Radio Guide

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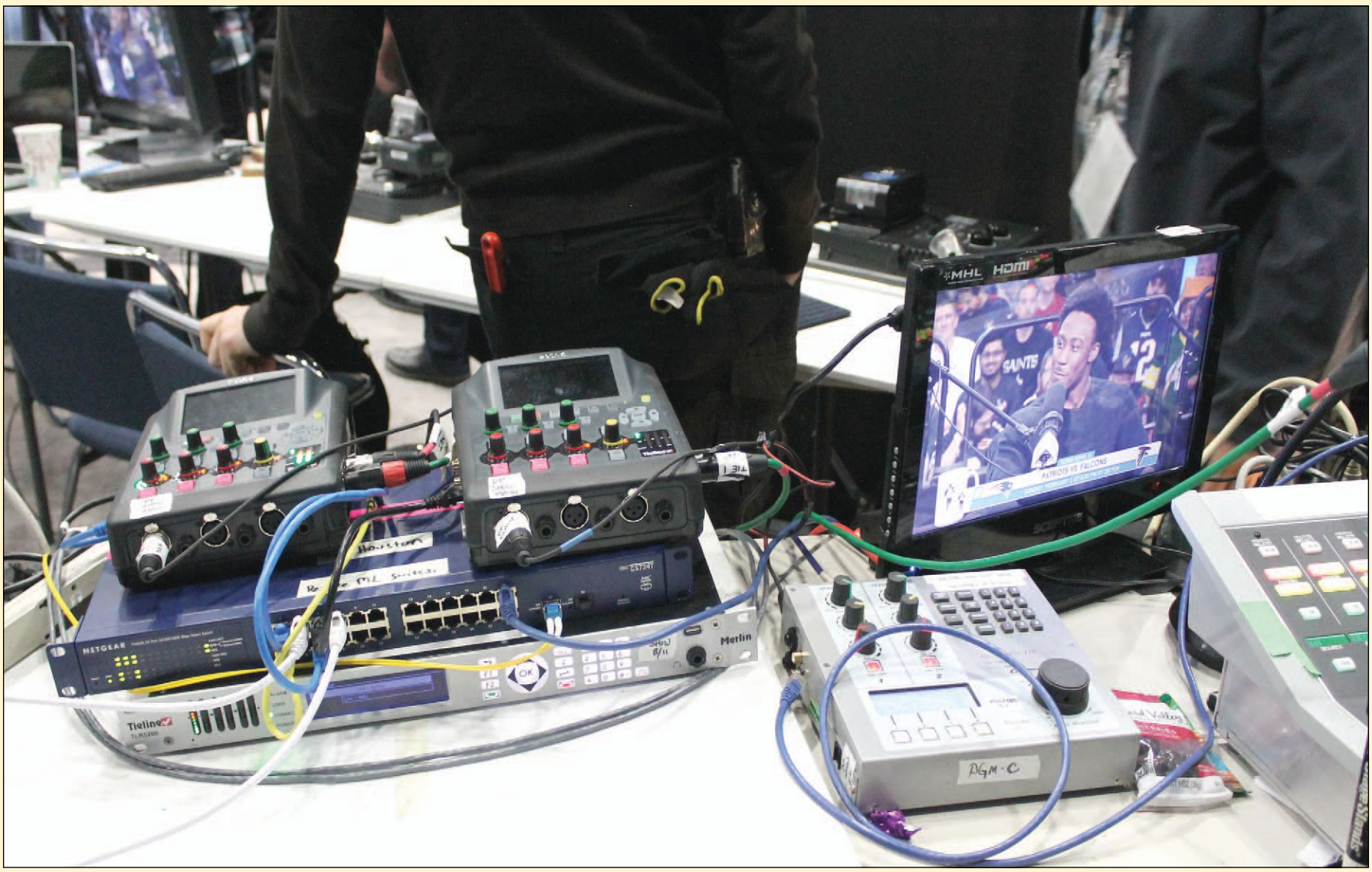
May-June 2017 – Vol. 25, No. 3

Taking the Show On the Road



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Broadcasters' Desktop Resource
... edited by Barry Mishkind – the Eclectic Engineer

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Cover Story

Taking the Show on the Road

by Jim Hibbard/Pacific Mobile Recorders,
with Contributions From Kat Coffey, Alan Guzzi

For the past 8 years, The Dan Patrick Show has hit the road to the host city of the Big Game! It's a full remote for the entire week preceding the game and guests include: current and former NFL players, coaches, commentators, team owners, athletes from other sports, even some actors and Sports Illustrated swimsuit models. Beginning in 2015, The Rich Eisen Show has also been part of the pre-game festivities, with his full team and a huge guest list as well.

The Operation:

The Dan Patrick Show has a basic talk show setup with a 12 channel Wheatstone IP console. Dan and his four co-hosts (The Danettes) each have mic on/off/cough panels with a talkback to Dan and the remote board op, while Dan's talkback feeds his producer. Dan and the Danettes have individual channels of the headphone amplifier so we can interrupt audio and talk to each separately. There is a small speaker on set for guests to hear phone calls, bumper music and truck playback, as guests rarely wear headphones.

The console input layout has 7 mics, main and back up Tielines from the home studio (phones, bumper music, other audio drops, and a Premiere Networks countdown), truck audio and a sum of all the wireless mics which are handled by the TV truck. Wireless mics are used during the TV-only portion of the broadcast, which occurs during radio commercial breaks. All 4 program buses were utilized to create discrete mix minus to accommodate both radio and TV.

The Rich Eisen Show uses a 32 channel Behringer X32 PA mixer. The input list includes mics for Rich Eisen, 2 co-hosts, 2 guests, 7 wireless mics and the board op. Two Tielines feed main and back up audio from the home studio in El Segundo, CA. Communication inputs fed to the remote location with Tieline Merlins are on the second layer of the 32 channel mixer. Eight post fader Monitor sends were used for mix minus buses.

