Radio Guide

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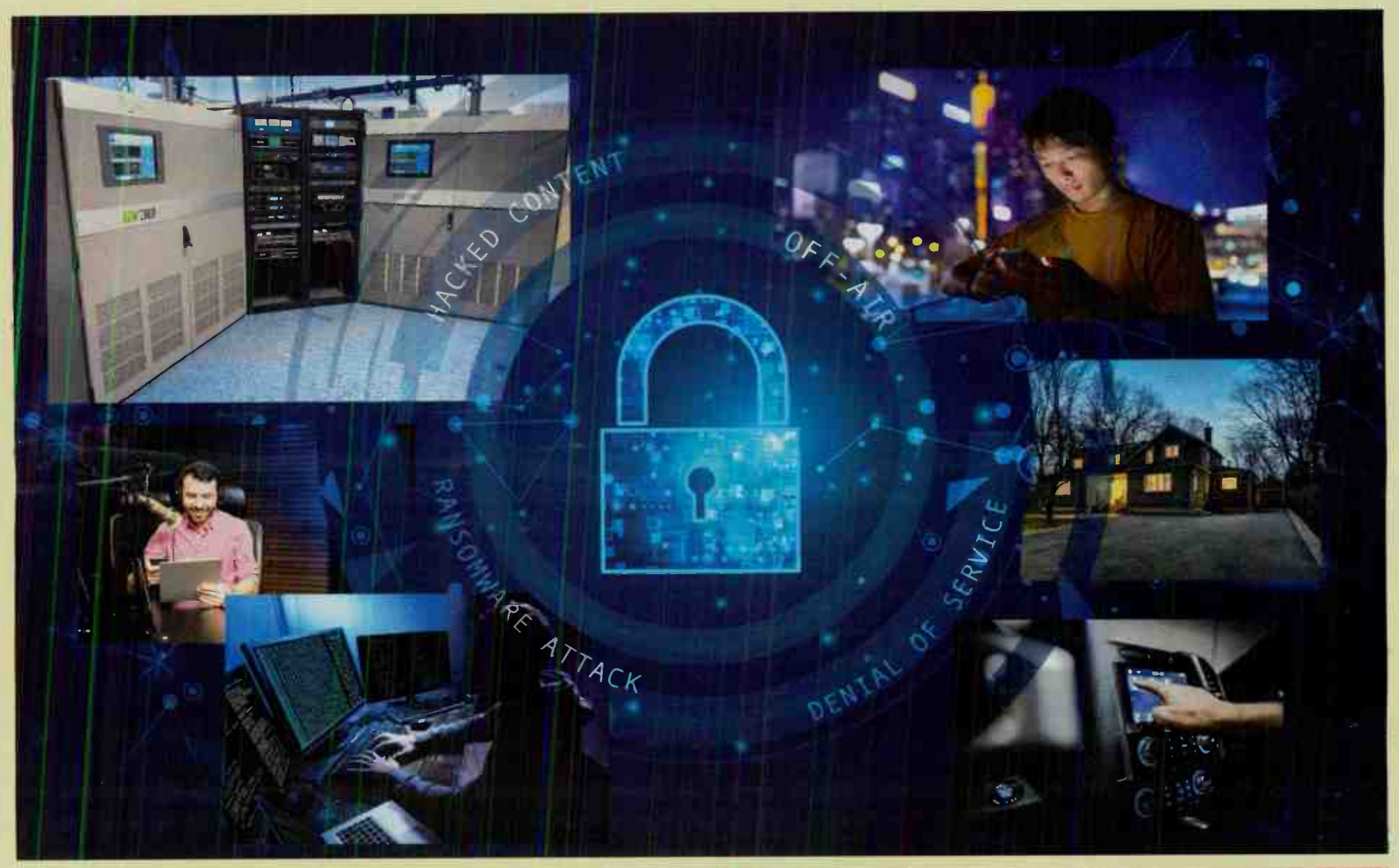
May-June 2022 – Vol. 30, No. 3

IT Security at the Transmitter and Beyond



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I Hate Meeses to Pieces: *"The top of the transmitter, where the RF output connector is, has an opening that must be 6 inches by 10 inches. There may as well have been a "Mice Welcome" sign! To (hopefully) prevent future damage we covered that area with some hardware cloth cut to size and held in place by some Scotch 130C Linerless Rubber Splicing Tape."*

Tower Topics – *by John Marcon (page 40)*

High Intensity Tower Light Project - Part 1: *"There have been many technological innovations in broadcast technology and in the lighting industry, the trend today is to move from strobe to LED tower lights. They claim that the LEDs last much longer than the strobe and consume less power. After looking at the alternatives, we decided to go with the latest LED high intensity obstruction lights. As we look for vendors of this system, we discovered that we did not have to go far and wide because the SBE website itself has a list of companies that provide the latest high intensity LED system ... the trend today is to move from strobe to LED tower lights."*

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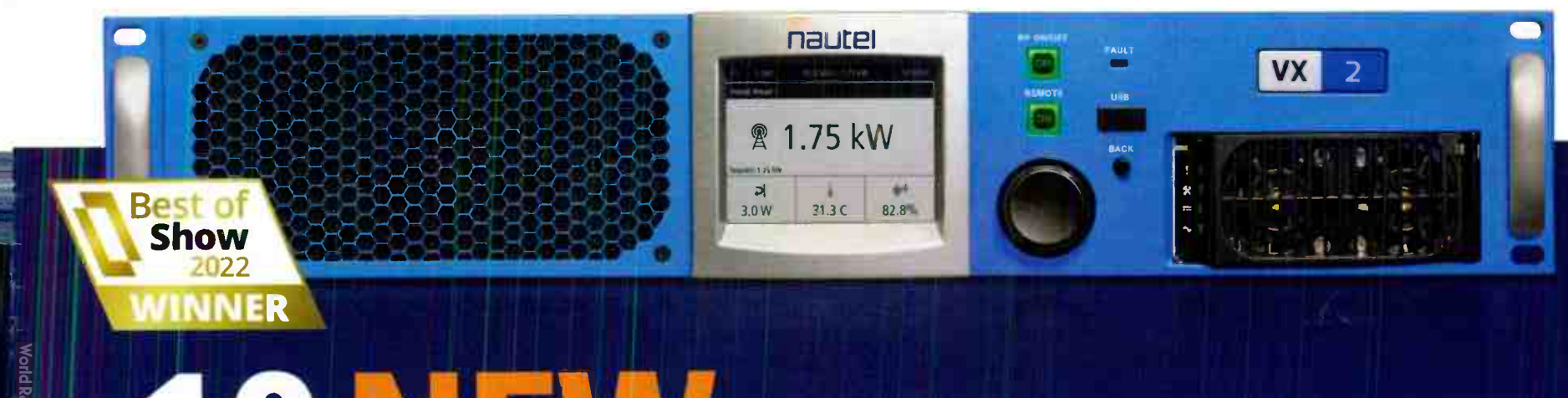

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Cover Story

IT Security at the Transmitter and Beyond

by Jeff Welton

Over the years, we've all had to learn at least some basics of IT security. I may be dating myself, but when I started at Nautel 30-odd years ago, our entire network was a PC8086 and 8088 connected with a piece of coax, running Lantastic. Need I mention that things are just a *little* bit different now? Unless you're one of the young radio engineers who grew up with computers (we need *more* of you), or someone who joined broadcast from the computer world, you're probably in the same boat I am. We've had to do a lot of learning, and unfortunately, there are bad guys out there who know a lot more about IT than most of us do. IT security affects every aspect of your station's operation – from the sales department to traffic/billing, to programming, to remotes, your signal transport, and of course the transmitter.

With the proliferation of Internet of Things (IoT) devices, it was only a matter of time before these technologies became integrated into broadcast equipment. I periodically use an IoT search engine to do on-line searches for visible devices, using broadcast manufacturer names such as Barix, Comrex, Tieline, and yes, Nautel. A surprising number of devices are always visible from one or more of these manufacturers ... and if they appear on the Internet, they're an invitation to hack into your station. (If I find a Nautel transmitter in this search, the user gets a friendly reminder from us to hide it from sight.) And it's not just these devices you need to worry about. If your station uses Internet-accessible door locks, webcams, temperature controls and other IoT products, those can be a pathway into your network too.

guys can't get past it. Luckily, there are some basic things you and the rest of your station's staff can do to stay reasonably safe. These may be the most critical steps:

1. Know what devices in your facility are talking to the Internet.

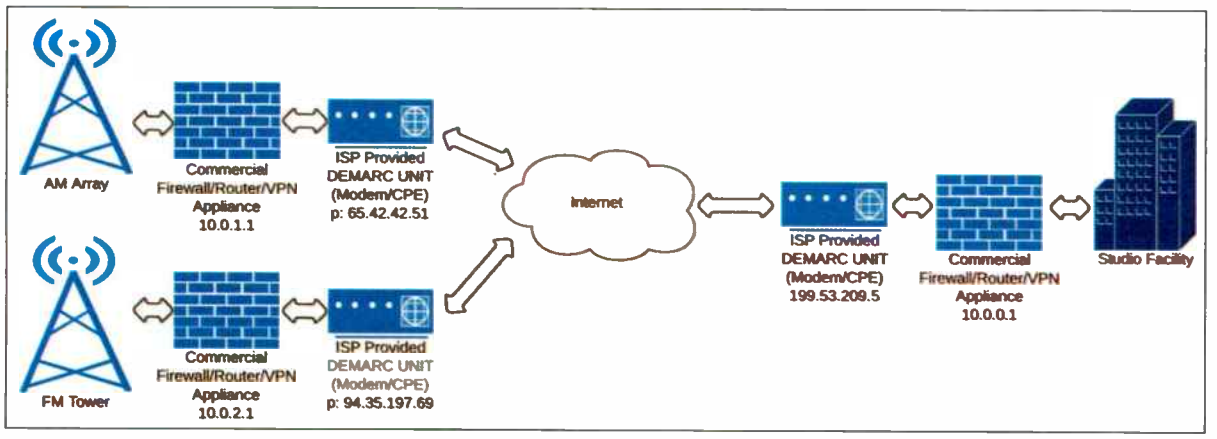
If you don't know what you have, you don't know what needs to be secured! It's a great idea to maintain a database or spreadsheet of devices, with their IP addresses, any subdomains and the gateways they use for Internet access. Each device should be checked to make sure their Internet connections are secure, which leads me to the next few points:

2. Change default logins. (Do any of your devices still use "admin" as the username?)

3. Use strong passwords (paraphrases).

If you're using passwords such as "password," "qwerty," "123456," "letmein," and so on, we need to talk. Your password needs to let *you* in and no one else. It should be uncommon, and be a combination of upper and lower case characters, numbers, and symbols. Paraphrases are useful, such as "JeffWelt0nisCr@zy!" (now that I've suggested that one, don't use it). Better yet, use a password generator and keep access to that generator highly secure with a passphrase. The important thing? *Everyone* who has access to your network needs to set up a strong password on *every* device they manage.

4. Don't allow those devices – or user laptops or other equipment – any access to the sensitive parts of your station unless they're on a VPN with strong firewalls.



A secure VPN includes firewalls at each site. If outside Internet access is required, that traffic should be inspected by the network's primary firewall.

Why worry about IoT visibility on the Internet? Let's just say that one ransomware attack can really ruin your day. Whether you're a mom and pop station or a global operation with hundreds of stations, the hackers don't care – your ransomware demand will be the same. Or, hackers with a twisted sense of humor can take over your transmitter and run their own content until you're able to shut them down.

So how do you keep these people out of your business? The trick is to be as invisible as possible. If hackers can't see you, they won't try to get in. And if they *do* see an access port, that port needs tight controls so the bad

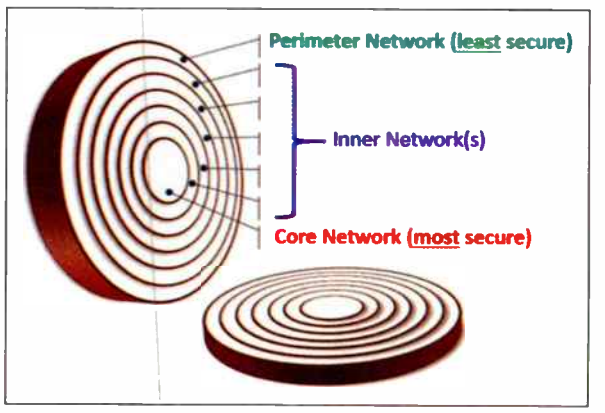
This obviously includes your Internet-enabled transmitter but could also include remote studio operations, staffers working from home, and so on. Many stations will place a single firewall between the studio and other parts of their air chain, but this means numerous holes are being punched through the firewalls to deliver audio, get telemetry, or provide remote access for your staff. Each hole punched through the firewall is a hacking point. A VPN with multiple firewalls is *much* more secure. Place a firewall at each endpoint; this way no ports are visible from the outside and all sites are authenticated by your VPN. Don't open ports on the secondary firewalls for outside Internet access; route all of that traffic through your primary, highly robust firewall. Some devices may need to live outside your network; give them their own, separate port on your router and isolate them from the critical areas of the network.

5. Watch what comes in to your facility from the outside.

USB sticks are notorious for carrying viruses into an otherwise secure facility. If someone wants to deliver an ad or sound bite to you via a USB stick, set up a "sacrificial computer" in the lobby that is used to run security scans on those sticks. That computer should remain isolated from any critical parts of your IT infrastructure. Remember that WiFi doesn't respect boundaries, so be sure to set up guest access for anyone outside your inner circles, and keep WiFi networks completely separated from your air chain and other critical areas.

And be sure *not* to be "the guy" who brings a laptop computer from home and plugs it into the network!

As you set up your IT security, consider "The Onion Approach" where you have different layers of access and protection:



Use "the Onion Approach" when setting up security zones. The outer layers of security provide additional protection for the inner ones. Image courtesy Wayne Pecena, Texas A&M and former SBE president.

6. Pay attention to potential 'back doors' into your IT network.

Your router/firewall may have lots of ports that have been used for various functions at one time or another. Close any ports that aren't being used, use non-standard ports when possible, and monitor your network regularly so you can make sure everything's normal.

You'd be surprised at the number of bots that are out there pinging your ports every day. This is to be expected, and is another reason why you need high levels of security on those ports.

7. Get the entire station involved.

Keeping your network secure can't be left entirely to Engineering and the IT department. Social media managers, sales people, production, station management and others all need to be aware of why IT security is so important – occasional training sessions should be scheduled for the entire staff. The potential revenue hits will get their attention if nothing else does.

If you're looking for more tips on setting up a secure VPN with firewalls and other IT security issues, check out Nautel's *Transmission Talk Tuesday* webinar archive from earlier this year. One entire session is devoted to VPNs. You'll find these TTT sessions at **https://nautel.com/webinars/**

Jeff Welton is Nautel's Regional Sales Manager, Central U.S. He can be reached at jwelton@nautel.com.

