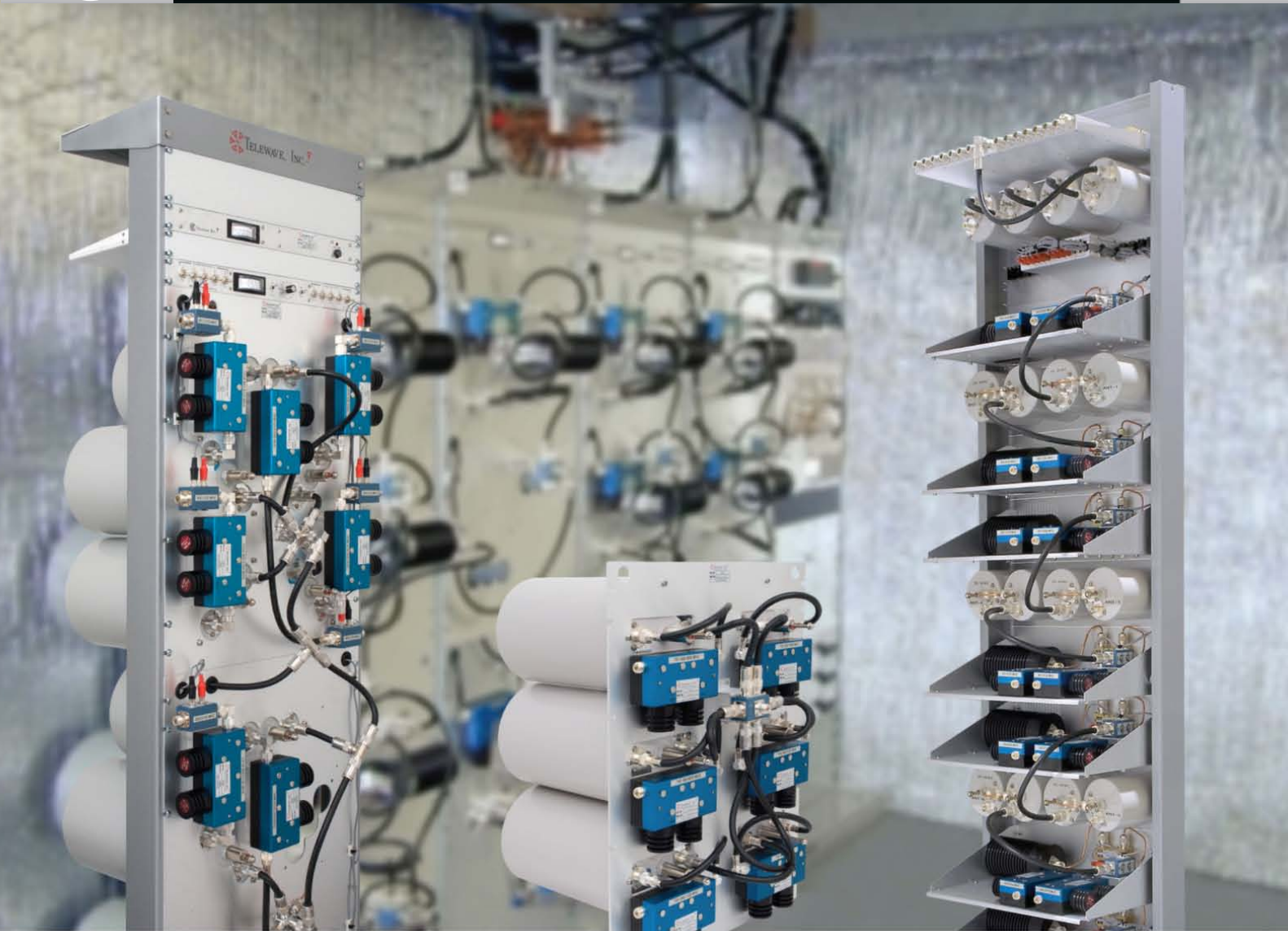
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on the cover

The Mount Saint Helena North Peak site in Sonoma County, Calif., serves broadcasting and wireless telecommunications. Photo courtesy of ComSites West.

Cover design by Scott Dolash

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editorial comment

Make It More Clear

During the final minutes of one of the educational sessions at PCIA's Wireless Infrastructure Show in Hollywood, Fla., the moderator asked panelists to make



one prediction for next year. "We'll still be wondering what FirstNet is going to do," said one of them. FirstNet is the name of a nationwide wireless communications network intended to serve public safety first-responders using LTE technology

that would allow interoperable communications among various local, state and federal authorities. It is a function of the First Responder Network Authority under the U.S. Department of Commerce.

Bill D'Agostino, FirstNet's general manager, delivered a keynote speech at the show in which he went to great lengths to clarify what FirstNet needs to launch its nationwide network. He acknowledged that the project is complicated and involves variables that challenge the best efforts to define, confine and refine them.

He said it has been 12 years since 9/11 called such a high level of attention to the need for an interoperable wireless communications system to support the activities of first responders during emergencies. Despite the difficulties, he said, it is time to solve the interoperability problem that has prevented first responders from communicating among themselves using their primary wireless networks.

Maybe this time next year it will be clear to all what FirstNet is going to do.

Tribal interest

A matter of growing concern among site acquisition specialists and others who perform land work leading to the

By Don Bishop, Executive Editor
dbishop@agl-mag.com

collocation of antennas on existing towers and the construction of new towers involves requirements for obtaining tribal approval, delays associated with those approvals and rising consultation fees charged by tribes.

"We see a lot of tribal interest in projects that probably don't require any tribal interest," said Monica Gambino, vice president of legal at Crown Castle USA. "For example, a straight collocation on a tower or a placement of a pole in a right of way. Tribes want to know about it and want consultation fees, and it takes time to work through all that process. There has to be a happy medium. The problem is that they're sovereign nations. It's not as simple as just having the FCC make a rule. There's a lot of international cooperation that goes with it. The FCC has been reluctant to open it up too many times."

Gambino spoke at the Wireless Infrastructure Show. Her comments highlight a need for the FCC to revisit the subject of tribal interest in antenna-siting projects. It isn't necessarily widely known, but the requirements for tribal approvals extend far beyond tribal land, and in fact those are the cases that may prove the most problematic.

Examples we've heard include tribal authorities taking an interest in proposed rooftop collocations where construction took place years before, and existing buildings are on land in which tribes express having an interest for historical reasons. Nothing that might take place on the rooftop would change the building footprint, but steps have to be taken to satisfy requirements for tribal approval, nevertheless.

The current climate is one in which the FCC seems willing to go to great lengths to facilitate the expansion of broadband communications services, whether wired or wireless. The time seems ripe for the commission to open up negotiations with tribes once again to see what might be done to help the wireless infrastructure side of broadband communications service expansion. ■



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publisher's note

The Best Place

First, congratulations to PCIA President and CEO Jonathan Adelstein and the PCIA staff for an absolutely excellent show this year in Hollywood, Fla. The association is strong and well-organized. PCIA remains the

absolute best place to meet with others in the industry and learn about overall industry trends. It has a great team and a great show. My thanks to PCIA for all of the hospitality.

One of the more exciting industry trends is the near

panic over the volume and longevity of the projects to be done. Apparently, it won't be over anytime soon. Macro sites are still where most of the work is happening; however, in-building wireless, small sites and almost every other configuration of anything with an antenna is fair game for an explosion of opportunity.

Global Tower Partners

For me, another hot topic was the Global Tower Partners sale to American Tower, which looks to be on track. I heard general discussion of how much sense it makes. The geographic and customer diversity between the portfolios makes this look like a great acquisition. And anytime you put money in the pockets of industry greats like those at GTP and (last year) TowerCo, you know they'll be back. I saw a number of the legends of the industry at PCIA, although they're keeping a low profile for now. As a parent of elementary school-age kids, I keep thinking of the simple science of life. It all goes in cycles. And our industry remains in a fantastic growth period.

By the time you read this, AT&T Towers probably will be part of Crown

Castle International, if the rumors are true. That leaves my fellow D.C.-based friends at InSite Wireless Group as the largest independent tower company. Yay InSite! Do we still call it the tower industry, or do we rebrand it the communications antenna-siting industry?

Small sites, picosites, microsites, ballast towers, DAS and all the other new widgets and technology were also all the buzz. The idea that the antennas need to be closer to users appears to have made its way from the research lab to the people who do the designing, permitting and deployment. Many people ask me if this means the macro sites will be decommissioned. Answer: absolutely not. However, the macro sites will continue to be the exclusive domain of the carrier. Carrier-grade network services will transmit from the macro and outdoor DAS, and from some critical indoor DAS/small cell systems. However, the majority of in-building, in-fill and capacity sites seem to be ripe for the picking.

An interesting choice for general manager of FirstNet is Bill D'Agostino Jr. because he is a tower guy, a cellular guy and a cellular network deployment guy. This just goes to show how much FirstNet really is a cellular network — well, of the LTE flavor. FirstNet's deployment and network operation are going to be little different from any other nationwide LTE network. The training, applications, uses, pressure, redundancy, resilience and many other operational details will be public safety grade. Many challenges face FirstNet, and Bill's keynote PCIA speech made it clear there also is real opportunity. There is no way to pay for the entire FirstNet deployment without providing ways

for commercial operators to use some FirstNet bandwidth, and for FirstNet to leverage some throughput that comes with the commercial operators' larger spectrum holding.