The Setup:

Radio remotes in new locations can be challenging! Packing enough equipment for two shows that sometimes overlap makes it trickier. And, feeding both radio and television at the same time requires extra pre-production planning. For these shows, we needed to coordinate the arrival of two pallets of radio equipment, two large road cases, and several other boxes of equipment from CA, CT, IN and elsewhere in the U.S., to arrive in Houston on the same day in order to begin the 2-1/2 day setup in preparation for the week-long shows.

This year's event was situated at the back of Houston Convention Center, as part of the NFL Experience. We had two 40' x 40' stages on 3 foot risers approximately 100 feet apart. The "technical area" was located behind the sets and hidden by a curtain. This designated space was only 15 feet deep and housed lighting, The Dan Patrick Show "control room," all the RF equipment (wireless mics and IFB), and technical personnel for both shows! Two television trucks were in the loading dock behind the building.

Connectivity:

Generally, for The Dan Patrick Show remotes, we use Tieline Field Commanders to connect via IP to our Tieline rack-mounted G3s in our home studio in Milford, CT. The home studio feeds phone calls and audio drops. This alleviates the need to set up phone lines and phone systems in our remote locations, plus, feeding phones through the Tielines means our call-ins can use the same phone numbers they normally use. Also, we don't have to bring extra equipment to supply audio drops since they are also fed through the IP connected Tielines.

ViA codecs feeding main program audio for both shows with Merlin for backup.

For the remote in Houston, we used the new Tieline ViA at our remote location for our main program feed, using the Music PLUS codec. It interfaced seamlessly with our 9-year old G3 in the studio! The ViA was connected to a Cellular Modem through an Ethernet cable to our Dark Fiber network, connecting with static private IP addresses on both ends. The dark fiber network acts like one big local private network, allowing for incredibly low latency connections. Our backup program feed was with our Tieline Field Commander G3 which was connected through a cell modem. The cell modem supplied a DHCP address. That connected to a Static Public IP in CT.

Merlin PLUS & Commander G3 codecs feeding IFB for both shows.

The Rich Eisen Show is handled a little differently. Everything, with the exception of the phone calls and the spots, is done locally from the remote. The music playback, bumpers, truck playback and all the mics are mixed on the Behringer X32. This show usually uses a similar setup for remotes using Tieline G3s, but this time, we used the Tieline ViA for the Main Program, again, through the dark fiber network. There are 2 channels of return audio – one is full program from Premiere Networks, which is "confidence audio" for the on-camera board operator. This confidence feed lets the board op know when he's back on Radio air so he can cue the TV director to re-join, so that TV and Radio once again match up after commercial breaks. The second return is phone calls and any home studio playback. The backup unit was a Tieline Merlin with the same setup.

In addition, we had another Tieline Merlin connected to LA Master control sending audio to Rich. We achieved this by using an external mixer to premix program audio, the truck director, on-cam board operator talkback and LA producers to a split IFB (Rich's right ear). We used the Music PLUS codec to connect to G3 Commanders and Merlins to our remote studios.

The directors and producers for both shows were located in LA master control and also in the trucks in Houston. We used Tieline Commanders for them to communicate with Camera Operators using Belt Packs.

After leaving Houston, we headed to Monterey, California for the AT&T Pebble Beach Pro Am the following week. The Dan Patrick Show was broadcasting from the Driving Range for three days. The weather was not our friend on this remote. All the radio broadcast equipment, including our 2 ViAs, were located in the back of a minivan! The constant rain made mud that, in some spots, was up to our knees. Most of our wires were covered completely in mud and water. But, the show went on, and we used our cell modem for one ViA for the main program feed and a fiber connection feeding Ethernet from a switch for the backup ViA. Again, they were our central point for transmission and remote monitoring. With such varying conditions, we found the input knobs on the top of the ViA to be a convenient feature for quick setups and changes, rather than having to go through the software to make minor changes.

Conclusion:

Remotes are no longer a mic and a Marti in the back of a van. Talent has come to expect the same level of quality and convenience they have at their home studios, and with today's technology, that's exactly what we are able to provide.

Dan Patrick Equipment List

- 12 channel Wheatstone E1 console
- Analog and AD Blades
- Wheatstone M4 Mic preamps
- DBX 286 preamp for guest mics (gain controls on these units work well for different guests)
- AKG C 4500B BC condenser microphones
- AKG and JBL headphones
- ProSonus Eureka mic preamps
- Wheatstone mic on/off Turrets

Rich Eisen Equipment List:

- Behringer X32
- AKG C 4500B BC condenser microphones
- Multiple Behringer RX1602 line mixers
- Shure earbuds with personal fit moldings

Wireless Transmission:

- Sennheiser EM-series mic receivers and transmitters
- Shure IFB transmitter and receivers

(The wireless company handled all the frequency coordination with the NFL and provided the staff to fit the hosts and guests with the wireless equipment during the shows.)

Transmission:

- TieLine ViAs main for both shows
- Tieline Commander, backup DP Show
- Tieline Merlin, backup RE Show
- Tieline Commanders for IFB to/from CA (Dan Patrick)
- Tieline Merlins for IFB to/from CA (Rich Eisen)
- MusicPlus codec for all units

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The Evolution of Revolution

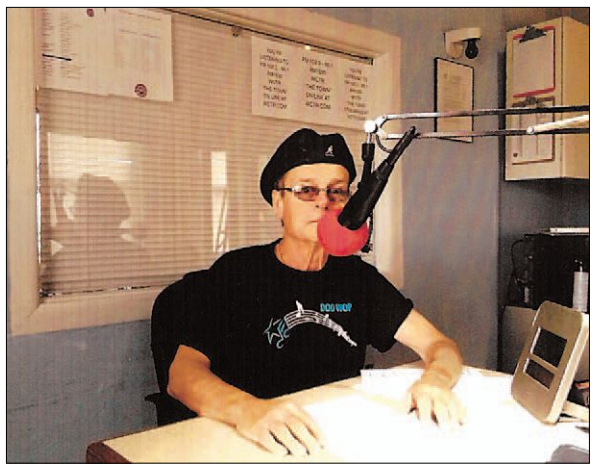
Readers Speak Out on Vinyl in Broadcasting

by George Zahn

Wow! Not since the mere mention of the ElectroVoice 635A "hammer microphone" have I had such a response on an article, as I did for last issue's *"On The Record"* look at vinyl transcriptions in broadcasting and the resurgence of the LP. Responses came in literally from coast to coast with interesting stories of vinyl still on the air. For some, this may be a nostalgia trip, and for others, it may be glimpse of the future, but here are a few of the comments that came in.