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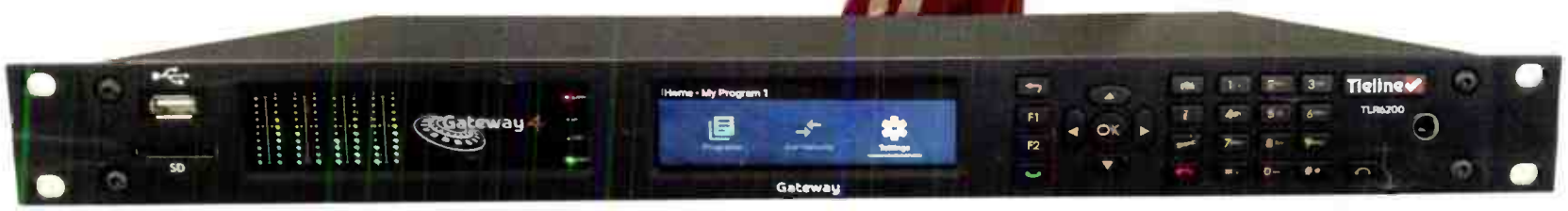

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Spruce Up Your Sound

From broadcast to podcast, are we getting sloppy?

by George Zahn

It's been quite a while since we addressed the whole concept of podcasts. The ever-growing boom of these segments for streaming, continue to cut into broadcast time spent listening. Many radio stations are adding available podcasts of their own shows (usually talk programs with royalty-free or buyout music) to either enter the fray or to regain some listeners using the streaming pipeline.

One would think that broadcast veterans would have a "leg up" on our podcast-only brethren, but even some long-time broadcasts re-packaged for podcast are deficient in some technical issues. Are we leaning too much on broadcast transmitter processing such as compressors and voice enhancement to have a decent-sounding podcast from the same "broadcast" material?

Here's what I'm talking about. Listen to any of the tens of thousands of "amateur" audio podcasts, and you'll hear a litany of technical problems. Among those are terribly inconsistent microphone qualities among the hosts/guests on the podcast. To me, it's inconceivable that co-hosts of a podcast could have such disparate audio quality. Even the least seasoned podcast beginner should be able to find and afford a decent USB microphone.

Sound-Alikes

Co-hosts who work together on a regular basis could do well to invest in the same model microphones. The market is being bombarded with USB microphones that include USB (and often also an XLR, which makes the mic desirable for other audio uses) output. The USB microphones will also often offer a mini-plug headphone output that can allow the host to avoid the hollowing sound of using the USB microphone with computer speakers adding phase issues.

Broadcasters entering the podcast realm, have a very good advantage. If you have multiple people in your studio, you likely have matching microphones, and professionals who know how to work the microphone for decent results. Simple podcasters could be as varied as one person on a decent professional-quality microphone talking with someone who doesn't see the advantage of upgrading their built-in laptop microphone. The mix can be jarring.

Podcast co-hosts in different locations should really work to try their best to match acoustic space and sound. It's as simple as using some absorbing material in areas that tend to have high reverberation, and doing it aesthetically if you're also streaming video. It's OK to show some of the tech in the video, and it lends a sense of credibility in addition to helping your sound.

Again, those of us who do live or recorded broadcasts that end up streaming as a podcast or on-demand program, have the advantage of decent studio atmosphere and sound. We also have the ear to help a guest who may be connected via Zoom, CleanFeed, etc. to work their equipment to improve what's on our air if we're using a virtual platform. Many podcasts sound as if they're just put together in a "whatever" laissez-faire fashion.

Making a Good Compression

One of the greatest pet peeves I have, as I've sampled broadcasts also made for podcast, is level differences. Some broadcast shows for streaming and strictly podcast material are frankly unlistenable because of the terrible difference in audio level of the people speaking. For those of us who are broadcasters, maybe we've been spoiled by our on-air processing covering little (or large) variations as we do an interview. Old and bad habits won't show up on the broadcast thanks to our Telos or Optimod, but if you take a wide dynamic range interview for podcast, there's no safety net to even out the levels.

This may be the greatest grievance I have against podcast quality. Now, not all podcasts are deficient in audio quality. Many are quite well done and show signs of a professional veneer. However some strictly podcast content shows can't even get levels right between hosts, much less than with guests – and how many times have we heard a booming theme or show open or spot within the podcast, then a barely audible host and/or guest. Is anyone listening to the finished or live product?

I agree with a colleague who was discussing this with me recently. We both find it hard to believe that some podcasts actually have audio producers whose job it is to assure decent audio quality and consistent levels, yet there is no apparent quality control.

Aiding the "Enemy"

At the risk of some of these tips falling into the hands of our podcast-only competitors, here are a few things I'd suggest for a better, and much more dependable and regular, listener experience.

Microphones: If the goal of your podcast is to grow an audience and/or generate revenue, invest in some decent microphones. In articles over the last several issues, I've mentioned that a decent USB microphone with min-plug monitoring capability can be had in the upper two digit to lower three digit cost range. Is a better end product worth a few hundred dollars? Our radio stations are dealing with decent microphones in most cases, but you can get a close sound without breaking the bank. Even a much heralded Shure MV-7 USB mic can be had for under $250 and has been said by some to be one of the better "bangs" for the buck.

Shure MV-7 USB

Studio: Again, if serious podcasters are striving for more listeners, match the microphone and the general acoustic sound of co-hosts or hosts and guest. Co-hosts should do their best to match acoustics. Guests can be more of a challenge. Other technology can sound better or worse that our studio telephone interfaces. A guest with a decent microphone via a virtual platform can sound like they're in the studio as opposed to the frequency limitations, and even digital phasing, of telephones.

Compression: This is the easiest fix of all. Decent audio compressors, including hallmark companies such as dbx, can be bought for a few hundred dollars. The soft-knee compression is quite forgiving and does not need an audio genius to operate. If you're doing a live podcast, do what the broadcasters do for the shows that air on terrestrial radio. Feed your audio through a console that allows you to compress (bring up the low levels and control the hot amplitudes) your finished product.

Whether you're a broadcaster or a podcaster and you're airing a recorded segment, you can simply run it through some basic compression in software such as what's built into Adobe Audition, Audacity, etc. I often will do this as a backup for shows about to be placed on our station's "podcast" page. Keep in mind that we're all (broadcaster and podcaster) being heard more and more on smart speakers. Just as the early days of transistor radios in the 50s and 60s brought us tiny, low fidelity speakers, the most basic models of smart speakers today give better sound than those old transistor radios. But they are not always full fidelity, and whatever we can do to improve the "listenability" of our audio product coming out of those speakers could help determine our future.

These are just some of the technical issues I hear in all types of podcasts today. There is one highly successful podcast that covers a local sports team. I enjoy the content immensely, but have occasionally just told Alexa to "STOP" when I'm jarred out of bed by a show open or a commercial that's 20dB hotter than the hosts – each which seems to have their own disparate level, which was already hard to live with as someone who listens to radio.

Talk About Me

I'm barely even mentioning some of the other nuances of many podcasts today. As a broadcaster, I really don't get the podcaster's need to fill time for two to five minutes at the top of the show talking about their day or minutia before getting to the topic I want to hear. For video podcasts, the challenge of similar at least minimally-effective lighting for split screen co-hosts can only help.

For some system or network podcasts, simply dropping commercials anywhere randomly into a podcast is disconcerting. Creating a rough broadcast-like format for a podcast, even the most rudimentary, can make for a predictable and pleasant listener/viewer experience.

Bottom Line: Our radio podcasts can be so much better than they are, and light years ahead of any of the "amateur" podcasters out there. The podcast-only shows are not going away anytime soon, and they might just be gaining on us. Broadcasters can beat podcast-only programs at their own game by instilling basic good practice tenets into our streaming options.

Let us know your podcast success stories and we can share them, and other reader comments and questions, in a future article!

George Zahn is a Peabody Award winning radio producer and Station Manager for WMKV-FM at Maple Knoll Communities in Springdale, Ohio. He is a regular contributor to ***Radio Guide*** *and welcomes your feedback. Share your stories with others by sending ideas and comments to: gzahn@mkcommunities.org*

The Reporter.

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Chief Engineer

I Hate Meeses to Pieces!

by Scott Schmeling

Before starting this edition's article, I'd like to take a quick look back to the last article about removing the "battery snot" from our Nems-Clarke Field Intensity Meter. My good friend Marv Olson suggested that I could have prevented the problem entirely, simply by removing the batteries before putting the meter on the shelf. You are absolutely correct, Marv. But in reality, how many of us actually do that?

If you're old enough, you recognize the heading from Mr. Jinks in the Huckleberry Hound cartoon series. Like all of us, there are some things that I really dislike. Two of them are mice and wasting time waiting for something (not necessarily in that order).

Another Aside Before I Start ...

Thank you to Ken Duvio, for your e-mail and kind words. Among other things, Ken shares my distain for *Mice!* In his e-mail he said:

"I was a Retail Facilities Manager for Kmart based in New Orleans. Critters loved pet food – particularly bird seed – but whatever they could get into. We knew that all a mouse needs to get into something is a 1/4 inch slit. Orkin showed us videos of mice breaching such, with a glass side so the viewer could watch a mouse become an "amoeba" long enough to get through.

They chew through wood patch, caulking, mortar. Even Portland too. After much trial and error, the magic formula was mixing a paste of plastic roof cement and steel wool."

Thanks, Ken. I knew steel wool would stop them but didn't know how to keep the steel wool from rusting away. I'll bet many readers will put that tip to good use.

OK ... now let's get down to business.

I had a situation recently that involved both mice (sort of) *and* ... waiting.

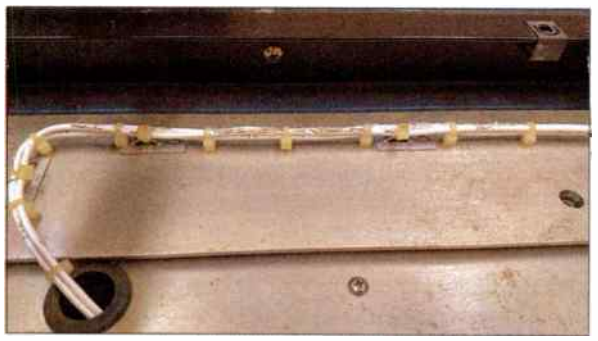
The telephone had been out for some time at one of our AM sites. In fact, a tech had been dispatched a few weeks earlier and a couple days later I received an automated phone call that our trouble had been resolved. One call to the SINE at the site and I knew the line was still not operating. I placed another call to report the outage.

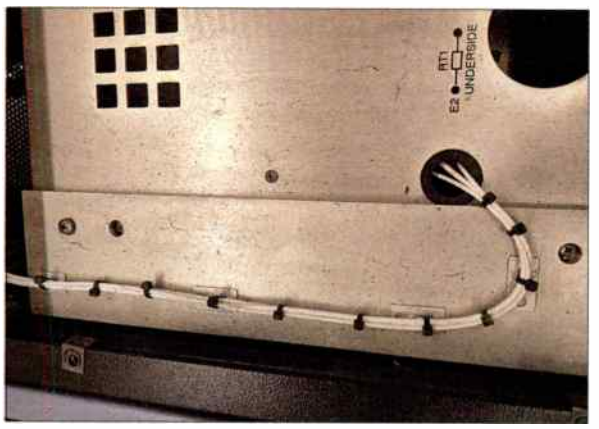
So, this time I was told the technician would be on site between 8:30 a.m. and 4:30 p.m. It was also mentioned more than once that if no one was at the location and the tech needed to get inside or to ask questions, there would be a $99 charge. I didn't care about the money so much, but I *needed* to get this phone line working again, for obvious reasons.

On the appointed day, I received another automated phone call indicating the tech would be delayed and would not be on site until 12 noon. I arrived at 11:45.

This site has a 5 kW Nautel Ampfet ND-5 AM transmitter. It has survived *two* floods, needing only minor repairs. My good friend Marv (remember him from the beginning of this article?) and I did the clean-up and post-flood repair. For some time, the mice had (apparently) easy access to the building. They left nasty evidence of their presence.

After the second flood, work was done to better seal the building to at least make gaining access more of a challenge. In the process of repairing the transmitter we found evidence of mice nibbling on small coax cables that are routed through the upper portion of the transmitter – below the top cover. You can see in the photos below where mice have chewed away at some of the outer jackets and shields. None of the cables had failed, but we replaced them anyway.



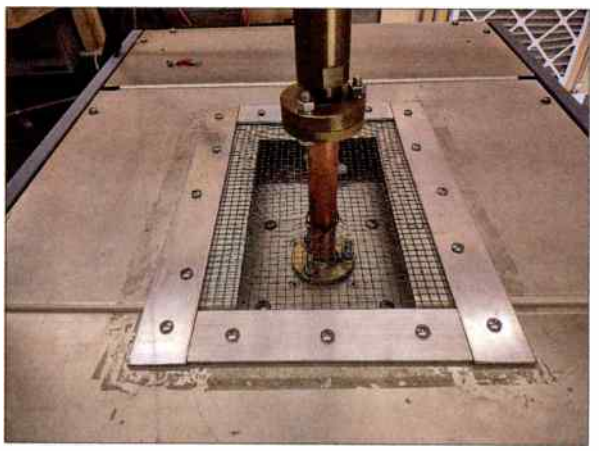


The top of the transmitter, where the RF output connector is, has an opening that must be 6 inches by 10 inches. There may as well have been a "Mice Welcome" sign! To (hopefully) prevent future damage we covered that area with some *hardware cloth* cut to size and held in place by some Scotch 130C Linerless Rubber Splicing Tape (I *love* this stuff!) *(see photo below)*. If you're not familiar with it, hardware cloth is a coarse metal screen of sorts. The holes seem to be small enough to keep mice out. It's also good for keeping rabbits from helping themselves to your garden.

But I digress – this mouse damage and repair had been years ago.

You know how, sometimes, a temporary fix seems to become more permanent? I mentioned holding the hardware cloth in place with the Scotch 130C rubber tape. That was supposed to be a temporary fix. But with so much going on at other sites, if a site isn't giving you trouble it is visited less often. But today I would be here – waiting, waiting – for possibly as long as four and a half hours. Today I would do a more permanent job.

In preparation, I picked up some inch and a half aluminum strips, four feet long and about 1/8 inch thick. Enough to make a suitable frame to hold the hardware cloth in place.



I'm not going to include any measurements because they would only be pertinent to this situation. Using a small square and a tape measure I marked the aluminum then using a hacksaw with a *fresh blade,* I cut them as straight as I could then filed the ends so there were no nasty finger-cutting edges. I marked and drilled holes in those aluminum strips for the screws I would be using.

The top of the transmitter cabinet is actually three separate pieces. After marking where the screws would go, I removed two of the top pieces and drilled the screw holes needed. (For the remaining piece, I drilled it in place with a piece of shop towel below to catch any metal fragments.)