On that public safety topic, I'm an old P25 (the narrowband, 25-kHz, digital public safety standard) guy, having worked on some TIA TSB 88 standard committees in years past. This is a great example of a system that was effective at the time it was developed, but quickly became outdated. Here in D.C., we've seen P25 systems fail at critical times, most recently during the Navy Yard shootings in September. If you did not have a cell phone, you did not have much communication. The best plans fail too often. The nonproprietary systems often work without as much preparation. The same was true during 9/11, although in New York City, so much of both the commercial and public safety networks (and the backhaul infrastructure they both relied on) was lost. Maybe having public safety users on commercial networks would provide some of the resilience needed in uncertain times.

Safety for tower workers

I've recently had the opportunity to do some tower work with my engineering company hat on, and I've been surprised at the state of that side of the industry. Unfortunately, *AGL* has had to report entirely too many accidents and tragedies. It can make the *AGL Link* email newsletter sometimes look like the local obituary pages. Exactly why so many accidents continue to occur, I can't claim to know. More work needs to be done to improve safety for workers at tower sites. The number of fatalities needs to go to zero. ■



Photograph courtesy of mkefosterphotography.com

By Rich Biby, Publisher
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research

Help for LTE: Wi-Fi for Mobile Operators

By Chris Nicoll

Nearly 70 percent of fixed and mobile operators we surveyed have deployed Wi-Fi to meet the data consumption and service requirements of their customers, yet most operators are finding it difficult to create a compelling business case for Wi-Fi. However, as the role for Wi-Fi in a mobile network becomes clearer, the monetization options are becoming clearer as well, according to Analysys Mason's report, "The Case For Wi-Fi: Benefits and Challenges for Mobile Operators in an LTE World," published in July.

Wi-Fi is frequently seen to be competing with cellular services, but it is playing an increasingly important role in mobile network operators' (MNOs') approaches to traffic management, improving customer satisfaction and controlling churn — particularly for MNOs that also offer fixed line and content services with the ability to extend premium home services to on-the-go users. Monetizing Wi-Fi services has been difficult, but this situation will change.

Wi-Fi's four key roles

Contrary to concerns that many MNOs have about Wi-Fi cannibalizing cellular traffic, we have seen few specific examples or cases in which this is happening extensively. Instead, our conversations with MNOs around the world suggest that Wi-Fi plays four key roles in MNO business strategy.

Capacity and coverage extension: Wi-Fi adds network capacity and coverage to macro cellular networks where mobile spectrum may be constrained. Wi-Fi can also fill in for "notspots," and we expect it to be used with most small-cell deployments.

Supplementary wireless data service for end users: Wi-Fi can also be used to augment cellular data caps, offering a low-cost/no-cost wireless service to users and connectivity to devices (such as tablets) that are not connected to the cellular network.

Roaming support for out-of-area and international services: Cellular data tariffs are usually high enough to encourage users to find suitable Wi-Fi services for noncritical data communication needs.

Service and brand differentiation extending home-based premium services to users on the go: MNO-branded Wi-Fi hotspots serve as a reminder for subscribers (and nonsubscribers).

The monetization challenge

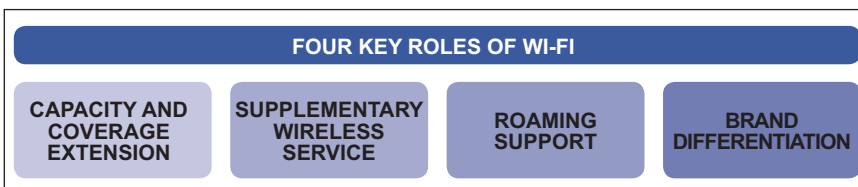
Today's Wi-Fi business cases are relatively basic. Few operators that took part in our survey consider Wi-Fi to be a significant revenue generator, and those that have already deployed the technology indicated that it is revenue-neutral. However, most MNOs view Wi-Fi as critical to customer satisfaction and retention.

Monetization options are largely

limited to direct user charging, location-based services or charging the venue operator, sponsored content and retail partnering with stores such as Starbucks. We expect future monetization options to include selling insight about Wi-Fi users' behavior and usage as well as direct marketing activities such as couponing and tie-ins to loyalty programs by retailers. New Wi-Fi solutions from vendors such as Cisco Systems and Ruckus Wireless provide extensive data analytics that can enhance location-based services and offer additional revenue-generating opportunities for marketing, advertising and loyalty programs. However, both MNOs and retailers will need to create new business systems in order to capitalize on the business opportunities that are offered by the insights. In particular, MNOs will be challenged to invest in systems to enable Wi-Fi analytics data to be combined with a variety of other sources including the MNO's cellular network data and the retailers' data in order to generate useful marketing insights.

Wi-Fi clearly provides key benefits for most MNOs. Monetization of Wi-Fi by the carriers is in the early stages of development, but Passpoint 2.0 and Phase 2 of the Next Generation Hotspot specifications will be launched in 2013 and both will bring Wi-Fi closer to cellular standards for security, access control and performance management. Monetization opportunities will improve with these new developments, and we expect to see better monetization of Wi-Fi across MNO and retail markets by 2015. ■

Chris Nicoll is a principal analyst with Analysys Mason. His email address is chris.nicoll@analysismason.com.



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guest opinion

Being Trained Doesn't Make You a Tower Hand

To send someone to do a job right after attending a basic training course without being accompanied by seasoned climbers or, worse yet, *alone*, is not only irresponsible, but unconscionable.

By Dr. Bridgette Hester

When I established the Hubble Foundation, I jumped in headlong. I wanted to create a foundation to advocate for the tower climbers in the wireless infrastructure industry, and especially for the families of the climbers who perished. I knew very little and wasn't sure exactly what I was doing, but I did know a couple things for certain. First, I wanted to be the climber advocate — no hesitation, no questions. I was just going to do it and learn as I went along. Second, I needed to know what they did for a living — not in theory — in

phone calls, and a few nights of crying about new fatalities, I was ready. I needed to get myself "Comtrained." I told myself I couldn't advocate to the best of my ability unless I took the class, donned a harness and climbed a tower myself.

My late husband Jonce Hubble had done this for a living. He died doing the job, and I thought I knew what I was getting myself into. Wrong. For those of us who are more suited for office work or academia, putting on a harness, even with no tools, and using pelican

hooks to climb a broadcast tower is a bit intimidating, to say the least. I endured heat, sweat, cumbersome equipment and my own nerves. This is nothing compared with what these men and women face every day. However, I can assure

After the Comtrain class, I was well-equipped, I knew the basics, I knew I could rescue someone if I needed to do so, I could tie some knots, and I could be 100 percent at all times. I knew how to keep myself safe. I knew the basics. The class was great, the instructors were fabulous, and the material overwhelming. Knowing the information and actually using that information to execute the job are two completely different animals. In the midst of climbing, I was simply astounded by the information I had to keep in the forefront of my brain while trying to get myself up the tower and rescue someone. I was concentrating so hard on calming myself a few times, I was *not* paying attention to the Y-lanyard being under my arm, my gate on the pelican hook not facing the right way, or getting myself wrapped in the descent line. These things were pointed out to me as I climbed, and I corrected the situations.

I tried to place myself in the mindset that I was really on the job, that I was really going to be rescued because I had made a mistake or had an accident,

The author is pictured on a tower in Texas where she received climbing safety, fall protection and rescue training provided by an instructor who received instructor training from ComTrain.

Jonce Hubble and the Hubble Foundation

On July 22, 2010, Jonce Hubble, 41, died of injuries sustained when a 300-foot tower collapsed after a bucket truck collided with the tower's guy wires. His co-worker, Barry Sloan, 37, also died of injuries sustained when the tower fell. They were at the 40-foot level, climbing

down. Bridgette Hester was Hubble's wife. She is the founder and president of the Hubble Foundation, which is dedicated to promoting the safety of tower workers, site crews and green energy turbine climbers. The Hubble Foundation website is at www.hubblefoundation.org.

practice. After 18 months of getting organized, making contacts, granting scholarships, sending a climber to instructor's school, helping stranded climbers, writing grants, answering emails, making and receiving endless

you that those minor conditions alone were sufficient enough to confirm that I am not a tower climber in any form or fashion. I did obtain the understanding I was searching for, which, in the end, will make me a better advocate.



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The author descends from a tower during safety and rescue training.

and that I was really going to rescue my current husband (we took the class together). While climbing, I realized that the sheer amount of information I had to remember was immense, immediate, and could make the difference between life and death. If I would have had to actually rescue my husband, it wouldn't have been pretty. He probably would have ended up having a femoral blood clot or problems with his breathing from hanging in the harness too long. I wasn't fast enough, I wasn't fluid enough, and I just wasn't comfortable enough yet physically or mentally. It was daunting. Anyone who has never climbed for a living, who gets trained only in the basics, and who states they aren't nervous (or at least apprehensive) or states they are fully capable of handling *any* situation, is either a liar or an overconfident employee who will end up getting one of your crew killed.

Do I believe that there are people who have never been in the business but nevertheless are naturally gifted climbers with no fear of heights, with no problem working in any kind of weather, and who are physically able

This job attracts strong personalities and with that comes a responsibility for the employer to ensure that the employees they hire are not only capable, but that they are also truly cognizant of the hazards and the safety protocol.

to attend to the duties of the job? Absolutely. Do I also believe that those same people should be (at a bare minimum) nervous about scaling a structure and having to possibly be responsible for another human being if the need should arise? I think they had better be. If they

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aren't, you have a potential problem. This job attracts strong personalities and with that comes a responsibility for the employer to ensure that the employees they hire are not only capable, but that they are also truly cognizant of the hazards and the safety protocol. The employers are responsible for making sure that those employees are willing and capable of understanding that their lives and the lives of others depend on their exercise of good judgment and the solid execution of what they have learned.