Tim Sullivan, co-host of *"The Rock and Roll Revue"* with Bill Blake on WCTR (AM and FM combo) in Chestertown, Maryland, uses only the original vinyl recordings from the Doo Wop era (1953-1963) on his show.

"The station supplied us with a Jensen record player, where we, once a week, download our play list into the computer. This is real time. Our Production Chief, then puts the recordings in the order of our playlist, inserting lines, commercial advertisers, station ID, along with a break for top of the hour news," says Sullivan. This answers one of the questions posed in the last issue about losing some of the "analog" sound when digitizing the audio from vinyl. Just as the old CD designation of ADD or AAD meant that the CD itself originated as an analog tape master, Sullivan let's the vinyl surface noise be part of the show.

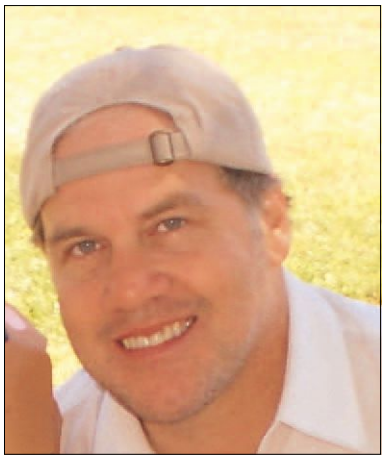


Tim Sullivan, Co-host of *"The Rock and Roll Revue"*

Sullivan adds, "One of our listeners e-mailed us to say that he could hear the crackles from some of the records. This was true. I do live shows and use only vinyl from my personal collection. Before I play any vinyl, either for the radio show or my live shows, I clean every record with an alcohol pad. This removes any dirt or grime. I also store them in paper sleeves and then inside another paper sleeve. People are amazed when I show up with a rack of vinyl for a show. I do not us CD's, cassettes or MP-3 players. I want my shows to be nostalgic as possible."

You can hear *The Rock and Roll Revue* on podcast at WCTR.com. The site also encourages requests for the show. Tim Sullivan is known as The Godfather of New England Doo Wop."

From the west coast, we received a shout from Brad Smith at KAHI (950 AM) in Auburn, California. The station made special accommodations for one show. Smith tells us, "We ran a weekly, one hour show called *'The 45 Guy.'* Each week the host, Mike McKinzie, would roll a couple of turntables into the studio, plug in, and go live. His music program was all 45 RPM vinyl records from his collection. There were no CDs or other sources, just vinyl (liners were off automation)."



Brad Smith, KAHI, Auburn, CA

While the regular show is no longer a regular show, *The 45 Guy* comes in to record a Christmas Special each year at KAHI. Smith relates that the format was a real throw back to the old disc jockey shows of yesteryear – complete with the host delivering background about the records and artists. The engineering was pretty basic according to Smith, "His turntables were a couple Audio Technica with Shure cartridges. They worked 'okay' but were not my first choice. They plugged into phono preamps, were then summed to mono into a Henry Engineering Matchbox, and then into the board. I also wired up a remote start interface that sat in front of the board during the show. Overall, it worked very well."

What's great here is that the station was willing to give vinyl a new life on the air. Nostalgia continues to ebb and flow as a part of our national, and sometimes regional, culture. Stations still embracing the 50+ demographic find themselves in an unlikely lockstep with those who may consider adding vinyl offerings for which millenials are showing a new fascination.

Nostalgia runs thick in the veins of Jim Jenkins, owner/GM of WAGS-AM in Bishopville, South Carolina, who sums up his station: "WAGS is live radio, real people in real time, playing from CD, LP, 45's, and yes some 78's – country, Americana, bluegrass, and reporting to Spins Tracking System for country, Roots Music Association and the Alt 66 Roots chart for Americana, and Blue Grass Today."

Jenkins adds, "Why anyone would have a digital board is beyond me. As to vinyl, [we've] been using it along with CD's since I bought WAGS-AM in 2000. Recent story in the trades described AM as different than FM in sound, but with good receivers not found in newer cars, with narrow band pass (2004 PT Cruiser vs 2015 Honda Fit which I own), a very pleasant sound. I have run tests in the PT Cruiser with AM/FM simulcasting of program music and find both very listenable."

Jenkins indicates that they use very basic audio processing. As for content, his take is that there are still many "lost" recordings that were done on vinyl that never made it to CD or YouTube. He claims to have found some real gems in the dollar bin. He sounds like the kind of person we'd find at an antique or second hand/resale shop looking for vinyl or old broadcast gear or radios.

On the difference between vinyl and CD, he adds, "Vinyl and CD's are like disc and drum brakes. I don't know which is better, if one actually is, they are just different. Each has its own failings. We play both all day long, and the vinyl is clean and the wear from songs I've played to death isn't there. We visual cue, so no cue burn, and you just have to learn to do your job." That's cool old school – how many of us have ever cued visually?

Audio-Technica AT-PL120

WAGS is still using an Audio-Technica AT-PL120 bought in 2009 for a little over $200. He does play from CD as well and prefers the Onkyo C-7030 model, which he's been using since 2015 – also a little over $200. For those stations using CDs, rumors persist that blank recordable CD media production may one day be phased out. As a manager who still uses recordable CDs for production and some archiving, I'm looking to flash card readers for when that day comes at WMKV-FM, my station.