Next, the top pieces went back in place and the aluminum strips and hardware cloth were screwed into place. At last, this temporary fix had a more permanent appearance. The rubber tape did a great job and it only had to be reinforced once. But now I'm confident any mice that get into the building will not be able to snack on those coax cables. And all this was accomplished while I waited for the phone company tech.

Speaking of which, I don't remember what time I finished with my project, but 4:30 arrived and no phone tech had been seen. I called their trouble number again and after navigating their automated system I *finally* got to a live person. Imagine my surprise when she said the ticked had been closed at 12:40!

I verified with her that the phone was indeed *still not working!* I had commitments the next day so we scheduled (again) for the following day. That day, I was on site and watched two phone company trucks drive past. An hour or so later, a truck drove up and the tech announced, "You have dialtone," which we did. They had gone farther up the line and found the problem. Apparently the previous time a tech was dispatched from a different area and was not familiar with things in this location.

The *up-side* of all this is that I was able to turn that otherwise wasted waiting time into productive time, changing a temporary fix into a permanent fix. And now the phone is working, too.

That's all for now. Until next time – Keep it between 90 and 105!

Scott Schmeling is the Chief Engineer for Minnesota Valley Broadcasting He can be reached via email at scottschmeling@radiomankato.com

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Broadcaster Liability for Non-"Use" Attack Ads

by Gregg P. Skall, Member – Telecommunications Law Professionals PLLC

The 2022 Mid-Term political season is well underway and is already extremely contentious. Broadcasters are bombarded with political ads from candidates and non-candidates alike. Many are highly partisan, advocate for legally qualified candidates for public office, and not infrequently highly negative. While broadcasters have liability protections for the content of candidate ads, the same is not necessarily true for non-candidate ads. As a result, non-candidate advertisements can raise tricky questions regarding liability for false, misleading, or hostile statements for broadcasters that air the advertisements. As explained below, broadcasters should adopt some best practices to ensure that they are protected in these circumstances.

It is well established that broadcasters are legally prohibited from censoring or editing the content of a broadcast message when it is presented in the context of a "use" by a legally qualified candidate for public office. Consistent with that principle, the Supreme Court has held broadcasters immune from liability for the content of such a message. Previously, a majority of political messaging was from candidates, however, after the Supreme Court's decision in *Citizens United,* broadcasters have seen a tremendous increase in the number of non-candidate advertisers, which raise liability issues for broadcasters.

Citizens United opened the door for political advertising by corporations, unions and campaign committees. These ads used to appear primarily in the sixty-day period prior to the general election; now however, they are seemingly the predominant type of political ad throughout the campaign season. Due to the ever-increasing number of these advertisements, there has also been increased focus on the issue of liability for the content of the advertisement.

Electioneering messages by corporations, special interest groups, unions or any non-"use" speaker can expose broadcasters to liability. These non-candidate messages create a breeding ground for threats of legal action intended to intimidate a station into ceasing further broadcast of the message. The threats can be claims of defamation, inaccuracies, violation of individual property rights such as copyright, or a general failure to exercise the broadcaster's public interest duty, often implying a challenge against its license at renewal.

For example, the American Federation of State, County & Municipal Employees (AFSCME) ran an ad that claimed a Congressman and Senate candidate voted to raise his own pay five times while in Congress. The campaign's attorneys sent cease-and-desist letters to broadcasters that aired AFSCME's ad demanding that they stop running it. According to the campaign, the Congressman had never voted to raise his own pay, thus broadcasters were obligated to stop airing the advertisement, arguing it was maliciously false, misleading, and potentially defamatory to the Congressman's character. Similarly, a recent advertisement by an opposing political party claimed that a Senator running for re-election had become the life of party life in Washington D.C. and was buying an expensive home in D.C., where he intended to stay permanently. His campaign lawyer claimed the ad was factually incorrect and defamatory and accordingly demanded that broadcasters withdraw the ad. These situations are cause for thoughtful action and response by the broadcaster.

The FCC has addressed non-candidate ads several times over the years, with an evolving response. In a 1960 Program Policy Statement, the Commission emphasized that licensees are obligated to avoid presenting deceptive advertising on radio and television and that every broadcast licensee had the responsibility to take all reasonable measures to eliminate any false, misleading, or deceptive matter.

This general policy against false, misleading, or deceptive advertising was reiterated eleven years later when the Commission declined to adopt specific rules to eliminate deceptive advertising. In a 1971 ruling, the Commission stated it would generally defer to the Federal Trade Commission on matters of advertising copy, but reserved the right to act in a clear, flagrant case. The FCC noted that when an advertisement is the subject of an FTC complaint, the licensee should review the charges and the advertiser's response, and then determine whether to continue to carry the advertisements. Though this implies that broadcasters might have a duty to make at least a modest investigation of the charges against an advertisement, the Commission also said that it would not require broadcasters to conduct their own tests. Thus, instead of adopting strict rules, the Commission decided to rely upon the licensee's discretion and judgment in evaluating advertising offered for broadcast.

In 1973, the Commission again had an opportunity to set standards for broadcaster responsibility regarding truth or falsity in political advertising, and again elected to rely on a licensee's exercise of discretion and good judgment. In *Complaint by Alan S. Burstein,* the Commission said that in the absence of a candidate "use:"

... each licensee may exercise its own judgment as how best to serve the public interest by presenting contrasting views, and what particular material is to be presented. Intervention by the Commission regarding specific material being broadcast for or against a proposition, even to the limited degree you urge, might create the impression that the Commission is advocating one viewpoint or attempting to judge the truth or falsity of material being broadcast on either side of a currently controversial issue – a position which would be inappropriate for a governmental licensing agency ... The Commission will not attempt to judge whether statements broadcast on political or other controversial public issues are true or false or whether a licensee was justified in either broadcasting or rejecting them. To do so would be to attempt to place the Commission itself, the government licensing agency, in the role of national arbiter of the "truth." Although we would be most concerned if substantial evidence were presented that a licensee had acted in bad faith or deliberately discriminated against a political candidate, we have no such evidence before us here.

In 1986, the Commission pounded in the final nail. In considering broadcast licensee character qualifications policies, the Commission specifically addressed deceptive advertising and ruled that a broadcaster would jeopardize its qualification to remain a licensee only if it were to engage in a "knowing presentation" of falsity. The Commission defined this as an active participation in perpetrating a deception upon the audience, either by its actual involvement in the knowing creation of a deliberately fraudulent ad or by awareness of FTC or other final governmental action involving the advertisement in question.

The Commission's treatment of these matters indicates that it has no intention to intervene and second-guess a broadcaster's judgment – unless the licensee knows an ad to be false and broadcasts it nonetheless. Absent such circumstances, threats of taking broadcasters to the FCC are unlikely to result in adverse action. Broadcasters nevertheless must consider other risks, such as civil actions for claims of defamation.

Generally, defamation occurs when a person or entity communicates false information that damages the reputation of another. For public figures, however, the standard is higher. In the 1964 case of *The New York Times v. Sullivan* the Supreme Court held that for cases involving defamation of a public figure (that is, one who places him- or herself in the public limelight, which includes candidates for elective office) the public figure must establish the statement was made with "actual malice," defined as knowledge that a statement was false or very likely to be false. The Court recognized that, the free flow of ideas and an informed citizenry required robust First Amendment protection for nearly all politically motivated speech. The Court held that open debate of political issues was too important to citizens in a democracy, where a free marketplace of ideas is critical to informed decisions. It also noted that open debate frequently becomes caustic and emotional, with sharp attacks infused into the effort to persuade, and allowing public futures to allege defamation for such statements made without actual malice would chill political discourse and harm the nation's democratic principles.

Thus, to be held liable for defamation, broadcasters must actively participate in perpetrating statements they knew or strongly suspected to be false. This ultimately involves a determination by a court of law – which can be time-consuming and expensive. However, broadcasters that make preliminary inquiries of advertisers to establish reasonable basis for inflammatory statements (and review the response to ensure plausibility) should be able to overcome a charge of actual malice.

In the example above, broadcasters sent a letter to AFSCME requesting a response to the campaign's letter. AFSCME responded with a line-by-line argument supporting the statements in the ad. That alone was likely sufficient to protect the broadcasters under the standards reported here. The broadcasters also asked their legal counsel to analyze the response, which revealed the truth to be quite gray. Either side could claim to be right, which meant, under the Commission's rules and New York Times, the broadcasters used reasonable judgment in airing the advertisement, and could not be liable for defamation.

Overall, when faced with allegations of defamation, fraud or misrepresentation regarding a public figure in a non-"use" advertisement, as general practice, broadcasters should first ask the sponsor for justification. If the response appears reasonable, the Commission and the courts do not require that the broadcaster be the guarantor of its truth, but only that the broadcaster not act with malice or knowingly participate in a deception.

This column is provided for general information purposes only and should not be relied upon as legal advice pertaining to any specific factual situation. Legal decisions should be made only after proper consultation with a legal professional of your choosing.

Gregg Skall is a member of the law firm of Telecommunications Law Professionals PLLC. He frequently lectures on FCC rules and regulations, represents several state broadcaster associations and individual broadcasters and other parties before the FCC.

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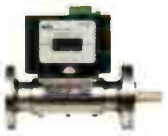

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Transmitter Site

Mast Mounted Radio Equipment on AM Towers

by Paul Thurst, CPBE

The proliferation of inexpensive IP-based wireless data links has opened many interesting possibilities for broadcasters. These systems can be used as LAN extensions, STLs, IP-based security systems, transmitter remote control and monitoring, remote broadcast linkups, or revenue sources such as WISP (Wireless Internet Service Provider) or leased data circuits. During the early days, there was a lot of debate on how long these inexpensive units will last out in the environment. Towers are large steel lightning rods that get struck often. Other concerns are RF immunity, heat cycling and UV degraded plastics over time. The disadvantage of Mast Mounted Equipment (MME) is the expense of a tower company every time something fails.

The first such system that I installed ten years ago was an experiment; a data link between the studio and transmitter site for a security camera system. I am happy to say that that system worked for many years until the studio moved to a different location. My experience says, properly installed, these systems are reliable and can last many years until the equipment becomes obsolete. If there is a failure, most times it is right out of the box. Thus, it is best to buy a few extra radios to have on hand in case of infant mortality.

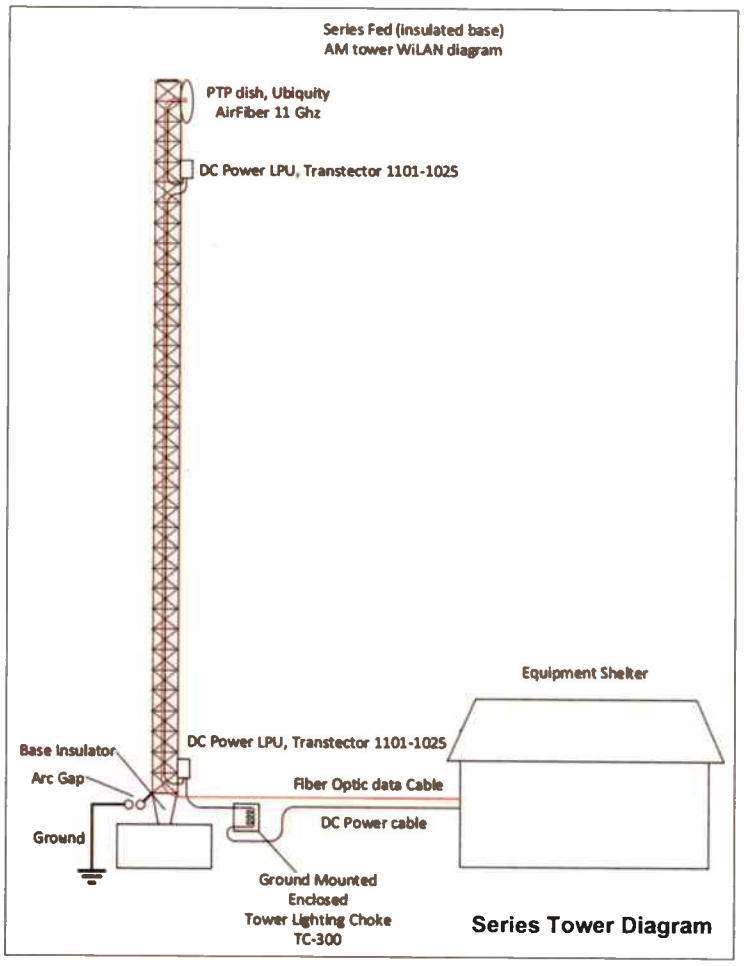
There are several manufactures of both licensed and unlicensed IP radio links. The equipment ranges from relatively cheap to insanely expensive. For critical applications like STLs, it is best to go with licensed units. The licensing procedure adds frequency coordination as an extra step and an extra cost to the project. Also, keep in mind that some of these less expensive radios are half duplex; sharing one frequency for both transmit and receive. Full duplex units use separate frequencies and transmit/receive full time. The difference is, some AoIP gear will not work well with half duplex units unless there is some type of edge device to buffer the IP packets.

Best practices for installing MME on AM broadcasting towers take into account lightning suppression, RF suppression, redundancy for critical systems, interference and network security. The cable type, grounding, and power protection (POE or separate DC power supply) are very important for system reliability. The tower installation labor is often the most expensive part of these projects. It pays to design well and install once.

Hoisting the WISP Antennas

Once the preliminary design considerations are completed (path analysis, bandwidth requirements, up time requirements) the next step is to decide on cable type. Fiber optic cable offers the best lighting suppression and RF suppression, however, it also adds complexity with ethernet to fiber converters. Shielded or armored category 5e or 6 ethernet cable is a good choice with quality lightning protection units (LPU) installed. If fiber is used, a separate DC power supply cable will need to be run to the MME, again with proper lightning protection units installed.

Good engineering practice dictates that before and after tower base impedance measurement are required. AM directional stations should also do before and after monitor point readings in accordance with their license. If the final base impedance measurement varies from the licensed value by more than 2%, a new license needs to be filed for.



Series Tower Diagram

When crossing a tower base, insulator fiber optic cable is the best choice. Make sure that the fiber cable does not have a steel messenger. To get the DC power across the base insulator, a tower lighting choke will work in most cases. Keep in mind the station's carrier power and wavelength of the AM radiator. A 1/4 wave or 90 degree tower will be fine with a tower lighting choke. As the tower height goes above 140 degrees, they become more resistive and have higher RF voltages at the base. Many older AM towers are 1/2 wave (180 degrees) or taller. These towers are very sensitive to any changes around the base. In that case, stacked lighting chokes or a parallel resonant circuit may be needed. This can be accomplished using a high voltage capacitor across each winding of the tower lighting choke. A network analyzer will be needed to center the resonant point on the carrier frequency. Depending on the carrier frequency a 25-250 pF capacitor will work in most cases. Kintronic makes an isolation coil that can be used for DC power with taller towers and carrier powers of 50 kW.