I would recommend that every employee of any telecommunications company, wireless carriers included, take basic climber training.

Both of my trainers (I trained twice) were very quick to tell me that the training is *basic*. Once you take the basic course, there remain years' worth of jobs, situations and additional training courses that need to be completed before anyone can ever truly be considered to be experienced. You don't take just anybody, throw him in a harness, run him through climber basic training, and then send him up the tower. It is likely that those who handle the business end of telecommunications, and maybe that includes you, have never put on a harness, climbed a tower and braved the elements (weather, bird feces, bird attacks, hideous deadlines, rain, sleet, snow and angry dogs). I understand that it's not your cup of tea. Trust me, it's not mine, either.

However, I would recommend that every employee of any telecommunications company, wireless carriers included, take basic climber training. Unless you understand your climbers and what they actually do, you don't understand your business. It really is that simple.

Since I have jumped into the advo-



The author, wearing fall protection equipment.

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guest opinion



cacy role, I have heard accounts and I have spoken to the climbers involved in which newly trained, green climbers, fresh from a training facility, were loaded into a truck, sent off to a jobsite, and told to “Get it done.” Newly trained

climbers are being sent out with only other green hands on-site, or worse, sent out alone.

The question I have when I hear this is, “What in the world is wrong with their employers?” In their infinite

wisdom, the employers have decided that since the climber has passed a basic training course, they are fit to be sent up a tower to perform tasks for which they have zero practical experience. I can technically climb now. Big deal. That hardly qualifies me to scale a tower and install an antenna. I understand on-the-job training. It’s indispensable, but to send someone to do a job right from training without being accompanied by seasoned climbers or, worse yet, alone, is not only irresponsible, but unconscionable. They are going to get someone killed, and ultimately, that will be on your head. Just because you sent your brand new men and women to a basic training course — listen to me — does not make them tower hands. Period. ■

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 green energy turbine climbers. Her email address is bridgette@hubblefoundation.org. Photos courtesy of the author.

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safety

Who Do You Want Building Your Network?

The trade association for tower construction and service companies explains why wireless carriers and tower owners would be well served by using workers from its member companies.

By Todd Schlekeway

AGL's executive editor and associate publisher, Don Bishop, interviewed Todd Schlekeway, executive director of the National Association of Tower Erectors, about his speech to the AGL Regional Conference in Chicago, "Who Do You Want Building Your Network?" The following are the NATE leader's remarks, edited for length and style.

Qualified contractors can do the work, the best quality work, and do the work safely because they have a proven track record. We're trying to drive home the point to the industry right now that, as busy as it is, contractors need to be vetted to make sure that they're qualified. What better place to go than members of NATE because when you're a member of NATE you have access to all of the safety resources and best practices that help create the culture of safety within your own individual company. That is the message and overriding theme. The message has been well received, but it continues to be needed to reach more people, stakeholders in the industry.

We focus on safety standards and education. That's what we're about. We want to partner, if you're a member company, so you have access to everything we have to offer. You have an opportunity to be a part of our standing committees, attend educational sessions and have access to members-



AGL Video Extra

only resources and members-only sections of our website.

Partnerships

We also want to partner with state wireless associations. We believe we represent part of the equation that is essential for wireless services to be delivered. So we want to partner with other organizations, whether it be state wireless associations, CTIA, PCIA, tower owners, contractors, equipment manufacturers or the carriers — all the players in the industry. We have resources that promote safety and that can make this industry safer.

With CTIA, Steve Largent, its president, is someone who commands a lot of respect in this industry. Speaking at

our convention in 2013, he said, "I have a deep admiration for the work that the tower construction and maintenance industry does with the wireless communications industry. It is indispensable, valuable and the features that you add to the wireless service ... there would be no wireless service without what you do." That statement summarizes the effect that tower construction and elevated workers have on the industry. I thought it was powerful.

There would be no wireless communications services without the effort of the men and women working on tower sites, conducting the LTE build outs, doing the antenna aligning work. We were blessed to have Steve attend our show. We're always looking to get more

involved with the carriers because they are a key part of this equation. From a safety perspective, everyone on the chain has a role to play when it comes to safety. Thus, I thought his statement was very powerful.

I have conversations with our members every day. The one common denominator is that everyone is extremely busy. It's not unusual for me to be talking with a member and they're on a tower site or they're taking a break from work. I hear it every day, and who knows how long the build out cycle will last. There are projections for the next two to four years. Certainly, it's a busy time in the industry so we are working hard to make sure that safety is not compromised during this busy cycle and to make sure that everyone in the industry can access our resources.

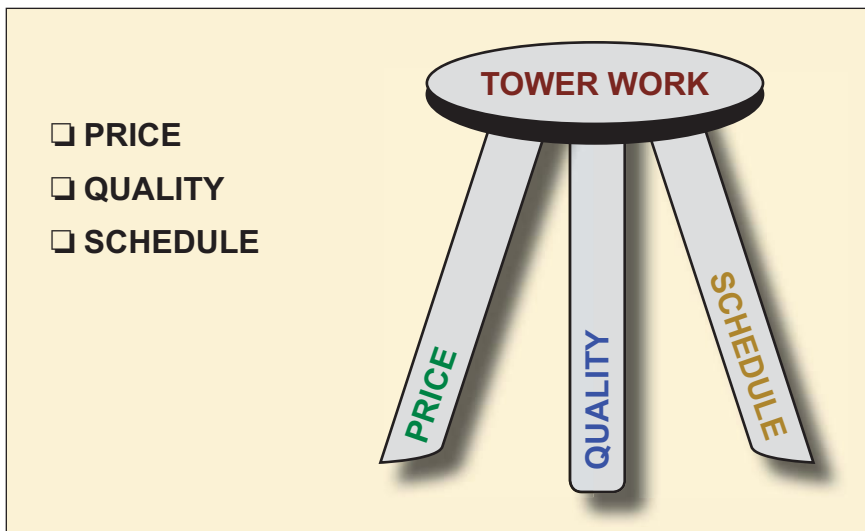
Many of these new companies springing up really need to pursue NATE so they gain access to our best practices and our resources. When it

We're always looking to get more involved with the carriers because they are a key part of this equation. From a safety perspective, everyone on the chain has a role to play when it comes to safety.

comes to finding the new companies, we get leads from members who will pass on someone they met while doing a bid walk on a tower site project. But there are companies springing up by the month, now, because there is work out there. We're being aggressive about attending all of the industry trade shows and getting in front of the wireless association events. But our best resources for finding new companies and encouraging them to pursue NATE membership are our own members, who are our best advocates.



safety



The three elements of construction, price, quality and schedule, have a role to play in safety. Tower work calls for a balanced approach among the three. NATE represents price, quality and schedule as legs of a three-legged stool. If you take away one of the legs, it's not going to stand up.

The three elements of construction, price, quality and schedule, have a role to play in safety. When it comes to tower work, we believe there needs to be a balanced approach. We represent price, quality and schedule as legs of a three-legged stool. If you take away one of the legs, it's not going to stand up.

With tower work, there's a price element, and quality, and then the schedule. What's the time frame or the deadline for that project's completion? All three factors need to be working in sync with

Our goal is to have more and more members on board as Star Initiative members. It's the cream of the crop, as far as we're concerned.

each other for a balanced approach and for work to be conducted in a quality manner and safely on the jobsite.

For example, if you always go with the lowest price, the contractor who is going to make the lowest bid, maybe that's a good deal, but does that compromise safety and quality? Does that compromise the schedule and how quickly that project can be completed? Is that timeline realistic? How does the timeline affect safety?

We feel there needs to be a balanced approach when it comes to tower work. Those are some of the elements of construction that need to be in sync with each other for work to be done in a quality manner and safely.

Who would you hire?

Any worker probably is trained in some line of work and in some manner, but only workers trained to work at elevated heights in a safe manner are qualified for tower work. Proper training, plus proper equipment, plus proper attitude, plus proper documentation equals lower risk and equals proven performance.

Is the contractor qualified? Are the crews adequately trained? It always boils down to the individual worker, too.

Is that individual worker making a commitment every time he steps on a tower site or ascends a tower to do the work safely and to do it right every time and to not take shortcuts and not compromise safety in any manner. It boils down to the safety commitment of each individual employee.

Checklist

NATE offers a qualified contractor evaluation checklist as a resource that

we really promote to everyone in the industry. Carriers, the turfing vendors and the tower owners should all use the checklist to properly vet the contractors and ensure that those who will work on the tower site are qualified.

The checklist asks questions such as, Has the contractor obtained insurance coverage appropriate for the scope of work? That could include worker's compensation and general liability insurance. It asks for a certificate of insurance.

Does the contractor have the necessary experience? Does he have references? Does he have a written safety program? Does the contractor conduct regular safety audits? Do they agree that there should be a qualified and competent person at the site who will conduct the audit? Are they documenting safety audits? Do they have them on file for you to review prior to them going to work?

Have they conducted drug screening on their employees? What do their orientation and training programs look like? Who trained their employees? Have they done a hazard assessment to determine what types of personal protective equipment and fall protection equipment are needed? Do they maintain OSHA 300 logs?

Another big question is whether that contractor is going to use subcontractors to help with the project. If they do, they need to notify in writing that they plan to use subcontractors, and then they must stipulate that the subcontractors follow the same checklists that they have to follow.

It's thorough, and it separates the wheat from the chaff. It is a great resource to use to ensure that the folks hired are qualified. We really promote this resource and believe it needs to be used on all projects.

Wireless carriers

We continue to maintain positive dialog with carriers. Some of the carriers have affiliate membership status with NATE. Some of the NATE board members and I have had the opportunity to speak at state wireless association events.