Onkyo C-7030 CD Player

From a personal standpoint, this author has been finding a little less "quality control" when purchasing blank recordable CDs – often having a spindle of 100 in which several of the CDs end up being unreadable or distorted. Jenkins seems to concur on CDs in general and it sounds like he abhors the "All or Nothing" principal that plagues digital media, "I get CD's that don't want to be found – 'No Disc.' I have CD's that play fuzzy after a year. I have a Hank Snow LP from 1956 that is clear as a bell. I eschew digital. It's complicated and expensive. Analog is simple and cheap. Oh Yeah, it works. And when it hits the fan it's easy to trace and do a work around."

I honestly don't know that anyone will ever go back to "all vinyl" on the dial, but the response to last issue, and the comments of other broadcast colleagues tells me that there is still burgeoning interest in mixing vinyl with digital offerings. How many will follow the WCTR *Rock and Roll Revue* idea of leaving some crackles is debatable. Many stations taking lost LP recordings that have never been remastered on CD, or digitally restored, often run the material through anything from Audacity on the low end, to Adobe Audition, to Cedar on the high end to help the older material match the perceived "cleaner" digital surface.

Thanks to those who responded on the concept of vinyl transcriptions on the air! As always, this is one type of "feedback" that is welcome and encouraged!

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*

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Chief Engineer

Transmitter Stories from the Trenches

by Scott Schmeling

Happy Summer everybody! I thought I'd share a few transmitter stories with you this time. With one exception, all of these instances happened in the last few weeks. It's been an interesting time to say the least!

Since last we talked, I received a couple e-mails from *Radio Guide* readers. The first one was from Richard Palmquist in California, who had some very nice things to say about *Radio Guide* and its many writers. Thank you, Richard. He also wondered if Max Schmeling might have been my great-grandfather. Well, Richard, not as far as we know. But the spelling is the same, so if you go back *far* enough, I imagine the branches of our family trees *must* meet somewhere!

I also heard from John Mulhern in Kansas, with a question about the Continental 816 series. He was having trouble with PA screen current jumping around. I hope you've been able to solve your problem, John. That's a darned good transmitter.

I have a predecessor to the 816, a Collins 831. Recently, it blew one of the capacitors in the high voltage bypass inside the cavity. After replacing both caps and the coil, the transmitter still would not fire up. To make a way too long story short, after cleaning the contacts of the overload relays behind the bottom panel below the drivers, it fired right up.

Helpful Hint #1: If you have one of these transmitters and it, for no apparent reason, doesn't want to fire up, give that metal panel a good rap with the palm of your hand. The overload relays inside have been known to stick at times and that's usually enough to release the relay and put things back to normal. (That's actually a method suggested by Continental Tech Support.) I wish I'd remembered that much sooner.

Some models of this 831 have an Overload Panel with lamps to indicate which of the four overloads had been activated. This transmitter has a home-made version of that panel. We had discovered, last time we were there, that *all* of the lamps in the panel were burned out, so I researched and ordered LED replacements which had not been installed yet. If they *had* been, we would have known right away that a relay was stuck. The LED's are in now!

Helpful Hint 2: Take some time and find LED replacements for those miniature incandescent lamps in pushbutton switches and indicator panels. Those lights do more than look pretty. They give you important status information – except when they're burned out! While you're researching, if you're not sure of the wiring, look for *non-polarized* replacements. These will work regardless of the polarity of the wiring to the lamp socket.

Every now and then, a transmitter throws you a curve ball or two. I take care of a couple BE FM10/B's that did just that recently. The first one was an intermittent HV arcing. This transmitter has an aluminum "chimney" that slides over the tube and is secured by a hose clamp. There was evidence of hot spots on some of the tabs on the outside of that chimney and some fairly severe pitting on the inside surface.

Frequent assistant, Marv Olson and I scheduled a trip to the site and started disassembling the cavity. Our plan was to use a Dremel Moto-tool with a grinding wheel to smooth down the pitted areas. It was a slow process, but eventually the surface was smooth enough to satisfy both of us. The cavity was re-assembled, the transmitter put back on line, high voltage applied, and RF slowly increased in steps. To our delight, there was no arcing, everything tuned nicely and the transmitter was running happily at full power.

Ten months later we were back at the same transmitter. Another arcing situation, but this time it wasn't the chimney. We turned the lights out, hit the switch and *watched for sparks!* (I *think* that's an accepted troubleshooting practice.) We found the source of the trouble in the upper portion of the cavity.

But *what* we found surprised me. The cavity is cylindrical and there are two pieces of plexiglass forming a shelf of sorts. The chimney has pegs sticking out and those pegs "rest" on the plexiglass shelf. I could see a dark carbon trail on one of the plexiglass pieces (see photo below). I was surprised because I'm pretty sure plexiglass is non-conductive. Our guess was that some moisture may have dripped in (we had received some heavy rains recently) and provided a path for the RF.

Again, we started disassembling the cavity. We decided to take both pieces of plexiglass out. We used a couple different drill attachments to grind off the carbon areas (see below). Once that was complete, we thoroughly cleaned both pieces and put things back together. Again, we brought things up slowly and again, everything came up nice and happy.

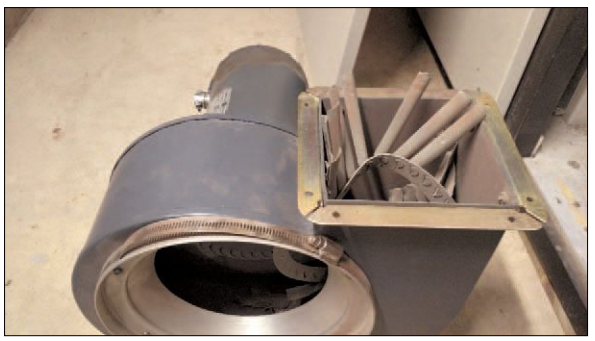
I don't know of any preventive maintenance that might have prevented this, aside from checking the roof. It's raining right now as I write this. I may have to run down there tomorrow to take a look at things.