LPU at Tower Base

Skirted towers are easier to work with, but still have some special requirements over non-AM broadcasting towers. On these towers, shielded ethernet cable can be used since there is no base insulator to cross. A good UV rated shielded or armored ethernet cable is worth the extra expense. Superior Essex makes an excellent corrugated copper clad armored cable (PN 04-001-55). It is important to make an RF choke at the base of the tower after the LPU. Long cable runs up the tower to the MME will be capacitively coupled to the tower. RF can get onto the ethernet cable shield and DC power conductors, if present. An RF choke will force any induced RF on the cable shield to ground via the LPU. An RF choke can be easily made with excess cable. Sixteen to eighteen turns of cable sixteen inches in diameter will net an approximately 215 uH choke at 1,000 kHz. That will help keep the RF and lighting from entering the ground mounted equipment.

Good, weatherproof LPUs are well worth the extra cost. Transtector makes a good line of both ethernet and DC power LPUs . The DC power LPU rating should be as close to the system DC voltage as possible. Keep in mind that you do not want the LPU firing its protection circuits on heavy AM modulation peak induced voltages. Look at not only the rated voltage but the peak firing voltage of the transient voltage surge supressor (TVSS) devices.

Of critical importance is the proper installation of shielded 8P8C (RJ-45) connectors on the ends of shielded ethernet cable. In order to be effective, the shields at both ends of the ethernet cable must have good ground connections though the ethernet jacks on the LPU, radio equipment, network switches, power over Internet (POE) injectors, and so on.

For network security, it is always a good idea to create a separate subnet to go to the transmitter site. It keeps the office broadcast traffic off of the wireless data link. It also prevents snooping from any others who might have a laptop and access to the transmitter site. I tend to use randomly generated long passwords for the wireless links. As always, change the default username and password, keep the firmware updated and follow all the usual good network security protocols.

Paul Thurst, CPBE, is co-owner of Data Wave, LLC. He can be reached at paul.thurst@datawave.us

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Security Guide

The Cost of Copper and Security

by Michael Bradford

Ten years ago I traveled to Las Vegas for a quick project to measure the signal level of a test FM transmitter north of town. The location was an in-use cellular tower site with a high security fence – a well-lit compound adjacent to a main roadway. We set up the test transmitter with a "Hurry Up" mast of 35 feet and were poised for the actual test at sunrise the following day. As the four of us arrived that following morning, we noticed the chain on the main gate was hanging loose, the generator enclosure was open and two coils of half-inch coaxial line were gone. Our test setup was untouched. Half way into the three hour test regimen, a local security company van arrived to investigate an "apparent" intrusion alarm. Why this "alarm" occurred, I never discovered as the security firm's employees were tight-lipped the whole morning.

It turned out, someone had bought a retired PG&E service van from Washington state, had it repainted, and had been traveling around to cellular tower sites, radio tower sites and even remote power sub-stations in broad daylight, and stealing any and all copper they could find. It seems that no one gave that van a second glance as it appeared to be perfectly normal for it to be at one of these sites.

That was a decade ago and the price paid for scrap copper has risen by some 28% since then to $4.59 a pound as listed at a local recycle center just last week. This means, of course, that the theft of copper will be on the rise, if not occurring already. It's time to review security issues at remote tower sites and make sure you're up to date.

Eight foot tall fences are all too common and can easily be breeched with a step-ladder or even an old blanket tossed over the top. I always recommend a 10-foot chain-link fence. Adding razor wire, or similar,, along the top certainly reduces the chance of illegal entrance. Stout chains and locking mechanisms on entrance gates are always a good idea but choose a good grade of chain. **(Figure 1)** If you use a combination lock don't use the station's frequency for the code. That's all too obvious even to a casual observer. And don't forget the driveway entrance gate. Use the same good quality chain and hardware with a different code from the building access gate lock.

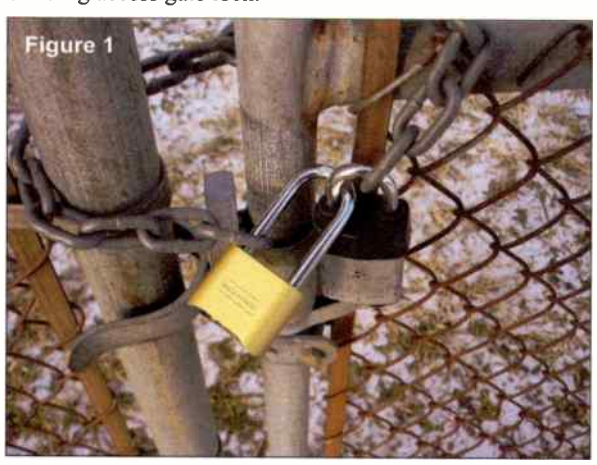
Figure 1

Perimeter lighting is critical for security. With the availability of LED outdoor flood light fixtures, you can cover the whole compound while using 1/10 the electrical power. I suggest photo-controlled lighting to come on at dusk; if the compound is dark, this just invites investigation by thieves. I also suggest proximity detectors separate from the perimeter lighting that connect directly into your third-party security system and/or the site remote control. This integration could be a simple relay or current-sensing transformer with an output sufficient to drive your remote control telemetry. This same proximity detection device could be coupled to a siren or horn to alert nearby residents. **Figure 2** is a system I installed that connects to an outdoor horn and is triggered by the proximity fixture. If the door of this system is opened or any of the input wires are cut or shorted, the alarm sends a text and email alert via the 4G cellular network.

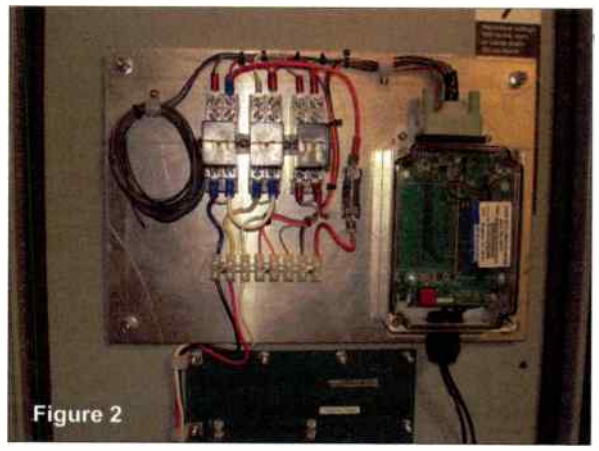
Figure 2

I have seen engineers coat copper grounding plates and cables with tar to keep would-be thieves deterred. I don't know of any recycle businesses that will accept anything covered in tar. **Figure 3** shows a radio tower site located near a residential area. Note the copper cap on the cement pier. There were four, 4-inch copper straps, down each side of the pier, connecting the cap to the ground system. There was an 8 AWG copper cable shorting across the base insulator to convert this to a grounded tower. No nearby resident noticed the thief crawl over the fence and carry off the copper. This is an example of a good place to have located a proximity sensor and loud horn.


Figure 3

Another area of concern is remote generator enclosures. Just like Mid Atlantic rack cabinets, Optimod processors and virtually all generator enclosure panel locks, it seems that one key fits every model ever made. I suggest a quick trip to a local locksmith to get panel locks that are unique to your site. I know this makes for a larger key ring for fellow engineers but I think it's worth the effort. Remember the story from above of the thief in Las Vegas? He had a set of keys and combinations for everything from Kohler to American Tower. I also suggest a basic security system just for your generator. **Figure 4** is a system I installed inside a generator surround cabinet. It samples battery charger output, generator output voltage, battery voltage and alerts to any panel being opened. You get an immediate alert within 30 seconds via 4G cellular communication in text and email format.

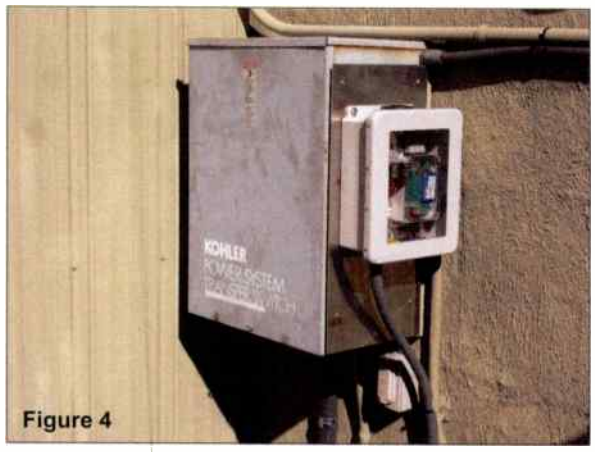
Figure 4

In 2019 there were 220,000-plus cell tower installations registered in the United States. At that time, AT&T estimated that they would need an additional 300,000 new tower sites to implement 5G. Now *there* is a reason for concern about remote security. Remember when the President visited Atlanta for Super Bowl LIII? Security had to address some 200 intersection Traffic Control Boxes to ensure POTUS would not have to alter his route for any reason, caused by hackers getting into the TCB control boxes. (Their initial solution seems to have been to weld the boxes shut!)

In short, security is not limited to remote Broadcast tower sites. More and more, studios themselves are unmanned to a great extent and need security from external assault and Internet hacking.

On the international security stage, a March 17 bulletin from the European Union Aviation Safety Agency warned that an outage of the GNSS global navigation and surveillance satellite system could cripple commercial airlines. This bulletin was prompted by reports from numerous sources analyzed by the EUAS, noting that jamming and spoofing of GPS satellites were intensified in the Baltic Sea, Eastern Finland, the Black Sea and Eastern Mediterranean. It was also noted that Russia has proliferated distribution of hand-held GPS jammers and road-capable jamming devices concurrent with its invasion of Ukraine.

Russian state-run television even boasted that, if "NATO crosses our red line it risks losing all 32 of its GPS satellites at once." This would virtually cripple commercial airline activity, in that planes would have to change destinations mid-flight or be unable to land safely. Not to mention our own nuclear detonation detection surveillance would be severely altered *(note)*. I mention this possible GPS scenario because communication satellites depend on GPS signals to maintain their timing and orbit stability. Satellite receivers use GPS timing to coordinate programming, commercial inserts and computer sync pulses for Broadcasters.

I also noticed a request from the FAA for feasibility comments for "rapidly deployable mobile control towers." This request was targeted towards the air traffic technology industry and one wonders if the FAA is anticipating possible interference to existing "hard" air traffic control towers by jamming of the their communication and/or air control systems that would require rapid transport of temporary units.

It boils down to this: We must be aware of many situations around us that would lead to increased threats to our industry, especially remote transmitter sites and unmanned studio sites. We must be proactive and alert. We must always plan for the worst and use the best methods available to thwart theft or interruption of service to our clients.

(Note 1) Details from GPS World magazine, April 2022 issue.

Michael Bradford began his career at WCCW in 1962, A CPBE since 1984, and currently a contract engineer. You may reach him at: mbradford@triton.net

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Facility Focus

The Phoenix Principle

by Jim Turvaville

In my younger years, I was fascinated by the *The Flight of the Phoenix,* a 1964 Novel by Elleston Trevor, and read it many times. It was made into a movie in 1965 which, as most people who have read the book first, was disappointing in that it did not match the written original, no matter how good Jimmy Stewart did in playing his part. It was based on a real-life event in WW2, though the aircraft name of *Phoenix* was chosen for the novel to symbolize the Greek mythological creature which rose from the ashes. If your curiosity has been piqued, then go look any of those three up on-line. But that is the point of my story today.

Living in the west, I am accustomed to extended periods of drought and the effects that such an event has on the environment – and to a lesser extent, our broadcast facilities. Obviously, I have seen firsthand how a prolonged drought can alter the parameters of my AM stations, particularly those with directional patterns. And in the wide open spaces out here, range fires are not uncommon when humidity levels are below 5%, winds are in the 45+ m.p.h. speed and it has been 4-5 months since any measurable precipitation has occurred. However, this was my first experience with not one, but two broadcast stations being affected by these fire events.

The first event, was a rather localized range fire in NW Oklahoma, at a 4-tower DA-2 AM station that I had built in a recent iteration of its existence. That was in 1989, when the new Nautel Amphet 1 kW transmitter was installed. It had some tower work done a few years later, but the Amphet was still in operation on the fateful day this spring. A range fire spread from about a mile away onto the grounds of the station, burning 3 of the 4 ATU's and getting to the studio/transmitter building in short order.

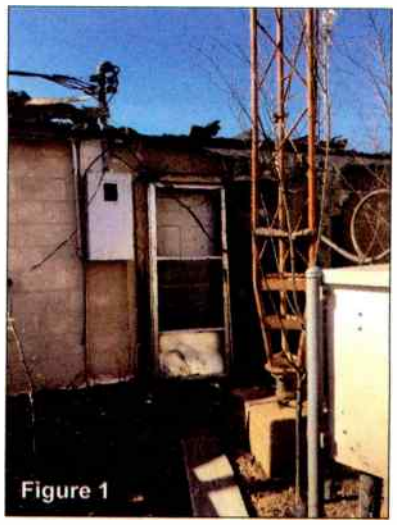
Figure 1

The concrete block building survived **(Fig-1)**, but the wooden roof was destroyed on the back half of the building – where the transmitter and phasor were located – and all of the electrical was melted. Much appreciation to the local fire department who concentrated on keeping the transmitter and its equipment wet enough to sustain mainly heat and smoke damage. **(Figure 2).**

My respect for those older model Nautel transmitters has gone up a notch; this one got wet and smoked a good bit, but after a few days of drying out and removing all of the modules and carefully cleaning all contacts in the shop, the old girl came right back to life at licensed power into a dummy load.

The phasor and ATU's did not fair so well and will likely have to be replaced or completely rebuilt. An STA was filed and swiftly granted to operate at 60 Watts non-directionally day and night (the minimum in the nighttime null which is also within the daytime null on the DA-2 station) into the one tower which did not have a melted ATU, and in a couple of days, programming was resumed. The station does have a non-collocated FM translator which did not miss but 12 hours of broadcasting until a long-wire was put up as an emergency antenna at 20 Watts. That was replaced by the authorized 60 Watt STA in another 72 hours after that, keeping the community served by the heritage AM station as it has since 1957.

Utilizing the north part of the building, which was still protected from weather with a partial roof, a new electrical service was installed and allowed for a room with lights and power for equipment racks and the transmitter to be put in place. **(Figure 3).** It's not as pretty, but it sure is a local station rising from the ashes in a very short period of time. Props to engineer and part owner of the station, JD Ford, for his love of AM radio and skills to pull off such a quick restoration project. He has a couple hundred pictures on his Facebook page if you can handle the full scope of such a disaster.