A regional carrier, U.S. Cellular, is a NATE member. They have taken the

step of requiring that contractors who do work for them have to be members of NATE. It's a commitment they made to safety at the contractual level, which is where they include the requirement. It's the gold standard we're holding up. We would like this model to be picked up by other carriers, by some of the large turfing vendors such as Black & Veatch and Bechtel. This is their commitment to safety, and they're willing to put it into their contract. We really highlight that as a positive move for safety.

NATE Star Initiative

This year's applications for the NATE Star Initiative exceeded the number from last year. Star stands for safety, training, accountability and reliability. The goal is to continue to move the NATE member companies that are involved in tower construction, carriers and tower owners into this program. The Star Initiative has an elevated level of commitment to safety. Those in the program conduct voluntary site safety audits and submit the results to the NATE office.

Now that the program is going into

Any worker probably is trained in some line of work and in some manner, but only workers trained to work at elevated heights in a safe manner are qualified for tower work.

year three, we have two years of data that we can extrapolate, and we can show that members have submitted over 200 hazards that have been identified proactively on their sites due to their safety audits. Not only are our tower sites becoming safer, they also saved in potential OSHA citations and fines — probably over \$200,000. Our goal is to have more and more members on board as Star Initiative members. It's the cream

of the crop as far as we're concerned.

It's too early to say what OSHA will pursue in a possible somewhat closer look at safety matters related to work performed on telecommunications towers. We're in continual communication with OSHA. We've worked with them on several legislative and regulatory issues. Dr. David Michaels, assistant secretary of labor and administrator of the Occupational

Safety and Health Administration, is going to take a look at the current state of affairs. What I've been told is that he still is in review mode to see where there may be opportunities. It's too soon to tell whether OSHA will place greater scrutiny on the industry. ■

Todd Schlekeway is executive director of the National Association of Tower Erectors. His email address is todd@natehome.com.

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am detuning

You Can Detune a Tower, but ...

New FCC rules go a long way toward mitigating any confusion among affected parties while ensuring consistent protection of AM station operations and providing greater cost certainty for tower owners.

By Michael L. Higgs Jr.



Most telecommunications towers host a variety of antennas, with each antenna emitting signals to be received at some distant point. For AM radio transmissions, however, the tower itself functions as the antenna. Omnidirectional AM radiation patterns are created using a single tower, and directional AM radio patterns are achieved using an array of multiple radiating towers. An obvious problem arises when a new tower is constructed in the vicinity of an AM tower array: The new tower could potentially reradiate the AM radio signal and distort

the broadcast station's authorized radiation pattern.

The FCC's broadcast rules contained several sections dealing with tower placement near AM antennas to protect AM stations from the potential effects of nearby tower construction. However, two prominent rule sections dealing with wireless communications, namely Part 90 (Land Mobile Radio) and Part 24 (Personal Communications Services) entirely lack provisions for protecting AM stations from the possible effects of nearby tower construction. By its recent Order in MM Docket No. 93-177 (Rel. Aug. 16, 2013), the FCC seeks to harmonize and streamline its rules by establishing a single protection scheme for tower construction and modification near AM tower arrays, and by designating "moment method" modeling as the principal means of determining whether a nearby tower affects an AM station radiation pattern.

First come, first served

In the absence of explicit rules governing parties' behavior in these instances, the FCC relied on its longstanding "newcomer" policy, which

mandates that a newcomer (i.e., the party constructing a new or modified tower) is responsible, financially or otherwise, for taking steps necessary to eliminate objectionable interference to existing stations. This policy dates back to 1947 when the agency held a broadcaster responsible for resolving interference to incumbent operations caused by its new facilities, holding that no specific rule or express condition on a construction permit is required for the FCC to apply the newcomer policy.

Seeking to eliminate any confusion among new tower developers and incumbent AM operators, the FCC proposed uniform rules for all services, thus ensuring consistent protection for AM stations. The FCC engaged with various groups representing

Background photo: WKTA, 1330 AM, Evanston, Ill., near Chicago, uses six towers to control its directional signal. Five nearby cellular towers have the potential to distort the signal pattern, which would cause the station to violate the terms of its license. To prevent the distortion, the cellular towers are fitted with detuning equipment. Photo courtesy of Waterford Consultants/Larry Giessman



am detuning

broadcasters, tower developers, RF engineers, and equipment manufacturers to develop the new rules.

Out with the old

The prior rules required licensees and permittees to notify AM stations and take appropriate action when a tower was constructed within a fixed distance of an AM station. This fixed distance approach has now been replaced by one that defines the critical distance from AM stations based on the incumbent's frequency and the proponent's tower height. The critical

distance for a nondirectional AM station is one wavelength at the frequency of the AM station. The critical distance for a directional AM station is 10 wavelengths of the frequency of the AM station up to a maximum distance of three kilometers.

The new rules exempt short towers from the AM proximity analysis requirement because such low-in-stature towers are inefficient radiators that would not generally affect an AM broadcast pattern. The threshold height for new tower erections or major modifications to comply with the requisite AM proximity

analysis is 36 electrical degrees for a directional antenna array, and 60 electrical degrees for a nondirectional antenna. Three hundred sixty electrical degrees equals one wavelength at the frequency of the AM transmitter. Most AM towers are built to a height of one-quarter of the wavelength of the station's transmitting frequency, or 90 electrical degrees (this comes in handy for back-of-the-napkin calculations). Therefore if the proposed new tower is shorter than 1/10 of the transmitting AM wavelength for a directional pattern, or 1/6 of the transmitting AM wavelength for a nondirectional pattern, then an AM proximity analysis is not necessary.



Wires that parallel the tower form a skirt as part of a system to detune the tower, which means to modify its electrical wavelength so it does not reradiate the AM station signal. Photo courtesy of Waterford Consultants/Larry Giessman

Up on the roof

When proposing the new rules, the FCC initially suggested excluding all antenna structures mounted on buildings from the AM proximity analysis requirements. Several commenters noted that buildings may support towers tall enough to be significant reradiators at an AM frequency. Although the FCC noted that it is possible for a building itself to be a reradiator of AM signals, it is impossible to detune a building or the combination of a building and tower. Because it is not feasible to analyze the combined effects of the building and tower, the new rules require only that a rooftop antenna structure alone be measured for compliance with the rules as if it were a freestanding tower situated on the ground.

Construction notice

So your proposed new tower is not too short, and not too far. Now what? Prior to the start of construction of the new site, its proponent must notify any potentially affected AM stations. The planned construction notice should be in writing, and contain the coordinates of the tower to be constructed or modified, a physical description of the planned construction and the results of the analysis showing the predicted effect on the AM pattern, if such "moment-method" analysis was performed. The AM licensee will have 30 days in which to respond to the notice. If no response is received, construction on the new site may commence.



Stand-off insulators support a portion of the wire skirt engineered specifically for the cellular tower. *Photo courtesy of Waterford Consultants/Larry Giessman*

In emergency situations involving essential public services, health or welfare, the FCC allows that a tower proponent may erect a temporary new tower or make a temporary significant modification to an existing tower without prior notice to potentially affected AM stations. As long as the emergency tower proponent provides written notice to potentially affected AM stations within five days after the erection or modification of the tower and cooperates with such AM stations to promptly remedy any pattern distortions that arise as a consequence of such construction, then the rules are deemed satisfied.

Only licensed and operational AM stations are covered under the rules; the permittee of an unconstructed AM station

need not be notified about proposed new tower projects. All too often, construction permits expire without the station making it to air, or the permits are modified prior to commencing station operations. Thus, the FCC determined that requiring proximity analysis and possible alterations to new site developments on a speculative basis would be unproductive. Furthermore, if an AM proximity analysis were to indicate potential problems, the steps necessary to determine proper remedial measures require the presence of the AM signal.

Determining the distance to a nondirectional AM antenna is as simple as plugging in the coordinates of the site listed in the FCC's database. Towers

forming part directional AM antennas, on the other hand, could be situated several hundred meters apart. The relatively large spacing between antenna towers left room for confusion in determining the distance to directional AM stations. The new rules clarify that the center coordinates of the directional AM array, as listed in the Media Bureau's database, CDBS, should be used for any AM proximity analysis.

It's the limit

What if a new tower passes all preconstruction evaluations, but nonetheless alters an AM station's radiation pattern? The FCC took note that in certain situations a tower situated over 3 kilometers from an incumbent AM

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A capacitor (top) and inductor form a network that tunes the tower skirt to make the tower nonresonant at the AM station frequency. Photo courtesy of Waterford Consultants/Larry Giessman

station still may cause interference to the broadcaster, or that a particularly short tower might still cause problems if it is constructed too close to an AM antenna. Tower proponents argued that a lack of clear rules under these circumstances left the tower owner's responsibilities open-ended. The rules now define the type of showing required from an AM station when an otherwise excluded tower erection or modification affects the station's radiation pattern, and require that the studies be shared with the tower owner. A two-year time limit on claims of adverse effect has been established to encourage AM licensees to promptly identify potential pattern disruptions and provide tower owners with greater certainty regarding future liability.

The proceeding that led to the issuance of the new rules considered what types of structures should be subject to regulation in this regard. This becomes a tricky issue of FCC jurisdiction. Buildings, bridges, water towers and power lines can all become AM reradiators. How far should the FCC extend its regulatory reach? What about a greenfield tower project that does not require FCC registration and that has no FCC licensee tenants? An argument can be made that all of the aforementioned examples are

incidental radiators, and as such, would be subject to Part 15 restrictions. Opting for administrative restraint, the FCC determined that the new rules should only apply to applicants, licensees and permittees. In the future, a licensee or permittee may only place its antennas on towers that have completed all of the necessary steps outlined herein prior to the licensee's or permittee's collocation. In addition, if an AM station owner has shown that a tower creates a disturbance to its radiation pattern, no licensee or permittee may collocate on that site until such time as appropriate remedial action has been taken.