The third "curve ball" was just this week. Early one morning the transmitter called (never good). It was off and would not come back on. When I got to the site I noticed the HV breaker had tripped. I reset the breaker and tried it again. The breaker tripped instantly.

Past experience has shown me that a common cause of HV breaker trips is a shorted rectifier in the HV supply. I checked the rectifiers – all checked good. Next I disconnected the line going from the HV metering sample over to the PA cabinet and hit the plates button – high voltage came on and the breaker held. The problem was obviously in the next cabinet.

As soon as I opened the other door, the problem was obvious – and easily eliminated. In the upper left corner there's a High Voltage "Failsafe Solenoid Assembly." It's basically, a high voltage shorting bar. When the solenoid is de-energized the high voltage is shorted. When all interlocks are satisfied and filaments energized, the solenoid pulls up removing the short. As you can see in the photo below, the plastic linkage had broken, dropping the short and tripping the breaker. Simply lifting it out allowed the transmitter to go back on the air. My only wish here was that I had done a quick "eyeball" of the entire transmitter first, rather than spending so much time on the power supply itself.

I have one last story. This is from another Continental 816. The blower breaker was tripping. I arrived and found the backup motor (you *do* have one, don't you?). Once the blower assembly was out, I could instantly see it was more than just the motor. Here too, the picture below tells it all. And, no, I didn't have a spare *blower!* The front bearing had broken apart allowing the motor shaft to wobble and the fan blade assembly to hit the sides of the enclosure. You can see what happened. I had never seen *this* before! We were able to buy a full blower and motor from a nearby station with a de-commissioned 816. Lucky break!



Helpful Hint #3: When you replace a blower motor, if the transmitter is not already setup this way, wire a "pigtail" from the motor and add a terminal strip nearby. This way, you don't have to remove the wiring plate on the motor to disconnect and remove it. A little time added now, will save much time in the future.

One more thing – hot weather is on the way. Check your cooling/ventilation systems and filters. Heat and dust are the enemy!

I hope you all have a great summer. Until next time – Keep it between 90 and 105!

Scott Schmeling is the Chief Engineer for Minnesota Valley Broadcasting. You may email him at: scottschmeling@radiomankato.com

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Tower Topics

Sending A Strike To Ground

by Wiely Boswell

If you have lightning issues you have to review the situation. There has been volumes written on this subject and the main thing is keeping potential across equipment to a minimum, and keeping the site as safe as possible.

Voltage can develop between AC power, antenna feeds, telephone lines, cable, water line, satellite feeds, and a few other possibilities. This is why standard practice calls for power ground, telephone ground, and cable ground to be bonded together at the power service entrance. We have to include a tower with feed lines as well. The worse scenario, hardest to correct, is power entering on one side of a building and feed line entering on the other side of a building.

One situation that comes to mind is a PVC water line. If lightning current is traveling in the ground, and has no other path of lower resistance, it will go right through the water (not distilled), and can boil the water and blow up the PVC. If you are lightning that's what you do: you blow stuff up!

If you install #12 or larger ground wire in the trench with the pipe, it provides the better path and may save the pipe. The ground conductor carries the current surge and lowers the voltage gradient, which in turn makes the water not be the best path. It will also be useful in later locating the line. If you happen to have a metal line you should use a ground strap and jump around the water meter. No potential across the meter – a smooth path around. That is the concept; keep potential low across equipment you want to protect and give it a smooth and as straight a path as possible. Bends are the inductive enemy to a ground, but a friend if you put it somewhere you want high impedance to a high frequency lightning path.

Make sharp bends and/or use ferrites in and around transmission lines, phone lines, power cords, or power lines. Nautel even provides small and large ferrites with new transmitters. Running the main AC power drop thru 20' or more of metallic conduit acts like an inductor and inhibits high rise time pulses coming in longitudinally on the power feeds. I have seen lots of cell-site antenna feed lines run thru pipes on the ice bridge before they go into the building. Same idea – high rise time equals high frequency. Even the skin effect of a conductor comes into play. Think of the main lines coming down a tower as a path, leading an electrical fireball down to earth. It is coming like a freight train and does not want to change direction; it wants to go to ground and will take the best path. If the path is weak, it can start going everywhere, looking for ground. A "weak" path will result in a voltage drop which can end up as voltage across equipment or arcing.

When a cable comes off a tower at six feet and comes straight into a building, it really puts the well done entrance ground bar to the test. Cellular industry does this, to work along with a halo ground inside the building. They bond the shields right where they come off the tower and several feet away at the building entrance. They tie every thing together – fences, gates, doors, racks, HVAC systems, and power. If you use the right cadweld mold you can connect a ground to just about anything.

A lot of us are on a tight budget, even if it is money well invested. Therefore we are a bit more practical. We use what we can afford and get creative. You can spend large amounts of money, but at some point spending more does not get you more protection. The bottom line is how well do you survive strikes? What gets arced will give you a good idea where the potential builds during a strike. I have seen arcing between metallic flex power cable and the steel of a hut. I took a #6 copper run over the metal roof and brought it down to the main ground.

Lightning can jump right off the tower towards a building or small auxiliary tower. This happens especially if the main tower ground is not low impedance. A ball of lightning can be blown by wind off the tower also, so whatever it can jump to needs to have a low impedance path back to main ground – it has to go *around* equipment, not show up across it.

A power panel lightning protector must be low impedance all around. If the "hot" wires from the protector, connecting it to the phases is long and makes bends, or is run thru metallic conduit, it can not perform its function. It will not be a hard shunt to ground and/or between phases. It will be a "stealth" protector! They typically have their own direct ground connection (not thru panel) as well. Adhere to the installation practices of the protectors used. A good protector should protect spikes between *all* phases and from *each* phase to ground.