Figure 3

The second event was a massive range fire that was just a few miles from my own house, and took out the building at the base of a communications tower. The fire itself consumed 39,500 acres of grass and pasture land, including about a dozen barns and outbuildings and at least six residences. There was a time when a nearby town was threatened by the fast moving fire, but the quick actions and skills of our local fire departments averted that potential disaster. I'm very thankful that, while these incidents are by no means rare in my part of the world, there is a small army of volunteer personnel who are trained and experienced in fighting these fires.

But the tower in question is a 320-foot guyed tower, which, besides housing the non-commercial FM which I had built for a local church, was also a central relay tower for a regional Wireless Internet Provider (WISP). The fire moved very quickly, and I have no fault with the local fire fighters who were protecting the two homes within a few hundred yards of this site. But the wooden frame and wooden floored metal building was a total loss. **(Figure 4).**


Figure 4

The fire happened on a Monday afternoon, and I had an out of town commitment on Tuesday that kept me from being able to visit the site, located less than 30 minutes from my home, until Wednesday afternoon. As I made that drive, a million thoughts were running through my mind: Is there anything that can be salvaged? What does a 1 kW FM transmitter look like after it's been melted like that? How much of the just-installed-last-year new coax will have to be replaced? Will the tower owner move quickly to get the radio station and the WISP back into service?

As I approached the tower site, there was a flurry of activity going on – the WISP had a crew measuring out new cables to run to their 12 dishes on the tower, none of which had sustained any serious damage. All of the coax lines on the tower were melted at the base, as the building was only a few feet from it. Expecting to see the carnage, I was instead greeted by the tower owner who had already bulldozed the remnants of the building and equipment and it had all been carried away to a dump. The only incidentally remaining sign of the old building was the bottom plate of an aluminum relay rack that had been used by the WISP – and it was just a solidified puddle of molten aluminum with hardly any sign of what it had previously been. The fire was so hot and complete, there was next to nothing identifiable in the rubble; and it was already removed and a gravel pad was already in place for a new building. I cut the end off of the 7/8" coax until it was mechanically clean, attached a new connector and my handheld analyzer told me the antenna was just as it was before.


Figure 5

A new building was delivered that same week, and service was restored for everyone less than 168 hours from the incident. **(Figure 5).** Indeed, this Phoenix had risen from the ashes as well, and life goes on much as before for all parties involved.

I now realize why there is such a large area of gravel around a tower site, as the other towers in the area, as well as oil tank batteries have these, and suffered no damage from these fires. My hope in sharing this with you is that you are prepared for any kind of disaster that may come your way.

Jim "Turbo" Turvaville is semi- retired from 43 years in full-time Radio Engineering and lives in Rural Wheeler County Texas in a "tiny house" where he maintains a small clientele of stations under his Turbo Technical Services (www.jimturbo.net) operation providing FCC application preparation and field work.

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Maintenance Guide

Of Brush Hogs and Weed Whackers

It seems like just yesterday that the weeds were knee high at the transmitter site. Do you simply cut them as needed – or engage in some long term prevention.

Battle of the Weeds

Like many of you may be doing right now, I not so fondly remember battling the weeds, volunteer "trees" and other nasty vegetation at my transmitter site.

Weeds Are the Enemy

And as I get ready to do battle once again – both within the tower fence next to the building, and at those anchor points – this year I've got a plan.

As I sit here, I vividly remember the endless hours of sweat, keeping the bush from overtaking the building year after year. The light finally went on.

An Epiphany

It dawned on me this past weekend, as I readied my yard for my daughter's upcoming graduation. The realization was that, years ago I should have taken the advice of the landscapers on TV and invested a few hours and a few dollars working some of their ideas into my transmitter site.

Remember Rule #1: Work smarter, not harder – and don't repeat the same tasks, if at all humanly possible.

The Plan

So here's my plan, and perhaps it could become your plan this year.

First, I plan to go out and hog, whack and cut down all the same stuff I did last year and the year before that – and the year *before* that. All that is, which has started growing back again this year.

Then I plan to use a big mower to cut the grass (weeds) down as close to the ground as I can. Man, I want to kick up some dirt, and cut them to the ground if I can. (OK, so perhaps this is sounding too bizarre, and one shouldn't seek revenge for years of weed torture.)

Anyway, I plan to do this both inside the tower fence and for at least three feet from my transmitter shack and my anchor points. I may get aggressive and do the same for a couple of feet outside the fence too.

The Material List

I plan a quick trip to a home center for some herbicide – actually *lots and lots* of herbicide, weed blocking cloth, and some kind of edging. I think you probably have figured out where I'm going with this.

With all this in hand, I'm going to apply the herbicide liberally, to kill off everything where I've cut. In about a week, I should have nothing but dried out weeds. I then plan to rake up (with help of course) whatever will pull easy.

Now for the Weed Cloth and Borders

My plan is to lay weed cloth, covering everything that I've killed off. Following directions on the cloth roll, I'll be sure to overlap the cloths runs as suggested and stake down the cloth. This should provide a barrier to prevent re-growth and new growth.

Next step is to place my borders. I think Ill get the ones that give me about four inches both above and below the ground. This should prevent future encroachments from either direction.

Time for Rocks

With measurements in hand, it's off to my favorite quarry, to price out some pea stone, granite chips or other rock that will fill the bill. My plan is to get the least expensive stuff that will work.

I looked at possibly just using mulch as a cover, but that tends to break down with time and I don't want to have to budget for that every couple of years.

Likewise, I thought about buying my rock from a home center, but this much rock would be too expensive purchased a bag at a time. Due to the size of the project, bulk buying is the only way to go. Maybe your station can trade out for the materials and someone with a dump truck to haul it in, versus hauling it in your pick-up truck.

Final Steps

My plan is to lay in a second round of weed killer (yes, I want to make sure those babies will *never* grow again), and then I'll put about 3 inches of rock to cover the weed barrier.

Heck, I'm so excited about not having to be an annual weed terminator, that I may even take the time to paint the transmitter building before I lay in the rock. This way I won't have to worry about the ugly of dripping paint on the rocks. But I digress ...

One thing I made a special note of, is to be sure that the weed blocking cloth is not just butted against the foundation of the tower, building and anchor points, but to make sure to use a few inches up the structures to ensure weeds don't find a glimmer of light and start germinating.

I also plan on manually spreading the rock, so I don't rip the cloth in the process.

It's Kick Back Time

When I'm done, I plan to never have to hog, cut or whack weeds, underbrush or vegetation at the site again. In future years what little bit of weed dares to rear it's ugly head with be summarily destroyed with herbicide.

Now, I suspect that this project will take about 25 hours of work – even if it takes a bit longer that's OK. It will save at least that much work in the first two years, not to mention the hours of frustration dealing with the problem.

We all have more productive things to do than kill weeds every year.

Tick Check

This is of the utmost importance. Whether you tackle this exterior overhaul or not, it is important that you check yourself for ticks whenever you work at your site.

Wood ticks are bad enough, but easy to see. Deer ticks on the other hand are the size of a poppy seed, and carry Lyme Disease. Lyme is physically debilitating to humans.

If you happen to take your dog to the site be sure to check him for ticks as well. If a dog is bit by a deer tick and develops Lyme, you have an 80% chance the dog will go into kidney failure and have to be put down if it's not caught and treated in time.

On to Other Maintenance

While we're on the subject of site maintenance, remember this is the time to make sure all of your annual spring/summer checks are made. Old bees nests need to be knocked down, and check the building to see if mice or other critters have found their way in over the colder winter months.

Don't forget to change filters, or at least clean the filters on the transmitter and other equipment. For most of us this is the start of the dirtiest time of the year, so we need to make sure our equipment is protected.

You may want to do a light bulb check as well. Even though the days are longer, those midnight calls may still come, so you may find yourself in the dark if the bulb or motion detector isn't working properly.

Clean out old bees nest tucked under an exposed roof soffet.

Roof Check?!

There is one other important item that you should check at least every year: the transmitter-building roof. If you have a wood and shingled roof, check for discoloration that may indicate a leak. You should also climb onto the roof to check the condition of the roof shingles. With high winds, and in areas where there is freezing and snow, it is possible that some shingles have become damaged and may need to be replaced.

Yes this is a pain to do, but remember the roof is protecting your transmitter and related equipment, that not only has several thousands of dollars of value, but is also your station's lifeline. An ounce of prevention in this case could save thousands of dollars of damage to equipment and in lost revenues.

Electronics Checks

If you have a smoke detector, heat detector, or perimeter detector that wires to the remote control to alert you or others of a problem at the transmitter site, you may want to take time now to check their operation.

Likewise, check to see if there has been any winter damage to exterior ground connections.

Even if my plan for weed control didn't motivate you to do the same, and you don't have other big projects, there is still plenty of routine spring/summer maintenance to do.

Ah, summer, a great time of the year – then again, maybe not.

If you have a transmitter site story idea that you would like to see covered or you want to contribute a column let us know,email us at: radioguide(at)earthlink.net

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Antenna Topics

Time for a New Antenna

By Steve Callahan

There are many reasons why your FM station might need a new antenna. A friend of mine in Florida had a three bay antenna at this station when, after a few years, he started getting calls from listeners that they couldn't hear it in places where they could have previously. A quick trip up the tower by his favorite tower crew showed that the top bay had been blown to bits by lightning. Surprisingly, there was no indication of any increased reflected power from the lightning strike and they never did find the stricken bay's remains on the ground around the tower. The antenna company did the right thing and provided a new bay at no charge.

Aside from the obvious need to replace or repair your FM antenna following divine intervention, sometimes you have to consider a new antenna to improve your signal or increase your power. I was at a station once, that was shortspaced to a co-channel station in another state. The stations had been granted via Section 73.215 which is contour protection, but if both stations had agreed to mutual waivers, both could have doubled their transmitter power and the interference ratio would have stayed the same.

I just had to determine the degree of shortspacing so I could negotiate intelligently with the station in the adjoining state. After finding a fellow who performed extremely accurate GPS measurements, I set him to work to determine the degree of shortspacing between the two stations. Imagine my surprise when he proved that the shortspacing was all of just 60 feet! I then met with the national director of engineering for the other station's ownership group and he studied my paperwork carefully. Stroking his chin, he said that he would not agree to the mutual waiver, despite the fact that it was just a measly 60 feet.

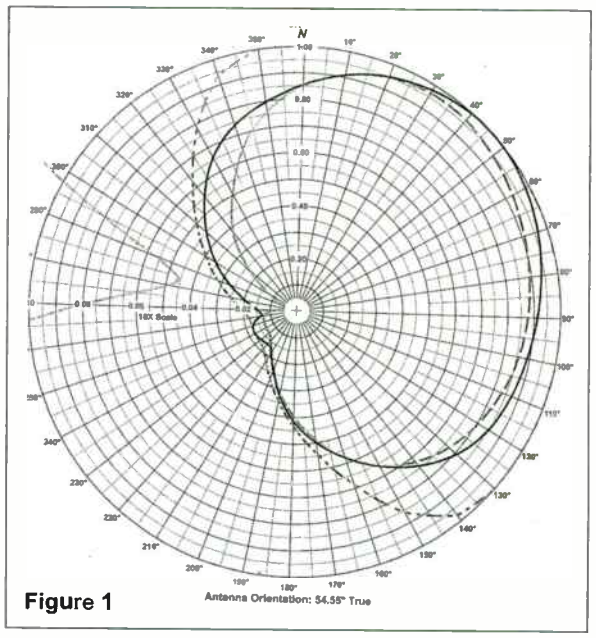
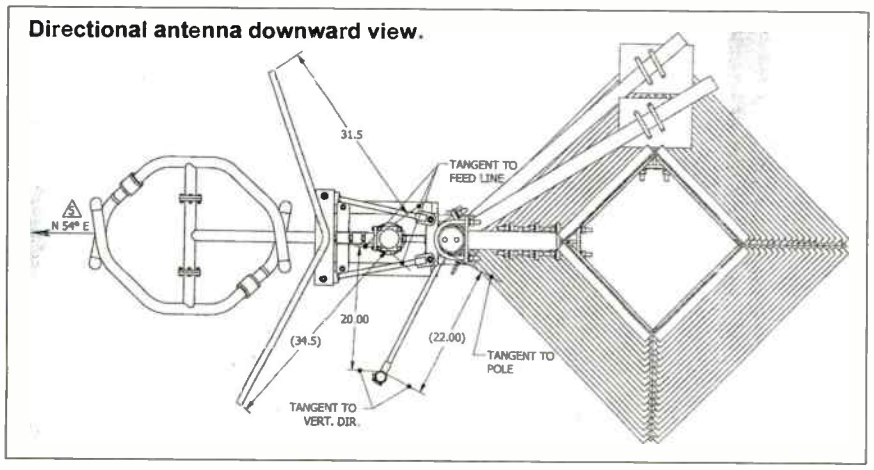


Figure 1

It was time for Plan B, which was a directional antenna. Granted it was more expensive than just turning up the power on the existing transmitter, but there was no alternative site to locate the station. You have to take into consideration tower alignment, intended and desired coverage and protection to be afforded to other FM stations. Patterns have been "proved" by antenna manufacturers using full sized, or reduced sized models, mounted on identical tower sections with all existing parts like ladders, conduits, and coax lines in place. That model is then rotated and, with the addition of parasitic elements and various mounting arrangements on the tower, a graph of the radiated pattern is generated (**Figure 1**). You, the antenna company's client, then select the configuration and alignment that best suits your needs.

At the time of the writing of this story, the FCC, at the behest of antenna companies and some respected consulting engineering firms, was considering changing this procedure to mimic, to a degree, the Method of Moments calculations that has been implemented successfully to develop AM directional antenna patterns without costly field measurements. The new data-based modeling could be tweaked and adjusted at a fraction of the time and expense.

Directional antenna downward view.

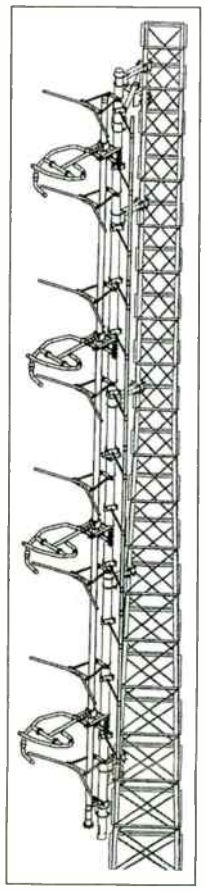


So you see that you have options and it all depends on you own particular set of circumstances. I recently was involved in a project where one FM station wanted to move closer to a larger population center but there was a co-channel station four states away that was shortspaced to it. Sound familiar? It sure did to me.

The options were, to move the shortspaced station to a fully-spaced tower site which would have required a lot of time and money. Another option would have been to drop the shortspaced station's power down to a lower class which would have affected it negatively, both in the short term coverage-wise, and in the long term, by giving up a more valuable higher power class. The option chosen was to utilize a directional antenna which nulled the signal of the shortspaced station toward the move-in station.