The new preclearance rules only apply to towers constructed or modified after the effective date of the order. However, the FCC will apply the new rules' remediation requirement to any construction commenced prior to the effective date, except that currently pending interference complaints will be resolved in accordance with the preexisting rules that were then applicable to the service in question. Once the rules become effective, AM station owners will have one year to submit a showing that their stations' RF propagation has been adversely affected by any tower constructed prior to the effective date but after the AM stations commenced operations.

Living in harmony

By this order, the FCC has harmonized and streamlined the rules regarding tower construction and modification near AM stations, improved the protections afforded AM broadcasters, and reduced the time required to determine the effect of tower construction in the vicinity of AM stations while reducing the costs of such analysis. The adoption of the new rules goes a long way toward mitigating any confusion among affected parties while ensuring consistent protection of AM station operations and providing greater cost certainty for tower owners. ■

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

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Investment Banking Supports Tower Construction Projects

Individual tower owners can best serve the carriers by building the towers for them. They are able to do it faster than some of the carriers themselves or even some of the large national tower companies.

By Don Bishop

In late August, AGL spoke with Clayton Funk, a managing director with Media Venture Partners in the firm's Kansas City, Mo., office, and Jason Nicolay, a vice president with the firm. Along with Ryan Carr, an analyst with the firm, they wrote the article "Trends and Forecasts for the Wireless and Tower Industries," published in the September issue.

AGL: What is your role at Media Venture Partners?

Funk: I'm a managing director.

AGL: What is Media Venture Partners?

Funk: Media Venture Partners is a boutique investment banking firm specializing in areas of telecommunications, media and technology. "Boutique" means we're very focused in our areas. We focus on private market mergers and acquisitions along with capital raising. Our firm is not one that would be doing any initial public offerings or high-yield debt deals that you'll hear about from large Wall Street firms such as a Goldman Sachs. However, we are specialists and experts in our areas of focus.

AGL: How did you get started in investment banking?

Funk: In many ways, it was really good fortune. There were some guys I had gone to college with who formed a

boutique, investment banking firm here in Kansas City that I was with for about seven and a half years called Nations Media Partners. In 1997, they contacted me and asked whether I would like to help them start the wireless tower division because they felt there was an opportunity for an intermediary to help represent sellers primarily in selling their tower

Clayton Funk: "The multiple for a fully loaded tower with no more structural capacity or market potential for more tenants is very different from the multiple paid for an immature tower."

assets, but as well looking to do some capital raising.

AGL: Why do you like to write the Tower Market Report?

Funk: We're very flattered to be asked to write the Tower Market Report every year. We get a lot of comments on it from

our clients and prospective clients and from people in the industry. From our standpoint, it's very good exposure, and we're flattered to be recognized as people who can offer that to the readers.

It gives us the opportunity to take a step back, look at what we wrote last year, and ask, "I wonder what's changed?" For us to be able to go through and edit that, fortunately, over the last two to three years, we've been able to say the same things: the market's hot, prices are high, and the future is incredibly bright and almost limitless for the tower industry. Maybe it's good luck and karma that we can continue to write this and hopefully nothing bad will happen to the industry.

AGL: Here's something that happened after you wrote your article. AT&T announced it wants to buy Leap Wireless. What effect would a purchase of Leap Wireless by AT&T have on the tower industry?

Funk: It's great news in the fact that people have questioned the creditworthiness of Leap as a tenant on the towers. I don't think you're going to see any wholesale decommissioning of sites. You're adding a whole bunch of new subscribers onto the AT&T network. The AT&T network has historically been very constrained for capacity for data usage. It's good in the fact that instead of having maybe AT&T as a tenant and then Leap

as somebody who is a little more suspect as far as a creditworthy tenant, you may have AT&T paying for two leases. AT&T is a very sought-after tenant for tower owners and tower buyers. I think it is a positive overall.

AGL: Multiples. Everyone wants to know, what's the trend for multiples?

Funk: Multiples have stayed steady over the last year and a half, maybe even two years. It's important to take a step back because whenever we are asked what towers are worth, what are they trading for and what are the multiples for towers, we can give an answer. However, it's more important to consider what the towers look like. The multiple for a fully loaded tower with no more structural capacity or market potential for more tenants is very different from the multiple paid for what we call immature towers that tend to be new, that maybe were built for an anchor tenant and that's the only tenant on there, but there is still some



AGL Video Photo

Clayton Funk, managing director, Media Venture Partners, about cash-flow multiples used as one method of calculating tower valuations: "Multiples have stayed steady over the last year and a half, maybe even two years. They've stayed flat, but they've stayed high, which is great."

structural capacity remaining on the tower such that we think and the buyer thinks that there is some market upside for the

tower for future tenants.

The multiples have stayed high, and we conclude that based on historical

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comps over the past 16 years of brokering transactions. They've stayed flat, but they've stayed high, which is great. Just being able to come right out of the box and give a specific number, we can do that, but we usually have to learn a lot more about the assets themselves.

AGL: If you could change one thing about the tower industry, what would you change?

Funk: In many cases, I would make it easier for individual tower owners to build towers, instead of having the carriers build towers themselves or being able to outsource to maybe a large, national tower company to do all the builds. That's for several reasons. One, I think, selfishly, a lot of our clients could build more towers, and the more towers that they build, then the more capital they'll need, and hopefully we can provide that or help them find that capital or the more towers they would build, they would sell more towers down the road and we'll be

able to assist them with that.

What I hear from a lot of our clients is that they can best serve the carriers by building the towers for them. They are able to do it faster than some of the

Jason Nicolay: "As you look at the wireless landscape today, the Big Four carriers, AT&T, Verizon, T-Mobile and Sprint, collectively they make up about 96 percent of all wireless subscribers."

carriers themselves or even some of the large national tower companies. They are

able to do it not only faster but also less expensively. They are able to deliver a level of detail and service to their clients that maybe the clients don't always appreciate. That's why they'll build it either for their own account or outsource it in large buckets to the national companies.

AGL: Jason, what is your role at Media Venture Partners?

Nicolay: I'm a vice president. Within MVP, I spend my time in the telecom group, which primarily is towers, spectrum and wireless operators. I work on a lot of sell-side projects with owners and entrepreneurs.

AGL: What brought you into this line of work?

Nicolay: I started as a certified public accountant, and I had a client who had a significant amount of work in mergers and acquisitions. I knew from being on that side of it that I actually wanted to be on the front end of the deal, working for

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clients and helping them secure the best price and actually be able to work on the deal. I haven't regretted moving in that direction since.

AGL: How do you view the proposed AT&T purchase of Leap Wireless?

Nicolay: The AT&T purchase of Leap Wireless is driven by their need for additional spectrum in highly coveted top-25-plus markets where they will be able to secure a significant footprint in Advanced Wireless Service spectrum. That footprint provides a lot of value for them.

The acquisition also helps their network, once they're able to convert the subscribers from CDMA to GSM. It's a very valuable transaction for AT&T for their network and spectrum needs.

AGL: Who do you think will be next to be acquired?

Nicolay: As you look at the wireless landscape today, the Big Four carriers, AT&T, Verizon, T-Mobile and Sprint,



AGL Video Photo

Jason Nicolay, vice president, Media Venture Partners, about who will be next to be acquired: "A new wave of transactions could involve mobile virtual network operators as carriers try to acquire subscribers that don't need networks. There's a growing number of MVNOs, which would be attractive at some point because carriers are cannibalizing each other's subscribers because there aren't many other subscribers to acquire."

collectively they make up about 96 percent of all wireless subscribers. Of the remaining 4 percent, 2 percent is U.S. Cellular. These are all wireless devices, including iPhones, smartphones and tablets. It doesn't leave a lot of room



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for a significant amount of growth, such as acquiring another Leap.

U.S. Cellular probably is an attractive target to some, given their spectrum. But they tend to operate in rural markets. C Spire is another large operator. From there, there's the Competitive Cellular Association with members that operate in a lot of rural, tier 2 and tier 3 markets. They're the next frontier, and they serve a much different customer than the customers in New York or San Francisco, for instance.

A new wave of transactions could involve mobile virtual network operators as carriers try to acquire subscribers that don't need networks. There's a growing number of MVNOs, which would be attractive at some point because carriers are cannibalizing each other's subscribers because there aren't many other subscribers to acquire.

AGL: If you could change one thing about the wireless carriers, what would you change?

Nicolay: I don't know if there is anything I would change. Carriers have been dealt a difficult challenge to meet consumers' needs, which are evolving faster than the carriers' abilities to deploy networks. Consumers are driven, now, to watch a YouTube video or upload their own YouTube video to Facebook or elsewhere. There's a large demand for data-intensive applications and uses for that in order to connect with your friends and tweet about your life.

The biggest thing for carriers is being able to deploy network services quicker. The United States is deploying wireless network services faster than most of the rest of the globe, especially with LTE. All the U.S. carriers are doing a good job of staying ahead of the curve compared with other parts of the world. They have a tough job keeping up with consumer demand.

AGL: If you could change one thing about Clayton Funk, what would you change?

Nicolay: He has a great name, so I don't know whether I would change anything. He needs to wear a little bit funkier clothes. Maybe a blue tuxedo with a top hat would look great.

AGL: Clayton, if you could change one thing about Jason, what would you change?