Grounding should be documented so the next engineer can tell what has been done. Once ground runs are buried, they can be quickly forgotten, so one good method is having ground rod connections exposed by burying 8 to 12 inches of 6" PCV pipe around the rod, keeping the dirt below the connection. You can use a round irrigation covers, which will leave an inspection point at ground rods to verify rod connections. It is also helpful to grade the ground around any rods to make water run down into the rod location. If you cannot drill a hole and want to drive a rod really deep, you can get rods that will screw together to make a 20 foot or longer rod.

Well drillers all seem to know each other so any company can help you find a local outfit. The smallest diameter hole my selected company could drill was 4 inches. They can install steel well casing like a normal water well, and use the casing as a conductor, but expense goes up. Instead, we used some old 1-5/8" Heliax that was pulled out straight, stretched a little, with the outside insulation striped off. We then pulled the cable about 100' up the tower, while keeping it straight as possible.

This helped the cable lower down in to our 80 foot hole with no problem. We are, however, assuming a skin effect on the outer solid sheath, and I do wonder what the effect the outer corrugated ridges in the sheath will present. Even so, it will have more ground contact surface, with lower resistance, since this large diameter surface area, in general, is superior to a 3/4" rod. I want to go back to my premise that we are trying to make a "slide" for a lightning ball to ride down– no sharp turns or it can get thrown off!

Figure 1 shows the concept and **figure 2** shows the tower base with large copper clamps that secure the #2 cable under the bare 1-5/8 heliax. The #2 originally took a 90 degree turn around tower base before it was welded to a ground rod. It was pulled up and straightened, to connect under the Heliax with clamps. It is hard to weld all this together because you can easily burn thru copper cable sheath. We used large copper clamps and a lot of NO-OX grease. Above ground, these connections can be inspected as the years go on. The transmission line ground kit lug was put under one of the clamp bolts.

As for the drilling experience, first they have to have good access – they drive in a big rig and a water truck. They erect the derrick, which can require 25'-30' vertical clearance. They dig a small hole and drop a mud pan down. A hole in the pan with a protruding rim goes into the bored hole about 5 inches. As they drill, adding sections along the way, water is pumped into the ground thru the drill shaft and out the drilling bit on the end. The water and mud comes back up and goes into the pan, where water is separated and mud is shoveled out.

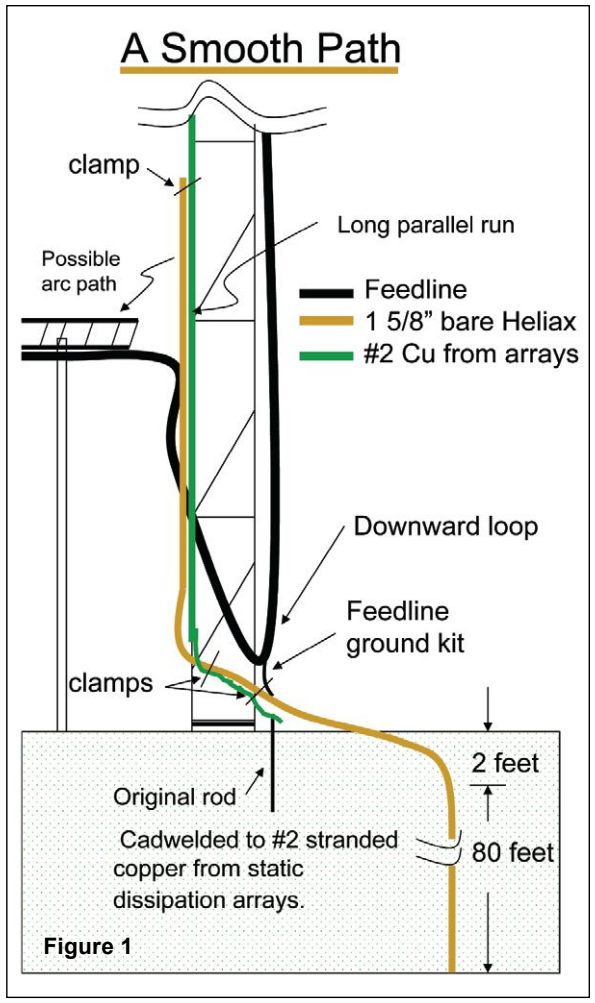

Figure 1

Once the hole was finished they wanted the pan to stay in place so the hole, not having a steel casing, would not cave in. We lowered the bare Heliax cable from way up on the tower into the bore hole thru the hole in the pan. It went right in and down 80 feet. I still had lots of slack which we had to pull back thru the pan as it was lifted up. They were dumping out left over water at that point, which I used to wash mud back down the hole. I left the site where rain water would gather and wash down the hole.


Figure 2

They finished, and I got the honor of trenching to the tower. I dug it very deep, right at the hole, to make a long smooth bend, and it approached the surface as it got to the tower base. There was enough room in the 4" hole to put an extra piece of 1/2 inch heliax 30' down into the hole. They were tied together and this short run was taken to the power pole with the meter base.

It was attached at the ground rod with enough slack to go to the top of the pole. So if a flash decides to jump to the pole it has a path also. So now an old Heliax line has some more useful life!

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

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Tools of the Trade

O.C. White Inc.

A Story of Three Generations

by Steve Callahan

Recently, I've been getting familiar with microphone booms. Yes, the humble microphone boom that graces every radio station studio. All of us who have ever spent a minute in a radio studio have had to reach up and adjust the mic boom. Chances are very good that microphone boom in your hand had its origins at O.C. White, Inc.

Back in 1883, a dentist from Hopkinton, Massachusetts came up with a unique idea. His dental chair needed an adjustable headrest, so he invented a universal ball and socket joint. This was just one of many patents that Dr. Otis C. White received, and for which he received many international awards at the 1893 Pan American Exposition.