After determining that the shortspaced tower would be able to support the new directional antenna, the antenna pattern was developed and the construction permits were granted to both stations to make the necessary changes to their respective facilities. My goal was to swap the antenna with little or no off-air time, which at first seemed like a daunting challenge. There was a small auxiliary antenna half-way up the tower which we utilized, with a lower power transmitter, to keep the station on the air during the tower work and to also keep the tower crew safe as they brought new antenna components up and the old antenna parts down the tower.

Surprisingly, the lower power antenna and transmitter did a good job covering the city of license and beyond. However, no project is free of unanticipated delays and problems. First, bad weather was a factor in getting the crew up the tower to disassemble the old antenna. When we hopped that hurdle successfully, we discovered that the new four bay directional antenna was fed differently than the old five bay antenna, which left us with having to bridge a 30 foot gap with a jumper made of a piece of 3-1/8 inch air coax which was not on-hand, but needed to be made and shipped from afar.



When you are putting a directional transmit antenna into service, you need to get the information generated by the manufacturer as to where the null needs to be pointed and where the signal maxima, or main lobe, can be pointed. These specifications are made quite clear and the FCC says you need a local land surveyor to determine the direction where you need to point the null to protect the move-in station.

Fortunately, I've done more than a few of these projects, so I have my own go-to professional land surveyor that I trained years ago to recognize the components of an FM antenna. Some surveyors like to make large indications on the ground with spray paint so the tower crew can point the antenna in the right direction. My guy determines the proper azimuth and then sights the antenna and directs the tower crew to aim the antenna in the desired direction.

With the 30 foot jumper on the tower, and the antenna pointed in the right direction, a field service tech from the antenna manufacturer arrived to sweep the antenna to make sure that all of the connections were proper and there was no damage in transit or during installation – and that the antenna performed as it did in the factory before shipment.

It's always the right time to say a silent prayer as you power up a new antenna for the first time. You keep one eye on the power output and the other eye on the reflected power and, if both respond as they should, you have achieved a successful antenna swap.

All that's left is for your land surveyor to issue a written certification that he or she witnessed the antenna properly aimed according the FCC's specification and that you, as the experienced broadcast engineer, supervised the assembly and mounting of the new antenna according to the documents provided by the antenna manufacturer which conform to the station's Construction Permit.

There isn't enough page space here to go into the fascinating details of antenna design and theory, but there are lots of books and articles out there on the Interweb for you to peruse.

Steve Callahan, CBRE, AMD, is a member of the engineering staff at Entercom Boston. Email at: wvbf1530@yahoo.com

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Survival Guide

The Small Station Challenge

by Wiely Boswell

We all know things are getting expensive. Running a radio station is no exception. I have spent time at a lot of small stations with owners trying to keep costs to a minimum.

There is a lot of advertising focus on the latest Cat 6 surface studio systems, digital STLs, and digital everything, basically. The tighter your budget becomes every day, the less likely you will have all of the latest equipment. I would like to encourage you that nothing is wrong with having an all analog audio chain. Simplicity is a good thing. You should take care of what you use the best that you can. You are here reading, so you certainly stay up to date with articles on the newest equipment trends, old equipment repair, and advanced studio builds. So when the need arises and there is no other choice but a purchase new, you will have knowledge of what is currently on the market. Reminder: past issues of *Radio Guide* can be found on line at **www.radio-guide.com** When the occasional serious breakdown does occur, a decision on expensive equipment may be required quickly, without much advance warning.

One new trend is having off-air events occur more often and lasting longer. It was always an emergency, but quick response is hard to come by and supply chain always is an excuse, so longer off air periods are increasing. Streaming audio is a good fallback. A small station owner will normally attempt to do a lot of their own work as able. A good contract engineer will help the owner to be able to address technical issues on their own – sometimes with a little phone support, which saves money. They can also help locate some used backup equipment. Engineers are getting hard to find and more young people need to get in the profession while there is some mentorship left.

Of course certain expenses can only be trimmed so far. The bills just keep coming, such as the power bill, the gas bill, or perhaps rent expenses. And sad to say, it's just running away. What things might you do? Changing out 1200 Watt incandescent beacons with LED beacons can save enough on the power bill to be considered for replacement. The savings have a payback time which will get shorter as electric rates go up. You may eliminate a tower painting job by having daylight LEDs flashing. You gain the advantages of strobes without the intense maintenance – that is an easy example. There are lots of ways to save on power usage, like increasing insulation or sealing building leaks. You have to look at a lot of factors like what it costs for changing strobe tubes, incandescent bulbs on a tower, or installing insulation and weather stripping.

No matter what, the manufacturers will come out with new equipment – that's what they do. Just because "it" has lasted a long time and works great does not mean they can repair it. They can run out of discontinued parts and possible knowhow. Not much of the newest equipment comes with service information or schematics. It used to be a standard part of the manual and you could have not have sold equipment 20 years ago without complete documentation. Talented bench technicians are hard to find and to keep. A company also has to make repairs worth their time. It can become a hard decision for you, if repairing it at a high price is compared to buying a new unit. If it is a large item like a transmitter, for example, and the circuit breaker type is no longer available, the manufacturer will do their best to come up with a work-around if they can. If they cannot come up with a part you will need to start looking.

Use Your Contacts

You need your local circle of contacts like the SBE will provide. Your vendor, where you purchase broadcast supplies and equipment, can certainly be of help with locating someone who just decommissioned a piece of gear you could use as spare parts or a working back up. Your vendor may even show up at your door! Just today Dave from BGS was in town, visiting stations looking to learn about how they might be of more help with studio install applications. I heard how a customer was doing a large studio buildout where BGS provided the equipment. Someone from BGS even came by to help them unbox equipment that was shipped to the site. It's good having a vendor present. They learn more about any

(Continued on Page 28)

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The Small Station Challenge

– Continued from Page 26 –

process shortfalls and are able to correct any possible issues with the order quickly. It seems like new equipment these days needs a software upgrade, just as soon as it arrives. But we are not considering a large studio build, so keeping existing equipment running and happy is the goal, while at the same time keeping to a tight budget. The good news is, older equipment should be available as inexpensive spare systems or parts. Remember, that old gear is subject to electrolytic capacitors drying out. You can see them bulge as they slowly short out or go open.

On-Line Groups

A lot of groups on the web are helpful when you are in a bind – you can send out a request for a manual or info on a similar experience someone has already gone thru. One of these is **CRTech.org**, a Christian broadcasting web group that has a wealth of knowledge and can help with manuals – sometimes old equipment and parts are offered. State Broadcasters Associations can also be of help. The Alabama Broadcasters Association (ABA), perform alternative broadcast inspections for their members for no charge except travel expenses. They have classes at their office in Birmingham, Alabama. and present at SBE meetings. They are a huge help with EAS systems and monitor most of the systems in their state. There are a lot of triangin videos and information that can be found at **www.al-ba.com** Classes are starting to resume after the pandemic pause and help with SBE certification, even proctoring testing.

The BDR broadcast page (**www.theBDR.net**) lists an equipment for sale/equipment needed section of what people are looking to swap or sell. A lot of other helpful information is also sent out on FCC actions and other news. Barry Mishkind is an expert, loves his publication and does a great job. One other resource is Steve at Bay County Broadcast (**baycounty.com**). They specialize in used broadcast equipment, some even new, that is tested. They also have an equipment wanted section. It even lists antennas occasionally. Lastly, there is also Ebay where you can search for equipment and parts. You can save the searches for spares and will be notified of items matching description as they are listed over time. My main point here is to be ready to swap things out before it is an emergency and organize your parts like fuses or wall-wart power supplies. An older station might use spare large cartridge fuses that are hard to find. Expect UPS batteries to go bad in three years – sooner if you have a lot of outages that take it all the way to shutdown with no generator. If you do have a generator it is another long topic. You should have a plan to be able to jump start your generator and watch your fuel.

So maybe there is a better way of accomplishing the goal if older on-air equipment fails. One example would be having an IP-based codec solution, using the Internet, if an STL gets antenna damage from lightning and takes out the receiver too. You should have this as a backup and perhaps not even hooked up until you need it. There are some computer programs out there that can function as a STL at a fraction of the cost. If your station is streaming you could just put the stream on air with a computer at the transmitter as a temporary solution.

Make room to keep some old equipment for parts. Look for any parts in the audio chain that you know can go bad and have the spare parts where you or your tech help can find them. Some times the spare can prove the problem is somewhere else in the path. A spare in this case does not have to be the exact same vendor. You could even backup to an older version piece of equipment that will keep you on the air. Yes, this all sounds scroungy but you have to hold the bottom line.

You need to be part of a community to call on for emergency equipment. You should also be a source to contribute by loaning a piece of gear to another station to help troubleshoot and/or get them back on the air. You have to be careful if you loan an exciter and then it gets hit – it could become awkward. So you need to have some sort of agreement ahead of time. First it needs to be confirmed it is working properly when it leaves and when they put it in their rack and turn it up and use it. This is so important to keep good relations. The more money that is involved, the more sensitive it can be if something does happen to the equipment while loaned out.

Gear could be so old that it is not worth it to repair or perhaps too outdated to even be able to send back for repair. So now you are down to just parts instead of a working unit. It always is nice to have two of the exact same pieces of equipment. Consoles, for example, can swap modules as needed to verify a bad module. The power supply can be moved between consoles or better yet a working production room that can easily take over all the on air duties if needed.

Wiely Boswell is Chief Engineer of Faith Broadcasting, located in Montgomery, Alabama; CBRE,CBNE, and SBE 118 Chairman. He may be contacted at: Wiely@faithradio.org

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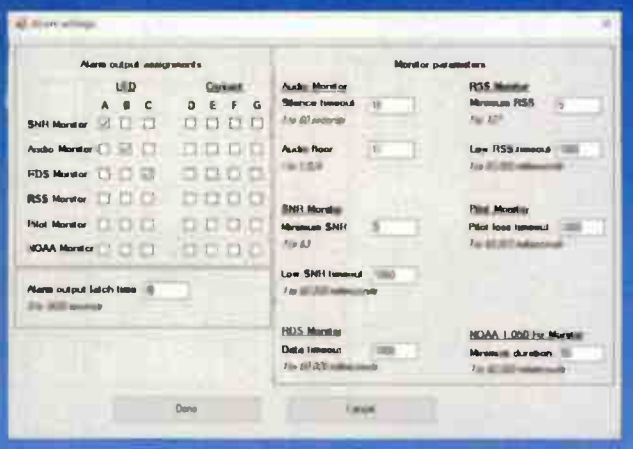

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Transmitter Topics

Servicing the Broadcast Electronics AM-1A Transmitter – *Part 2*

by Bob Reite, CBT

In the last issue we described how to open up the Broadcast Electronics AM-1A transmitter for access to all internal components and started to describe how to replace the RF module sockets. In part two we will conclude the socket replacement procedure and describe what is needed to move the AM-1A to a new frequency.

Replacing the Module Sockets Continued

Here is where we left off. The top of the card cage has been removed and the sockets are now clearly visible.

Now remove the six flat head screws holding the plastic barrier in place. You may also need to loosen the right side panel of the transmitter to get enough clearance to remove the plastic barrier without damage. Once it is out of the way, remove the six spacers and the two nuts holding the sheet metal panel in front of the board. With that out of the way remove the other two spacers. Now unplug the orange/brown connector to this board.

Now on the side that had the combiner board, start unscrewing all of the #6 screws that you see holding the board. You do not need to remove them entirely, backing them out an inch or so should be enough to free the board. Carefully work it free of the transmitter.

Once free of the transmitter, it is now time to remove the sockets. First make note of which socket positions have no pins. You will need to remove them from the sockets you just purchased. While there is a purpose-made tool sold by AMP for this purpose a thick paper clip, small jeweler's screwdriver or small pin punch that will fit the slot in the socket will suffice. Pay attention to which is Pin-1 on the connectors. It does make a difference for correct physical alignment and Pin-1 is marked on the board.

The easiest way to desolder the existing connectors is to remove the socket body by using your tool to release the shell from the pins, working from one end to the other. Once the socket bodies are removed, clamp the board in a vise, solder side up. Heat the pins one at a time with a fairly large iron and the pins will fall out once the solder melts. Clean up the holes with solder wick, or as I do with a vacuum rework tool.

Install the prepared connectors. Make sure that the mounting holes stay precisely aligned with the holes on the board. I just soldier the pins on each end, then check for correct alignment before soldering the rest of the pins. Be sure to use enough solder. These are high current connections and need the lowest resistance you can get.

Installation is the reverse of the disassembly procedure.

AM-1A Frequency Change

Like the vast majority of AM transmitters, if the carrier frequency is going to be moved more than 100 kHz or so, components in the low pass filter and RF amplifier boards will need to be changed. Below is a table of the "frequency bands" for the AM-1A, plus the part number for the parts kit.

Frequency Band	Parts Kit #
522-650 kHz	957-0115-001
651-770 kHz	957-0115-002
771-920 kHz	957-0115-003
921-1080 kHz	957-0115-004
1081-1300 kHz	957-0115-005
1301-1508 kHz	957-0115-006
1581-1700 kHz	957-0115-007

If the frequency being moved to is within the same band as the original frequency, all that needs to be done is to set the S2 dip switch and check the J6 jumpers on the exciter board. Otherwise the correct kit for the new frequency will need to be ordered and installed before changing the settings on the exciter board. When ordering the boards, tell BE what exact

(Continued on Page 32)

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– Continued from Page 30 –

frequency the transmitter is being moved to so that you can get the correct settings for the exciter board. The S2 switch settings are not in the manual and it's not obvious how to set it up.