Funk: I would change the fact that he's a KU graduate. I'd change the fact that he's a KU fan. He needed to go to a different school. Probably Washburn University would have been better suited for him. Division 2 athletics is something he should have more affinity for. At KU, he wasn't in a good fraternity, and I think that has affected him for his entire life. ■

Media Venture Partners, a telecom-focused investment bank, is a division of Financial Telesis. Clayton Funk can be reached at cfunk@mediaventurepartners.com or (816) 977-2822. Jason Nicolay can be reached at jnicolay@mediaventurepartners.com or (816) 977-2823. Ryan Carr can be reached at rcarr@mediaventurepartners.com or (415) 391-4877.

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Next-generation Wireless: Riding on the Back of Millimeter Waves

Radio links with minimal latency are critical for data-centric devices that must accommodate voice over IP (VoIP), live digital streaming, large file downloads and video conferencing through mobile handsets.

By Jeff Elliott

Of all the wavelengths in the spectrum used for wireless data transmission, perhaps the least well known is the millimeter-wave band. However, it is precisely this band (and the continuous bandwidth it provides) that enables wireless data transmission at speeds and bandwidth that compare to the high quality of fiber-optic communication systems.

Millimeter waves (30 GHz to 300 GHz) are a subset of the microwave band, which is itself part of the larger radio wave spectrum. These waves derive their name from the size of the wavelength, which measures from one to 10 millimeters.

Unlike low-frequency radio signals, millimeter waves are not appropriate for long distance transmissions through the atmosphere, due to higher signal loss. Instead, MMW radios typically operate over distances of several kilometers using highly directional, pencil-thin beams that also help prevent interference.

It is this characteristic, along with continuous bandwidth not available at more commonly used lower frequencies that makes millimeter-wave technology the ideal solution for point-to-point, high-speed, high-bandwidth wireless.

The technology, available as commercial transmitter/receiver units that operate at Gbps speed, is already being



The highly directional characteristic of millimeter waves is ideally suited to cellular communications, particularly in crowded urban environments.

utilized in multibillion-dollar markets such as cellular communications for the next generation of micro and picocell towers, high-definition/3D digital video for broadcasting organizations and the motion picture industry, and for high-frequency trading on Wall Street.

The millimeter wave

In spite of the relative anonymity of MMW radios in the commercial area, the MMW spectrum has been utilized for military satellite-to-satellite communications for decades.

Because of the dramatically reduced costs recently of MMW integrated circuits (a trend that is expected to continue), the technology is now being increasingly utilized for commercial applications.

The incredible promise of the millimeter wave, however, has as much to do with the FCC as with any other factor.

As part of its mandate, the FCC allocates specific wavelength frequencies for everything from FM/AM radio stations to television, cell phones, satellites, aeronautics and the military — to name



A millimeter-wave product for cellular backhaul called GigaLink Light Speed radios from Renaissance Electronics suits placements in densely populated areas to connect small cells with the cellular network core.

a few. However, with the explosion of wireless applications, most are jammed into small bands at lower frequencies of the radio spectrum.

Although the millimeter-wave band is also regulated by the FCC, if the more crowded bands can be compared to the population per square foot of Manhattan, New York, then the wide-open expanses available to millimeter waves are more like Yellowstone National Park.

This extra space is critical because it provides the continuous bandwidth required for high-bandwidth, high-speed data transmission. Without it, lower frequency products (despite being capable of such speeds were it not for their neighbors) are hitting a glass ceiling that even refinements and improvements in wireless technology cannot overcome.

Lower-frequency allocations, for example, are typically 2 gigahertz to

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5 gigahertz. In the millimeter-wave spectrum, the total allocation potential is up to 250 gigahertz, with 5, 7, 10, 15 and even 20 gigahertz of continuous bandwidth available.

With so much room to work with, practical data rates in the millimeter band top out above 40 Gbps.

Wireless for next-gen cellular

The highly directional characteristic

of millimeter waves is ideally suited to cellular communications, particularly in crowded urban environments.

In a market that analysts estimate will exceed \$5 billion by 2015, the installation of small base stations called microcells and picocells is expected to outnumber traditional cell towers by as much as 20 to one.

Microcells and picocells cover only a limited area, but require less power,

cost less and have a much smaller footprint than larger macrocell towers. This makes them ideal for indoor locations such as entertainment venues, malls, airports, train stations, office buildings and hotels.

But the advent of next-generation cellular networks is creating a new backhaul connectivity problem: how to connect the growing number of smaller base stations to the core, either through wired or wireless connections. This is exacerbated by concerns about frequency congestion and interference in dense cell deployments where four or more picocells could be mounted on light poles in a single parking lot or on a rooftop.

The most obvious solution for high-speed transmission of data-intensive content would be to establish a physical

Micro and picocells cover only a limited area, but require less power, cost less and have a much smaller footprint than larger “macro” cell towers.

connection using fiber-optic cabling. However, the cost and challenge of implementing fiber to each microcell or picocell site is prohibitive, particularly in urban areas where streets and sidewalks cannot easily be trenched.

As a result, outdoor, fiber-optic-quality wireless millimeter-wave products are being considered by providers. With typical link distances for picocell backhaul estimated at a few hundred meters between sites, and microcells less than two kilometers, millimeter-wave products are ideally suited for such applications.

“If you can’t run fiber-optic cabling, millimeter-wave wireless is the fastest, quickest, smallest and least expensive solution,” said Wayne Pleasant, former chairman of the Wireless Communica-

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tion Industry Association committee charged with helping the FCC establish guidelines for the 80-GHz light-licensed millimeter-wave band.

“In many key ways, millimeter-wave devices can be more reliable, and even faster, than fiber optics,” said Pleasant. “Due to a reduction in latency, transmission speed is improved.”

Millimeter-wave radios require only very small antennas, measured in inches rather than feet for Wi-Fi and other wireless options. This addresses the concern over potential visual pollution caused when mounting a large quantity of such products to light poles, billboards or the sides of buildings.

“Narrow-beam antennas allow systems in these bands to be engineered in close proximity to one another without causing interference,” Pleasant said. “Since a greater number of highly directive antennas can be placed in a given area, the net result is higher reuse of the spectrum, and higher density of potential users.”

In anticipation of the coming micro and picocell boom, Renaissance Electronics and Communications and its wholly owned subsidiary, HXI, recently released several millimeter-

Millimeter wave radios require only very small antennas, measured in inches rather than feet for Wi-Fi and other wireless options.

wave radio products for this market. Since 1991, REC/HXI has provided RF, microwave and millimeter-wave components, subassemblies, integrated assemblies and subsystems for military and commercial applications.

The company’s GigaLink Light Speed radios were the first millimeter-wave radios in the 60-GHz and 70-GHz bands to achieve FCC certification for unlicensed and light-licensed commercial applications. These millimeter-wave

transmitter/receiver units have a full duplex throughput of 1.25 Gbps and higher, offering plenty of bandwidth.

These radio links are designed to minimize latency, or lags in data transmission, which is critical to the next generation of data-centric devices that must accommodate voice over IP (VoIP), live digital streaming, large file downloads, and video conferencing through mobile handsets.

Wireless for digital video

High-speed, high-bandwidth wireless that can transmit uncompressed high-definition (HD) video signals and even High Def 3D is required to place digital video cameras in remote locations without wires and without concern for interference.

Motion picture, television, sports and electronic newsgathering organizations have struggled for some time to iden-

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Millimeter-wave products support high-definition and 3D digital filming over wireless radio links.

tify wireless and even physical cabling connections that can keep up with the rapidly increasing bandwidth required for high-definition and 3D filming.

Because 3D is shot utilizing two cameras that film slightly offset images that are synchronized to create the dimensional effect, two indepen-



The GigaLink HD wireless radio links are available as single or dual channel. They are the first unlicensed wireless system that transmits uncompressed HD/SDI video at 1.485 GB/s. The unit shown above is a receiver.

dent HD streams must be transmitted simultaneously. This immediately doubles the data transmission requirement and presents the challenge of doing so through a delivery system — physical or wireless — that has no latency problems.

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has significant latency issues that can affect the synchronization of the two digital streams of data. To compensate, complex and expensive multiplexers are required, which lead to racks of equipment on-site and a completely non-portable solution.

Due to the deficiencies of fiber-optic cable, the industry often utilizes a coax cable solution that can be run to a distance of approximately 300 meters. However, the limitations of data transmission often lead to stepping down the resolution and sacrificing quality.

To meet this need, Renaissance/HXI introduced a millimeter-wave-based product specifically designed for high-definition and 3D digital filming, the GigaLink HD wireless radio links, which are available as single or dual channel. This is the first unlicensed wireless system that transmits uncompressed raw HD/SDI video at 1.485 GB/s.

The GigaLink products transmit up to 500 meters in clear air and were developed specifically for use with Sony HDC and HDCU-F950 Digital 4:4:4 CineAlta systems, but they will interface with any SMPTE 372M- or SMPTE 292M-compliant production system.

For financial companies engaged in high-frequency trading (HFT), profitability depends on how quickly trades are executed.

The dual-channel model can transport independent, uncompressed video signals from two HD cameras or alternately high-definition 3D with both

3D/HD input signals transported in perfect synchronization at 2.970 Gbps (combined). This is all without the need for compression or forward error correction, avoiding the associated latency.

Wireless for high-frequency trading


For financial companies engaged in high-frequency trading (HFT), profitability depends on how quickly trades are executed. Millimeter-wave radio transmitters can speed connections between data centers and their markets.

The concept of HFT grew out of the SEC's 1998 decision to allow electronic exchanges to compete with the NYSE and other marketplaces. By 2010, HFT was accounting for more than 70 percent of the trades in U.S. equity markets, and a growing percentage of trades in other countries.