By 1894, Dr. White's new company was producing gas lighting fixtures and in less than a decade, they had delved into the new world of adjustable electric lighting with the introduction of the "Mazda lamp."

Skip ahead to World War One, and by this time Otis C. White Jr., Doctor White's son, was at the helm of the company and they were specializing in adjustable arms that were used by the Army Signal Corps and were cited as helping to, "produce a victory over the enemy." In 1939, O.C. White was designing desk fluorescent lamps and physician exam lights.

By World War Two, O.C. White was producing adjustable lights for the war effort and in the 1950's, they were the dominant producer of adjustable lighting for machine manufacturers like New Britain Machine, Cincinnati Machine, Bryant and other makers of lathes, drills and milling machines. If you ever learned how to use one of these machines, chances are very good you remember an adjustable clamshell light that was attached to the machine and was invented by O.C. White.

Richard May Sr. and Andrew May

The company entered a new chapter in 1956 when they introduced their own illuminated magnifiers as well as it's now famous broadcast arms. In 1964, Robert L. May, who up to this point had been a manufacturer's representative for the company with 20 years of lighting experience at Sylvania Electric and Westinghouse, bought the company and started the three generation ownership of O.C. White by the May Family. Richard May, Sr., Robert's son, now heads up the company and moved the company to a 72,000 square foot brick mill building in Thorndike, Massachusetts in Central Massachusetts.

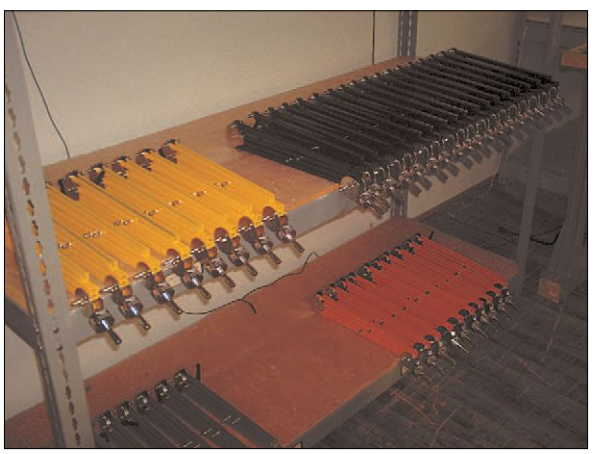
I know that I've seem more than my fair share of their mic booms with the two sets of springs. However, that's the description of yesterday's microphone boom. I was introduced to the O.C. White ProBoom Ultima line and I just had to learn more and to see where it came from – and to learn more about the future of microphone boom technology.

I had to travel to the quiet little mill town of Thorndike, Massachusetts to meet the May family. O.C. White is headquartered in a six story mill building next to an old railroad spur, which used to be the home to an awning company. It's right in the center of town and is so typical of hundreds of older mill buildings in Massachusetts, that I drove right by the building without seeing the small O.C. White sign high on the wall. However, this New England mill building is full of tomorrow's technology for an international market.

I met with Andrew May, Vice President of Sales and Operations for O.C. White and he gave me the grand tour of where he and 20 employees assemble, paint and deliver what has become the industry standard for microphone booms.

During my visit, Andrew was obviously proud of the O.C. White product line and the quality that his staff produces. Given their company's history with articulated lights, you shouldn't be surprised to learn that 20% of their production is articulated arm magnifiers that many of us use on our work benches for that necessary close-up work. At the mill, O.C. White assembles parts that come from a wide variety of suppliers and they have an experienced workforce that utilizes new technologies and some tried and true tools to produce their products.

I had the opportunity to walk through the assembly line and watch the various components in the magnifiers come together into a finished product. First the parts arrive at the mill and are washed several times to remove any manufacturing oil, then they get polished by hand and move across the building to the paint line. Much like an auto assembly line in Detroit, the new microphone arm parts are hung from a conveyor and they snake across the paint room to the paint booth where they get their appropriate color.



Colorful Microphone Booms

I was used to the O.C. White battleship grey and crème colored booms, so I was pleasantly surprised to see that their mic booms and their magnifier arms are produced in a bright rainbow of colors. They have ten standard colors but any color or creative design can be produced.

One thing that I was amazed to see was the precursor to today's computer directed multiple-tool drilling machine. This piece of equipment from the previous century looked like five drill presses in one with a wide feed table. A machinist from that time could drill five different holes in a piece of metal without changing a drill bit. It doesn't get a lot of use today but it was fascinating to see it still in their machine shop.

After paint, the parts make their way up stairs to the assembly area. An entire floor of the mill is devoted to the assembly of mic booms and magnifiers. Another part of the mill is devoted to their microscope line that is used for small component examination by customers like NASA. After assembly, the arms go to an impressive shipping area that's located on the first floor of the mill.

O.C. White sells their product through a network of 80 sales reps worldwide and has been responsible for at least a million mic arms being in our radio studios. Their latest mic boom product, the ProBoom Ultima, is a creative mix of mic arms and monitor arms. Since today's radio studio frequently has more computer monitors than microphones, the ProBoom Ultima can be configured and installed to fit your own unique need.

The O.C. White ProBoom Ultima

You start with their 18 inch Vertical Riser, which can be bolted or clamp-mounted to your furniture. Then you add mic arms or monitor arms at any height along the riser. If your needs change, you can very easily change the arm configuration. One feature that I liked, and have used, is to extend the mic arm. There are no more external springs and the arms are two segments long, but if you need a longer "reach," it's a snap to add one more segment to make the arm three segments long. There is a clever system of wiring channels and set screws in the ProBoom Ultima.

I ended my tour of O.C. White in their lobby where they have a very impressive collection of the company's previous products, like articulated lighting arms of all sizes – and even one of Dr. White's dentist chairs. They also produce reproductions of the company's most memorable lighting arms which are as much a work of art as a functional lamp.

You could consider O.C. White the world's oldest industrial lighting manufacturer but they are so much more than that. Dr. White would be proud.