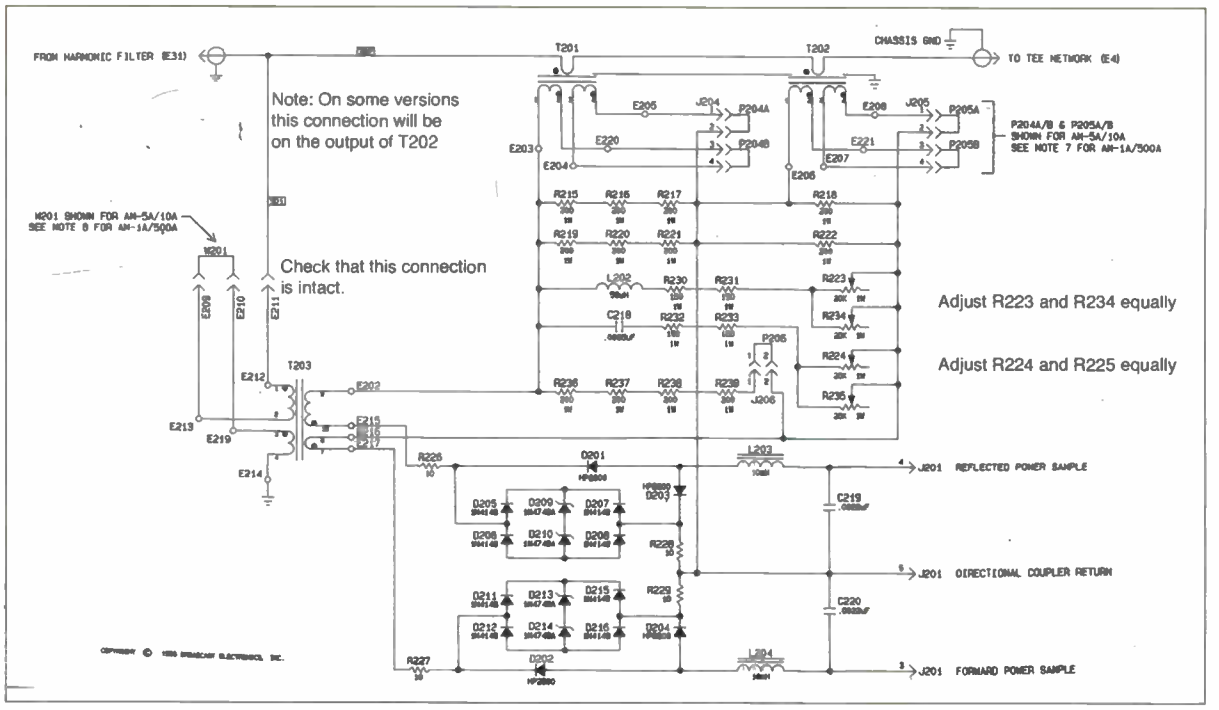
The kits contain the new capacitors for the low pass filter and a pair of capacitor and inductor boards for each of the RF amplifier boards. While it might be temping to second source the capacitors, if the kit is ordered, the parts for the RF amplifier boards are already installed on daughter boards that just screw into place.

Before changing the frequency, first make sure that the transmitter is operating correctly on the original frequency into a known good dummy load. Make any necessary repairs before attempting to change to a new frequency.

I sometimes get asked, "If I'm on the edge, can I move 10 kHz and get away it it?". Meaning for example, if the transmitter is originally on 1300 kHz, can it be moved to 1310 kHz or of it's on 780 kHz, can it be moved to 770 kHz. I'd have to say "maybe," The problem with going up in frequency, is that the low pass filter may attenuate the carrier too much and you won't be able to make the 1 kilowatt rated power and might overheat the low pass filter capacitors. The problem with going down in frequency, is that the capacitors will be too small and most likely the second harmonic suppression will be inadequate.

Adjusting the Directional Coupler

Normally the directional coupler should not need adjustment unless the operating frequency has been changed. However, I had one unit that still showed high reflected power into a known good 50 Ohm dummy load. All the diodes on the directional coupler board were good. Another thing to check for, not mentioned in the manual, is that the connection to the voltage toroid is intact as shown in the schematic.



There are four trimpots on the **Directional Coupler Board** which BE says are "not field adjustable" but can be accessed through a hole in the back panel. I believe the reason for that is that they are parallel pairs in order to keep the power dissipation within the limits of the parts. So the pairs need to be adjusted together, so they will continue to share the current equally. After making sure that there are no bad components between the directional coupler and the RF output connector, connect a voltmeter to the remote reflected output on the control unit, so that you can see it as the pots are adjusted. Turn on the transmitter with no modulation and confirm that the external meter follows the front panel SWR meter. Turn a given pot only a half turn, one at most. Note which way the meter moves. If it drops, adjust the other pot the same direction. If it goes upscale, turn the pots the opposite direction. Work back and forth between the pairs. One pair inserts more inductance into the circuit, the other more capacitance. Once best null is achieved, modulate the transmitter around 90% with a 10 kHz sine wave and confirm that the null is still good.

Bob Reite operates his contract engineering firm, Telecentral Electronics, Inc. servicing radio stations in Pennsylvania and New York state and may be contacted at br@telcen.com

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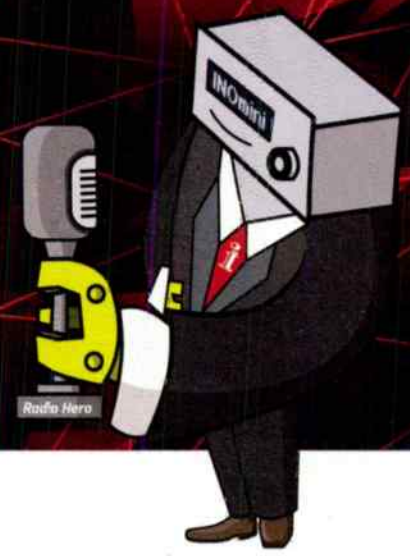

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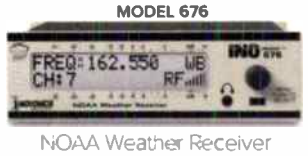

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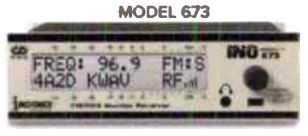

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Shop Talk

by Steve Tuzeneu, CBT

Misc. Tech-Tips and Thoughts

With the busy schedule I have, it's always a challenge to find the time and material to put into this column. One of the sources I have is you, the reader. I always welcome thoughts from readers who can spare a few minutes to send an email. Emails from my readers make writing this column worthwhile.

Reader Email

When you write articles for a national publication, you never know who is reading, until you are contacted. I recently heard from a reader who honored me with his comments. Barry Walters, who is the director of engineering for Salem Media Group in Dallas, Texas, wrote to say: *I continue to enjoy your Shop Talk articles in Radio Guide.*

Thanks, Barry, I appreciate your kind words.

Another reader writes:

Steve:

Just a quick thumbs up for your Shop Talk Column. Love the community. One of the first things I read in the Radio Guide. So, thanks for your work in putting it together.

Cheers - Jay

ColoRadio, KB0TS

Thanks, Jay, for your kind words!

Gmail Revisited

I recently read on-line where Google mail is requiring two-step authentication for email. While this is better for security, it is not good for those of us engineers who use Gmail for automated contact purposes.

There are a few transmitter remote-control units that will send an engineer a text message or email notification when an alarm condition exists – or when an alarm condition returns to normal. Set up is usually a simple matter of configuring an email address and a password. If this two-step authentication process is required for all Gmail accounts, I can't imagine we will be able to use it with our remote-control units to send out messages via email. There is a possibility that the manufacturers may issue a patch to fix that, but that remains to be seen. Some remote-control units already have this figured out. I believe Burk fixed this with their ARC Plus Touch units.

Air Checks

Earlier in my career in radio, I was an announcer. There were times when I had to make an "air check" of my shift for review by a program director, or because I wanted to critique my show. Back then, we used the old cassette recorder connected to a relay. When the microphone was turned on, the deck would record an audio feed from the radio or modulation monitor output.

Cassette decks are nearly extinct, so last year I removed all of our decks from the on-air studio. We used to use them to play programs, but now everything comes from our audio file server.

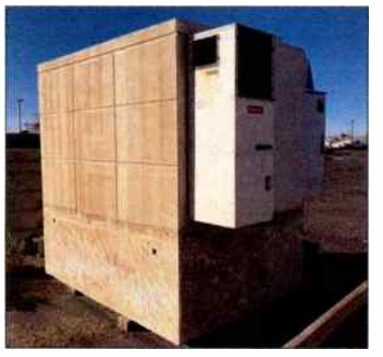
Air Check Software

These days, if you want to record an air check, you load some software onto your computer and connect it to an audio source that is processed.

At the station, where I am both the general manager and chief engineer, we have been using a software package called *"Total Recorder."* Sound familiar to you? Slight pun intended. I looked at their website [**www.totalrecorder.com**] and was surprised at the low cost of this software. For $17.95, you can get the standard version of this software that will do most everything you need. In the day of subscription software, I was pleased to read this is a one-time purchase price. If you want or need more features, you can purchase the professional edition for $35.95. Even at that price, it is still a bargain.

Transmitter Buildings

There are a few different ways you can house your transmitter and associated equipment. You can purchase a small toolshed and use it as your transmitter shack. Or you could build it out of cinder blocks. Then there is the modular building, which I think is the best way to go. I found a source of used equipment shelters offered by a great company called Tower Direct. As their name implies, you can purchase towers from this company, but you can also purchase generators and a number of other items. You have seen these shelters used by cell companies all over America. I like these shelters because they require almost no exterior maintenance, are bullet-proof, pre-wired, termite-



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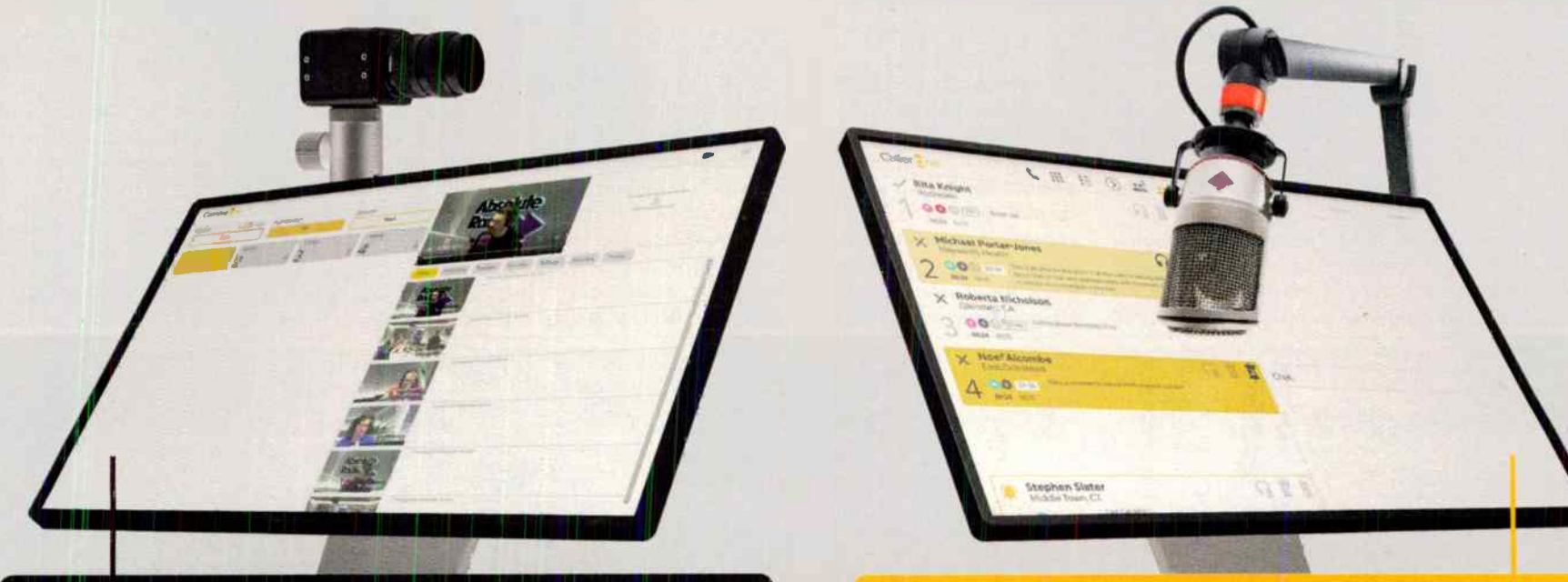

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Shop Talk

– Continued from Page 34 –

proof, and often come with built-in air conditioning. You can purchase a small shelter from Tower Direct for as little as $8,000. Their website is: **https://usedshelter.com/telecom-shelters/shelter-condition/used/**

It Pays to Shop

Guys don't usually like to shop with their wives for groceries or clothing, but most of us engineers like to shop for electronic items we need for our stations. I recently did some shopping and saved some money in the process.

A little bit of history is in order. A previous engineer at the station where I work connected an old, decommissioned Unity satellite receiver to power the LNB. I was moving several satellite receivers out of one rack and into another. The old rack was located in an office area, and the new location was in a rack that had other equipment in it. I didn't want to install the old satellite receiver and just use it as an LNB power supply, so I asked one of my sources for a recommendation for a power inserter. I figured the new power inserter would be small enough to mount on the inside of the equipment rack where the receivers would have their new home.

I contacted the company that makes what I needed and found out they wanted almost $200 for the power supply. Because I needed it, I thought I would purchase it. Then I did a little search engine shopping and found nearly the same thing for less than half the price.

A company by the name of ATX makes a power inserter that is working very well for what I need. I send power up the LNB with it, and my three satellite receivers get a healthy signal from the satellite dish. Here's a picture of the inserter.

For this inserter and other items, you can visit **https://atx.com** The power inserter is available directly, or from a supplier. I called the company, and a very nice gentleman answered all of my questions.

BW Broadcast

The last thing I heard about BW Broadcast was the owner(s) had died. I have also heard that most of the people who worked there left the company. Most recently, I have learned from the Internet that a couple of gentlemen have attempted to bring the company back to life. Some engineers who have had dealings with the company were not impressed with the new owners. Other engineers have suggested contacting SCMS here in the states to get service or support. If you know anything more or different than what I have mentioned here, please contact me so I can report about it here in my column.

Clock software

Here's a nice website based in the UK where you can find some free software to have a clock on a computer screen for use in your studio. It's called *"Studio Clock for Windows."* You can get it from the **Radio Tools** website, and here is their web address: **https://www.radiotools.uk/** On this site, you can also get their version of Rivendell playout software. Their version is different. On the site it says: "AirPRO is the result of an in-house effort to enhance functionality and resolve issues we experienced running the open-source Rivendell playout system at FM radio stations in the UK. Our design requirements were that, as well as being a fully featured rock-solid platform for high profile broadcasters, it must also have well documented installation and support notes, a fixed database structure between versions and the ability to upgrade individual studio machines without any concern that even a minor update might affect or require the upgrade of all other machines at a station." You can find out why they reworked Rivendell and read answers to questions you might have about AirPro on this webpage: **https://www.radiotools.uk/difference.html**

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Looking for Input

Are you an engineer who has learned something new? Maybe you discovered a cool app that you love having on your smartphone. Or perhaps you found some software that is very helpful. Whatever gem you may have discovered, I would love hearing from you. Apparently, another national publication liked my idea of apps and they started listing their favorite apps in their magazine. Feel free to contact me at stuzeneu@sbe.org; your useful information will be appreciated by my readers and me.

Thanks for reading my column. I hope you found something interesting or useful. The thoughts, ideas, and opinions in this column are my own, and do not necessarily reflect the views of *Radio Guide* or its publisher.

Steve Tuzeneu, CBT, is the general manager and chief engineer for WIHS 104.9 FM in Middletown, Connecticut. He is licensed by the FCC as an engineer and is a Certified Broadcast Technologist with and member of the SBE, and an extra class radio amateur who has been in radio broadcasting since 1973.

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Small Market Guide

Your Local Ham Operators Can be Your Best Allies

by Roger Paskvan

About a month ago, I received a call from a local Ham (Amateur Radio) operator informing me that he could hear music on his 80 meter Ham receiver at 3.9 MHz I figured front end overload since he lives a few miles from my AM towers, or skip. I've found that Hams are usually nice people but occasionally exaggerate the situation. However, I learned that was the wrong attitude and I should have immediately looked into the problem more thoroughly.