Unlike other types of stock strategies that try to profit from large changes in the prices of a stock over a period of time, HFT involves analyzing

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This is also true for today's DAS systems. The N Type connector provides poor PIM performance when compared to a 7-16 connector, but the 7-16 is too big for DAS systems. The 4.1-9.5 connector is the best available choice, it's the size of an N Type connector but it provides the superior PIM performance of a 7-16 connector.

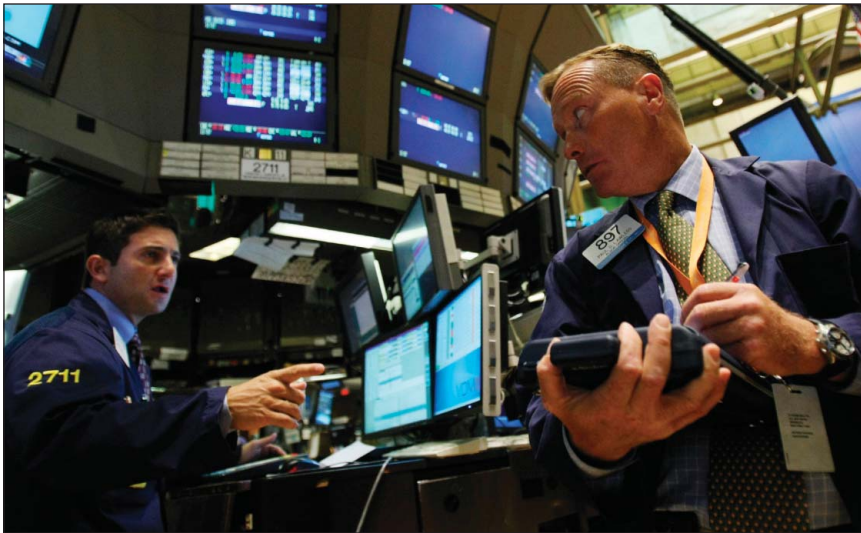
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High-frequency trading can generate huge profits, but only with the right infrastructure. Exchanges have implemented systems that brought down the latency to about 3 milliseconds on average. HFT firms are increasingly turning to wireless transmission systems to connect their data centers to the exchanges.

massive amounts of information and locating even minute opportunities for profit that may have otherwise been overlooked. By executing thousands or millions of such transactions daily, billions of dollars in profit can be made. The HFT is usually not interested in holding onto a stock for more than a few seconds and will start each day without any holdings.

Even if the HFT doesn't make a direct profit on the sale of the equity, it can still make money because exchanges will typically pay the HFT a small amount, say ¼ cent per share, for the transaction. All those pennies add up. According to Tabb Group, a financial markets research and strategic advisory firm, by 2008 traders earned \$21 billion in profit from HFT.

Huge profits

HFT can generate huge profits, but only with the right infrastructure. Trading companies, therefore, heavily invest in the hardware, software and personnel necessary to gather and analyze momentary changes in market data and then execute based on that data.

To make this possible, exchanges have implemented systems that brought down the latency to about 3 milliseconds, on average.

Contributors to network latency include the time it takes for a packet to

travel from one place to another at the speed of light, the medium itself (optical fiber, wireless), and the size of the packet because larger packets take longer to receive and return than smaller ones.

Latency

Other conditions that affect latency are the speed of processing through a router or other gateway node. Packets may also experience storage and hard disk access delays at intermediate devices such as switches and bridges.

The physical distance of the cabling is also a factor. To reduce latency, trading firms have placed their computers as close as possible to those of the exchange.

But that is a risky proposition. Particularly after 9/11, many firms decided to move their data centers out of Manhattan and placed them in nondescript buildings in New Jersey or on Long Island, without even the company name on the building, so the data centers are not a target for terrorists.

Although this did make the data centers more secure, this move increased the distance between the HFT computers and the trading systems on Wall Street, sometimes adding hundreds of microseconds to each round-trip.

Installing new lines in a city like Manhattan presents its own difficulties. "Running fiber often isn't practical in



A trading company can install a microwave radio link such as this atop a data center in New Jersey and use it to create a direct connection to Manhattan. Or, if the distance is too great for a single link, or if obstructions would block the signal, a series of radio links can be used to relay the signal.

an urban environment," said Pleasant. "To install fiber, you have to disrupt local infrastructure like digging up streets or hanging it on pre-existing structures, which is expensive and time consuming."

As a result, HFT firms are increasingly turning to wireless transmission systems to connect their data centers to the exchanges.

A trading company can install millimeter-wave radio links on top of a data center in New Jersey and use it to create a direct connection over to Manhattan. Or, if the distance is too great for a single link, or if there are obstructions that would block the signal, a series of radio links can be used to relay the signal.

By using millimeter wave instead of fiber-optic cables, an HFT firm can establish a much shorter path to the marketplace, reducing latency.

"Lower latency equals faster trading speeds, which equals more money to be made for the end user," said Pleasant. "In this industry, nanoseconds count, so having the lowest latency connections is a big deal." ■

Jeff Elliott is a Torrance, Calif.-based technical writer. He has researched and written about industrial technologies and issues for the past 15 years. Renaissance Electronics and Communications can be reached at (978) 772-7774 or visit www.rec-usa.com.

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www.metal-cable.com

Pan and Tilt Antenna Mount

Pepro's pan and tilt 300 directional antenna mount is specifically designed for the wireless communications industry. The all-aluminum design makes this a rugged and lightweight (15-pound) mount suitable for fixed and mobile tower applications. The unit offers the ability to adjust from the ground with either a manual or wireless handheld controller. This feature eliminates the need for certified climbers and bulky safety harnesses. It also eliminates the need to lower mobile towers for adjustments. The mounting surface is predrilled to accommodate a wide variety of antenna mounting configurations. The mount can support dish antennas up to three feet in diameter with up to seven feet of sail area and withstands winds up to 120 miles per hour.

www.peprollc.com

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RF Industries' type N male connectors simplify the critical cable installation process by eliminating the need to trim the braid during cable preparation. Model RFN-1006-49I features a solderless, captive pin. Model RFN-1006-4I features a crimp pin. Combination hex/knurl coupling nuts allow for tightening by hand or wrench. White bronze

(tri-metal) plating eliminates tarnishing while providing improved electrical performance and reduced PIM. The devices exhibit an exceptional VSWR of less than 1.10:1 up to 3 GHz and less than 1.20:1 up to 8 GHz, which is achieved through an enhanced impedance matching design. Industry standard tooling can be used for cable preparation and crimp termination. Heat shrink and assembly instructions are included with each connector. VSWR charts are available. Connectors are compatible with high-performance cables such as Times Microwave LMRR-400, CommScope CNTR-400, Belden 9913 and RF Industries RFI-CU400T.

www.rfindustries.com



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Pacific West America specializes in the manufacturing and distribution of cable assemblies, connectors, and other telecom mounting products. The company offers 19-inch to 23-inch rack adapters, 1ru to 6ru, T-204 dual antenna mounts and a wide variety of cable assemblies for rack mount and other hardware. It also offers panel-mounted, type N bulkhead connectors that mount to standard 19-inch and 23-inch racks for easy access and connection of cables.

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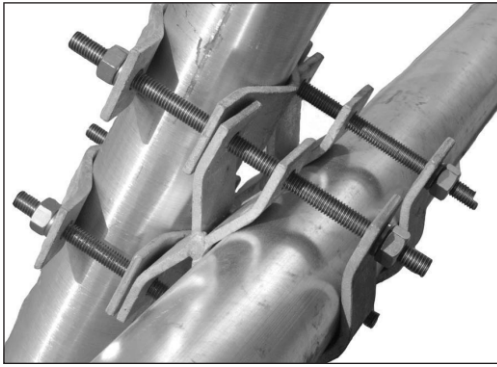
- Construction or alteration of any FCC-licensed communications tower structure (includes tower owners!)
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product showcase — cables, brackets and mounts



Antenna Mounting Hardware

The **Telewave** ANTC482 mounting clamp kit is designed for mounting to square or round member towers from 1.5-inch to 3.5-inch outside diameter. It is fabricated from heavy-duty galvanized steel with stainless-steel fasteners, and the middle clamps are separate for more flexible installation. Two complete clamp sets are included in the kit. The ANTC483 mounting clamp kit is also fabricated from heavy-duty galvanized steel with stainless-steel fasteners. Both models have middle clamps welded at the center and are designed for mounting to square or round member towers from 1.5-inch to 3.5-inch outside diameter. This clamp kit can also be used in a 90-degree crossover configuration to attach a side-mounting boom to a tower leg and two complete clamp sets are included in the kit. The ANTM433 side-mount

kit is designed to mount an antenna 15 inches from a tower. It is fabricated from heavy-duty galvanized steel with two heavy-duty clamps included.

www.telewave.com

DAS/LTE Antenna Hoist

For hoisting DAS or LTE antennas onto towers, look to **Tuf-Tug** for its antenna pipe rooster head lifting mechanism. The unit can lift as much as 250 pounds. It features a 4-foot pulley with an oversized groove. The groove features a needle bearing for smooth operation and long life. It can lift 1/2-inch rope or 3/8-inch wire rope. It is constructed of solid steel with a hot-dipped galvanized finish to prevent rusting and resist harsh environments. The unit slides into a standard 2-inch pipe mount, and optional 4-inch pipe mount is available.

www.tuf-tug.com

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Clearfield's cost-effective and easy-to-deploy environmentally sealed optical fiber delivery solution, FieldShield, suits the hardened connector environment. FieldShield connectors and the FieldShield SmarTerminal combine the advantages of hardened connector technology with the ease of use and cost reductions associated with pushable fiber. Traditional hardened connector technology is bulky and requires the use of flat drop cables, which are stiff and difficult to store. With the FieldShield equipment, the form and fit of the SC connector is maintained, slack storage is integrated within the device and restoration and troubleshooting are greatly reduced as field restoration is easily performed without retrenching.

www.clearfieldconnection.com



Dual-axis Mechanical Tilt Sensor

Radio Frequency Systems' AISG 2.0-compliant, dual-axis mechanical tilt sensor is designed to accurately measure the position of its antennas and enables the entire process to be conducted remotely in real-time. The simple-to-install in-line device is engineered for durability and is watertight. It is ideal for providing reliable performance under the most severe environmental conditions.