At the end of the week, my secretary handed me a note from another local Ham operator that was complaining about hearing our AM signal on 3.9 MHz.

So, that afternoon, I contacted this Ham operator and we had a pleasant conversation about what was happening. It seems that he wanted to check into a net on 3.90 MHz and our AM signal was coming in on top of that net. Some quick math showed that the third harmonic of my 1300 kHz transmitter ends up on 3.90 MHz – that's in the upper part of the 80 meter Ham band. Well, we agreed to meet the very next day. I went to his house and got the free home demonstration on his $1,500 amateur radio transceiver. Yes, my station's AM signal was loud and clear, six miles from my tower, at a frequency we should not have been on.

Over the next week, I checked our Gates Air AM transmitter. All seemed very normal and in good running condition. A field inspection of the tower indicated nothing unusual. Using a Potomac FIM-41 (field strength meter), I could hear a signal on 3.90 but it was in the microvolt area, just exceeding the noise at a mile out.

In order to do justice to this measurement, I drove out several miles from the towers and took measurements on 1300 kHz and 3.90 MHz. A quick calculation showed the 3rd harmonic to be down only 60 dB. Wow! I had a serious problem and my AM station was causing problems to another radio service. This was something the FCC would surely not appreciate.

Over the next few nights, I checked out our 1300 transmitter, finding everything normal in the RF chain. It is not easy to locate harmonic problems. Eventually my problem was traced to a defective mica capacitor that was across the harmonic trap inductor. The capacitor measured short, thus providing no attenuation from the trap. A replacement cap was installed and the trap tuned to null 3.90 MHz with a network analyzer. There was a small minimal effect on the transmitter resonance but a touch up of the loading and tuning brought things back into perspective.

The next morning, I took the FIM 41 out to the same spot and measured the third harmonic. There was a small rise in the hiss that I could hardly make out, but the dB ratio became more than 80 dB down.

A quick call to our Ham friend indicated the signal had dropped from S8 to S0. He could not hear any music on 3.9 MHz. Another small victory in Small Marketville. I bought him lunch that day and learned he was a long time avid listener of our AM station. Later that day, I also gave him a tour of the station.

The FCC rules (Part 73.44) indicate ... Emissions removed by more than 75 kHz from the main carrier must be down 80 dB below the unmodulated carrier level.

It might be a good idea to measure your out of band products one or more times a year, just to be safe, secure, and keep the FCC from having to make house calls. Keep a good rapport with the local Ham community. If this Ham had first called the FCC, the outcome from this adventure may have been a lot different and very expensive.

The moral of the story is to keep the local Ham community as your friend. We can all co-exist in the same radio community, while helping each other out.

Roger Paskvan is a Professor of Mass Communications at Bemidji State University, Bemidji, MN. You may contact him at: rpaskvan@bemidjistate.edu

Tower Topics

High Intensity Tower Light Project – *Part 1*

by John L. Marcon, CBRE CBTE 8VSB Specialist

One of the banes of broadcast station ownership is the maintenance of the tower obstruction lights. There are two options for tower lighting: you can paint the tower and use red light or not paint the tower and use white light. Either of them is not cheap. If you do not follow specific guidelines, then you have to answer to two government agencies: namely the FAA and the FCC. There is a steep fine for any violation of the guidelines. One of our sites has a 1000-foot tower with flashing white obstruction lights.

The tower and the light system are decades old and most of the electronic parts are already obsolete. There are troubles with the lighting every now and then but, so far, we still are able to overcome them. We are also diligent in following the guidelines set forth by the FAA in terms of maintaining proper operation of the lights and reporting any malfunction that happens. Since our tower is above 700 ft, the light is the high intensity type which is specified at 270,000 candela and this is accomplished using Xenon flashtube.

The Old Lighting System

The lighting grid on our tower is a Hughey and Philips SS125 Flashhead/power supply system with SS122 controller subsystem. The SS122 is inside the building while nine SS125 units are on the tower. As some of you may know, the SS125 high intensity lighting system has the electronics and the strobe light itself integrated inside a stainless-steel box. When you look inside one of these boxes, the circuitry seems to be too complicated for the simple function of providing flashing lights. There are electronic boards, relays, transformers, capacitors and many other electronic components inside the box.

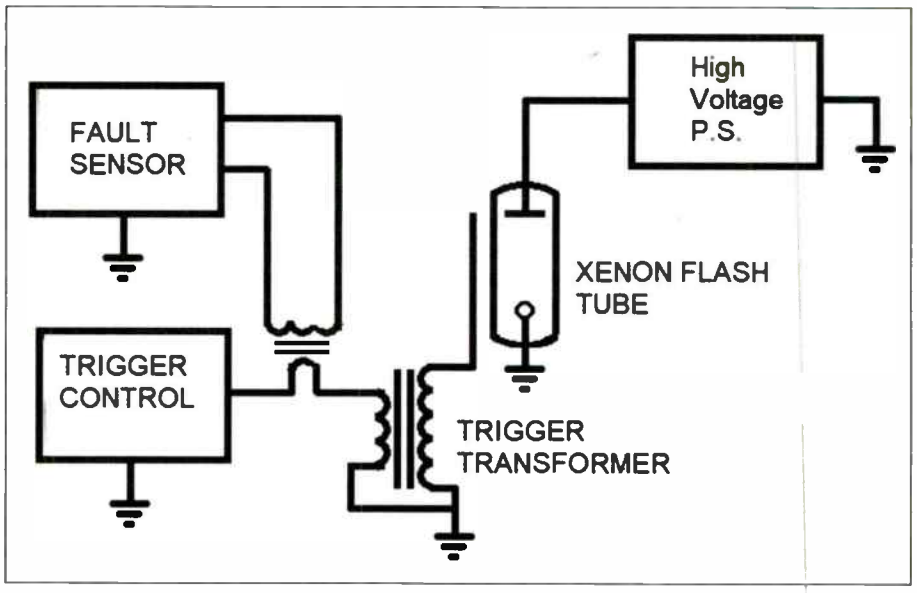

Figure 2 – A simplified diagram of an externally triggered Xenon Flash tube system. The flash tube is filled with high pressure Xenon gas and a high voltage is connected from the anode to the cathode of the tube. A coil of wire around the glass tube connects to the trigger transformer and the voltage from the transformer ionizes the xenon gas, creating the high intensity light. The fault sensor is triggered whenever the current to the trigger transformer falls below a threshold.

A 120V line and eight control wires from the SS122 control box go up the tower to each of the lighting boxes. It worked really well, but in the past few years the failures have become more frequent. In the past, the engineers recommended installing lightning spurs on top of the tower and they said that it somewhat reduced the failures. But I guess because of the age, some of the components started to get into the end of their lifespan. As a result, the repair costs have increased.

Figure 1 – The old Hughey and Philips SS125 strobe high intensity tower light installed in 1998. There are nine of these boxes on the tower and each box weighs about 70 lbs. On the left side is the flashtube and underneath (right side) are the circuit boards, capacitors, power transformer, etc.

However, the whole circuitry can be subdivided into four sections: the trigger and timing circuit, the power supply, the fault sensor and the flash tube. There are three tiers for the tower lights and one Aviation Obstruction Light (AOL) on top of the antenna. Each tier has three lights (SS125) for a total of 9 lights overall.

As you can see from Figure 1, there are many parts in the box that can breakdown. Just the three sub cards (trigger, fault and power supply) already have dozens of components. These cards sit on the main board together with the relays and other parts for the power supply. The relays are used to switch the light from day to night and vice versa. Then there are the four capacitors and the main power transformer. Another major part is the diode block, which is also used for switching between day and night mode. The whole circuitry including the flashtube are protected by the stainless-steel box from weather and water leaks. In one sense this is good, but during summer, the hotter inside temperature of the box would negatively affect the components especially the capacitors. They dry up sooner than the designed lifespan and this leads to premature failure. As you may have guessed (users of this type of system already know this), the problem with this system is that every time there is a failure on any of the parts, whether it's a fuse, a board, a capacitor and so on, you need to call a tower crew to fix it. Not only that they replace the defective part, they also replace parts that are still working because you do not want the tower crew to return again just for a broken relay or a blown fuse, or whatever cheap parts that may soon fail.

This method jacks up the repair cost even more. It is therefore important for the station engineer to have a record of the repair of the tower light especially the high intensity ones.

If the electronics are inside the building and not on the tower, then we can fix the electronic parts ourselves and the tower crew will only be called if there is a problem with the strobe light. The other thousand-foot tower that we have on another site does have the control boxes inside the building. The lighting system is from Flash Technology and it also uses the xenon flashtube. It was installed in 2007 and each of the lighting fixtures on the tower only have two components, the flashtube and the trigger transformer.

The rest of the electronic parts are inside the building. Because they are inside the building, our own engineers are able to do the repair of the electronics that are inside each box. However, the control boxes for the top lights were installed at 300 feet because the cables were not long enough to reach the building. The cables could have been extended but, for some reason, the engineers back then decided against it. As I mentioned previously, lightning spurs were installed on top of the tower some years ago and they claimed that it helped in protecting the lights. I have doubt on this because the box and the metal conduits act as a Faraday shield for all the electrical and electronic components and this should have been enough to protect from lightning.

Time to Change the System

The cost of a repair visit is always more than a thousand dollars and can run up to $6,000. In a really bad year, it can sometimes go up to more than $10,000. We calculated that in a ten-year period, the cost of all the repair amounted to about $80k.

(Continued on Page 42)

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High Intensity Tower Light Project – *Part 1*

– Continued from Page 40 –

This is a repair-as-it-fails scheme. There is an option of doing an annual maintenance and repair contract with the tower light service company but this is costlier in the long run. With the mounting repair cost, age of the system and the lack of parts, the owner decided to finally replace the whole lighting system. Because of our experience with the existing lighting grid, we wanted the new system to have few or no electronic parts on the tower. In other words, the electronics should be inside the building and only the lights are on the tower. As we will see later, this option is not as simple as it seems.

There have been many technological innovations in broadcast technology and in the lighting industry, the trend today is to move from strobe to LED tower lights. They claim that the LEDs last much longer than the strobe and consume less power. After looking at the alternatives, we decided to go with the latest LED high intensity obstruction lights. As we look for vendors of this system, we discovered that we did not have to go far and wide because the SBE website itself has a list of companies that provide the latest high intensity LED system. The companies listed are as follows: Slatercom, Lumenserve, Drake and Unimar. Drake is the U.S. name for the Canadian company Technostrobe. We also looked at other companies like H&P but they do not have LED high intensity system, while the other ones have a poor track record.

The LED technology has been in the industry since the 1970s but for some reason it only came to the high intensity obstruction lighting system fairly recently. Why did it take so long? It could be that the light intensity of the LED was not strong enough to be at the level of a Xenon strobe. Perhaps with the advancement in LED and driver ICs, they found a way to solve this problem. In 2006, a company called Dialight introduced the first LED medium intensity obstruction lighting system. (Flash Technology also came out of an LED obstruction light on the same year). It was a combined white and red LED system. Dialight has long been in the lighting industry. They actually started in 1938 and entered the LED market in 1971 so they are one of the veteran players in the field of lighting technology.

There are very specific guidelines from the FAA when it comes to tower lights. For example, unpainted towers 700 ft or lower must use medium intensity white lighting system. This is called FAA style D. For painted towers, they must use red beacons and their tower must have alternating white and aviation orange paint colors. For more than 700 ft, unpainted towers must use high intensity white light for day and night. This is called FAA style C. You can also use white day and red /night and this is style F.

We chose style F because todays' LED lights have white and red lights built inside the LED modules. The widely used Xenon strobe is rated to 270k cd (candela) intensity and the new LED is also capable of 270,000 cd. The LED also has a very narrow 3-degree beamwidth and as a result there is no light pollution in the immediate vicinity of the tower. *(To be continued ...)*

John L. Marcon, CBTE CBRE 8VSB Specialist, is the Chief Engineer for Victory Television Network (VTN) in Arkansas, with international experience in both Radio and Television Broadcast, and has an Electronics Teaching background.

Service Guide Radio Equipment Products and Services

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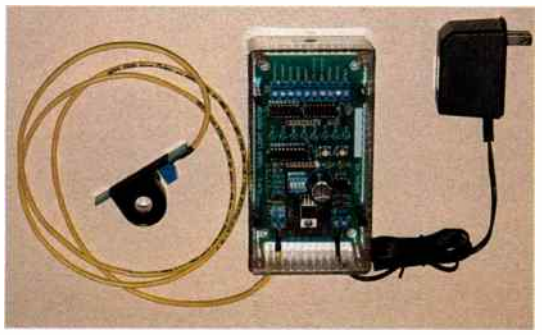

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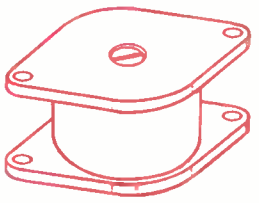

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Gear Guide — Arrakis Systems - Coaxial Dynamics - V-Soft

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Probe 5 is a unique, professional level, Windows, RF propagation modeling program for FM, DTV/TV and communications systems. Probe 5 produces "spectacular," atlas-type, coverage and interference plots, while integrating high resolution population databases with state-of-the-art polygon mapping. Modeling features include Longley-Rice, Okamura-Hata, Cost-Hata, PTP #1 & #2, line of sight, ITU-FM, and standard FCC.

Adopted by the FCC and Industry Canada, the intricate Longley-Rice graphic shown above in this article was made by Probe 5.

New in Probe 5 is the ability to use actual topographic maps as the underlay to R.F. coverage plots. The **Raster Map Data Layer** consists of digitized topographic maps and aerial imagery. This feature uses pre-indexed data files to merge different tiled maps together automatically. The program includes 1:100k and 1:250k USGS Digital Raster Graphic (DRG) data that is sent to the owner on an included hard drive. Also available is 1:24k high resolution, U.S. Topo map database that includes orthoimagery photographs and the 1:50k Canadian Toporama and 1:250k CanMatrix data. The program can import and export polygon data using standard GIS formats such as MIF and SHP files. Probe 5 can also import and display GeoTIFF files, so it can lock hands with other GIS mapping programs.

Probe 5 features our implementation of the industry standard National Spectrum Managers Association (NSMA) OHLOSS propagation model. It is a complete, terrain based, point-to-point model. This model can also be used for FM and TV frequencies and is commonly used for microwave link analysis.

For more information visit the V-Soft Communications website at: V-Soft.com/Probe.

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https://ne-ba.org/upcoming-convention/

WBA Broadcasters Clinic
October 11-13, 2022
Madison Marriot West, Madison, Wisconsin
https:www.wi-broadcasters.org

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Jacob Javits Center, New York, NY
www.aesshow.com

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