Digital filtering ensures stable measurements and prevents false alarms caused by antenna vibrations, and its ± 0.5 degree of accuracy improves RF optimization. The unit can even be installed into a live system and can be recognized by the system without requiring the system to be shut down or rebooted. The sensor is as easy to install as a standard cable at the antenna site.


www.rfsworld.com



Compact Quick-assembly Temporary Mount

The **Baird** BTD-12 mount folds for compact transport and assembles quickly with no tools or outside hardware required. The adjustable feet and legs on the unit create a stable mounting platform on rough or uneven terrain. It is designed for use with satellite dishes up to 1.2 meters, wireless antennas and solar applications with up to 15 square feet of modules. With mast sizes to accommodate all major antenna manufacturers and masts up to 10 feet tall, the BTD-12 is the quick-deploy mount suitable for just about any temporary antenna mounting needs.

www.bairdmounts.com



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

product showcase — test equipment



LTE-Advanced and Wireless Remote Control

JDSU's CellAdvisor JD740 series supports LTE-Advanced technology, aggregating up to five component carriers and MIMO 4X. In addition, it can remotely control the instrument via Bluetooth within a 100-meter range. The unit can test aggregate composite carriers within the same frequency band or even between bands with the flexibility to configure each component carrier at any transmission bandwidth. In addition, it can test MIMO implementations for two or four transmitting antennas to assess the independent power and modulation quality for each branch. The unit is capable of being software-upgradable to ensure advanced testing features are always available for the latest technology. The CellAdvisor's wireless remote control feature allows cell technicians and RF engineers to remotely test radio heads that are installed

in high towers using Bluetooth long-distance (Class 1) connectivity. This feature allows the user to have the same full visibility and control as if they were in front of the instrument, while remaining safely on the ground.

www.jdsu.com



Touch Tablet RF Analyzers

The RF-Vue touch tablet RF analyzer from **Kaltman Creations** is offered in several versions, but the flagship model is the RF-Vue T10. This handheld unit is integrated into a 10-inch touch tablet with the full Windows 8 operating system. The analyzer covers the standard wireless microphone and IEM frequency range of 470 MHz to 700 MHz. Additional models are available that offer greater frequency ranges, plus there are standalone RF electronics/software modules for computers or tablets. The analyzer has full-finger navigation functions so the user can pinch, expand-zoom and slide through the RF spectrum with ease. The user can enter any frequency sweep range within the range of the analyzer and view the RF spectrum, looking for open RF space for channel selections, interference avoidance or interference troubleshooting, all in real-time.

www.kaltmancreationsllc.com

Dual-band CW Test Transmitter

Electro Rent offers the Praxsym dual-band CW test transmitter for purchase, rent or lease. The PST transmitter is a portable CW test source capable of transmitting test signals in two bands simultaneously. The output from each band can be enabled independently and the power level can



be adjusted between -10 dBm +12 dBm in 0.1 dB steps. Its frequency and output level for each channel can be set from the touch keys on the front panel where the transmitter status can easily be monitored from the backlit LCD display. The transmitter also contains a USB interface enabling the user to download specific transmitter configurations stored on a PC to control the transmitter remotely. It can be powered from either the six internal AA rechargeable batteries, which run the unit for six to eight hours continuously, or from line power with the included AC/DC wall adapter. The unit features a calibrated RF output level, which is ideal for use as a test source to evaluate indoor and outdoor wireless coverage, and an input source to test distributed antenna systems.

www.electrorent.com

Broadband Site Analyzer Series

Bird Technologies' Site Analyzer Series is a user-friendly test solution for installing, maintaining, and troubleshooting antenna and cable systems. The SA-6000EX offers a diagnostic range from 25 MHz to 6 GHz. This broad bandwidth capability dramatically increases the number of diagnostic applications that can be supported by a single field unit. The devices can store up to 500 traces and feature a VSWR range of 1.00 to 99.99. They offer a wide operating temperature range (-10° to +50° C) and immunity from on-channel interference (+13 dBm). All units come with a two-year warranty.

www.bird-technologies.com



Terrain Analysis Software

SoftWright's Terrain Analysis Package (TAP) is a software analysis application designed for evaluating radio transmitter sites, predicting radio coverage, conducting intermodulation and adjacent channel interference studies and designing for microwave, VHF and UHF frequency ranges. It is comprised of 27 different software modules that may be purchased in various combinations depending on user requirements for area coverage studies, path profiles, interference studies, presentation of results and budget. Package A includes TAP minimum for basic coverage studies and path profiles, including basic mapping, RF facilities and Longley-Rice propagation. Package B includes TAP minimum for path analysis, including basic mapping RF facilities microwave reliability and VHF/UHF reliability. Package C includes TAP package for area coverage studies, including basic mapping, RF facilities, Longley-Rice propagation, Bullington propagation, land use, 3D display, pattern distortion, auto-coverage and aggregate coverage. Package D includes TAP package for microwave/VHF/UHF path analysis, including basic mapping, microwave reliability, RF facilities, VHF/UHF reliability, antenna elevation, reflection analysis, 3D display, shadow map and auto-path.

www.softwright.com

Next-generation Handheld Cable and Antenna Analyzer

Anritsu's Site Master S331L cable and antenna analyzer represents a new generation of rugged handheld field instruments. The instrument, which covers 2 MHz to 4 GHz, brings a high level of performance to return loss, cable loss and distance-to-fault (DTF) measurements. It has the highest RF immunity of any Site Master. It includes a sweep speed per data point of 1.5 m/s (typical) and the built-in InstaCal, which provides fast one-connection calibration anytime, anywhere. It also features a built-in power meter for RF field testing. Dust- and splash-resistant, the model S331L has a backlit 7-inch TFT touchscreen display and weighs less than 4.4 pounds, including the battery.

www.anritsu.com

VIA Echo Antenna System Testers

The VIA Echo series antenna testers from **AEA Technology** are compact and lightweight hand-held 4 MHz-to-2.5 GHz vector network analyzers available in three economical models. Two of the models in the series also integrate a spectrum analyzer, power meter and FDR. All models are rugged, durable and have dual ports S11 and S12. They have a quarter VGA backlit LCD screen, rechargeable NiMH batteries, full VNA testing, frequency and bandwidth selection, a cable null feature and 250 memory slots that also serve as stored test setups. All models include the Echo PC Vision software, a USB cable and open/short 50-ohm terminators. They also come with an AC recharger, a belt case, a quick-start guide, operating manual and a soft carrying case.

www.aeatechnology.com



product showcase — test equipment

Test Equipment Rental and Leasing

Purchasing test equipment that may only be used occasionally for special projects is an expensive proposition that doesn't always warrant the cost. Not all situations warrant a full test and measurement solution investment. In these cases, **Tessco's** Testing 1-2-3 program takes the complexity and cost out of making these expensive decisions and can provide a wide range of test equipment. Tessco offers the ability to select, own or lease equipment and offers support for the testing side of your business. Tessco offers test solutions from RF and fiber optics to PIM and Wi-Fi. The company carries a comprehensive test and measurement product portfolio. It has options to choose from including creative options for ownership that offer risk-free buying, leasing and credit options, a trade-in program and a suite of add-ons such as training certifications, accessories and extended OEM service plans. Tessco also offers post-sale customer service, technical support, training and education, and calibration services.

www.tessco.com



Vector Signal Generator

The **Rhode & Schwarz SMW200A** high-performance vector signal generator combines flexibility, performance and intuitive operation to quickly and easily generate complex, high-quality signals for LTE-Advanced and next-generation hardware. The vector signal generator covers the frequency range from 100 kHz to 3 GHz or 6 GHz, and features an I/Q modulation bandwidth of 160 MHz, with internal baseband. The unit can be equipped with an optional second RF path for frequencies up to 6 GHz and with a maximum of two baseband and four fading simulator modules, giving users two full-featured vector signal generators in a single unit. Fading scenarios, such as 2x2 MIMO, 8x2 MIMO for TD-LTE and 2x2 MIMO for LTE-Advanced carrier aggregation, can be easily simulated. It enables faster time-to-market, improves end-device quality, and exceeds important 2G, 3G and 4G digital standards and applications. Exceptional modulation and RF characteristics make it ideal for developing high-end components, modules and complete products for wideband communications systems such as LTE-Advanced and WLAN IEEE 802.11ac.

www.rohde-schwarz.com

Enhanced Functionality Digital Radio Test Systems

Aeroflex has enhanced its model 3550 digital radio test system with the addition of enhanced VSWR and distance to fault functionality to the tracking generator. By utilizing the sweep of the tracking generator, the 3550 can measure and display the VSWR of an antenna or find the location of one or more faults in a cable. This enhanced capability, combined with all of the other, expansive radio test capabilities of the 3550, make it the ideal choice for testing radio systems, whether on the bench, in a vehicle or at a site.

www.aeroflex.com



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