Steve Callahan, CBRE, AMD, is the owner of WVBF, Middleboro, Mass. Email at: wvbf1530@yahoo.com

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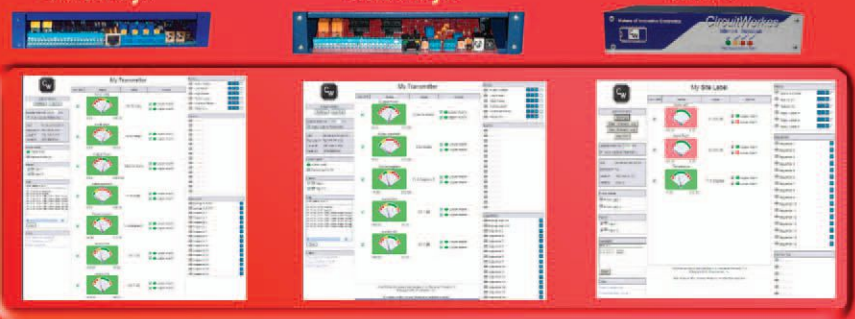

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Transmitter Site

Guy Wire Interference

by Mike Hendrickson

Have you ever had an interference problem where you simply cannot determine the source of the interference? The interference is intermittent and it appears to be completely random. A few years ago I ran into a problem like that.

We had upgraded KUOO (FM), Spirit Lake, IA from a class A station to a class C2 station with 50 kW ERP. The antenna was installed on a new 500 foot tower. Since we had the space available on the tower, we installed a 160 MHz RPU receive antenna at 400 feet above ground, about 50 feet below the main FM antenna. The coverage of the RPU system was very good, but after a few weeks of use we started having a problem with noise in the receiver. The noise was completely random. There would be some times with no noise and other times when the RPU was completely useless because of the amount of noise. Because we did not have a spectrum analyzer available at that time we could not directly observe the spectrum for noise.

Our first thought was that we had a problem with the receive installation. Because the noise was intermittent we waited until the noise was present before we checked the antenna system. Since a receive antenna can also be used as a transmit antenna, we used an RPU transmitter and a Watt meter to determine if there were any problems with the antenna system. Everything appeared to be okay.

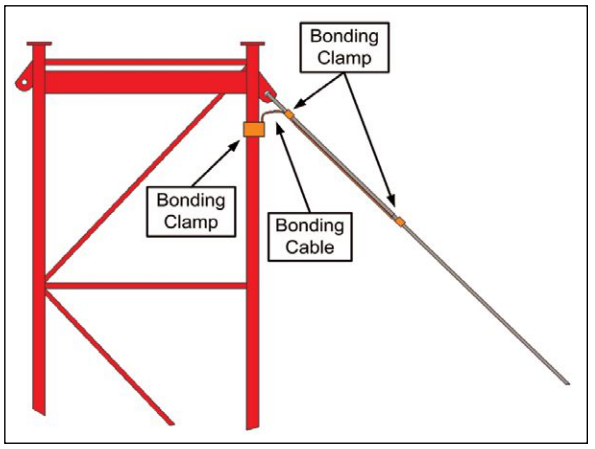
Next, we monitored the FM transmitter to see if it was causing the problem. The first thing we discovered was that if the transmitter was off, the noise disappeared. This told us the problem was related to the transmission of RF, but it did not tell us the source of the noise. We further found that the FM transmitter was completely stable. There was absolutely no change in the operation of the transmitter when there was noise in the RPU receiver.

After several weeks, we realized that the problem only occurred when there was a strong wind – when the wind was calm there was no interfering noise. After we realized the problem was related to the wind we had the FM transmission line and antenna inspected to see if there were loose bolts or bonding (grounding) straps. The tower crew reported back that there were no problems with the transmission line bonding.

At this point we were stumped as to the noise source. Then a member of the tower crew that was on the ground happened to push and pull on the guy wire that was terminated just below the FM antenna. Immediately the noise appeared in the RPU. When the guy wire movement stopped, the noise disappeared. All three guy wires connected to the tower at this level created noise when they were forced into movement – movement of the other guy wires on the tower did not create the noise.

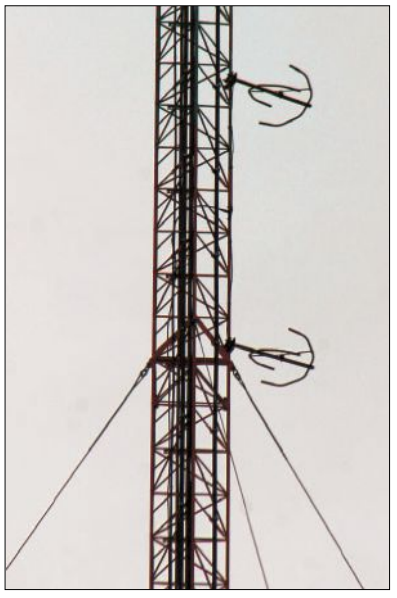
We discovered that the holes for the guy wire pull offs on the tower were painted. Thus, there was not a good electrical bonding between the guy wires and the tower. Whenever there was guy wire movement, the bad connections created RF spurious emissions that caused the interference to the RPU. The solution was to run a bonding jumper between the bare metal of the tower and the actual guy wire. This solved the problem..

A few years later, and at a different location, I ran into exactly the same problem. Again, the solution was bonding the guy wire to the tower. Notice, I said *bonding* the guy wire to the tower. This is not the same as "grounding" the guy wire. You want to bond the two metallic objects together so there is no voltage difference between them. If there is no voltage differential, there will be no diode action or arcing between the two metallic items.



This drawing shows the bonding connections between the guy wire, guy wire grip, and the tower.

When the towers were built, the guy wires that were directly in the field of the antenna were attached to a set of fiberglass rods that were then connected to the tower. The problem was with the guy wires that were below the antenna and not in the field of the antenna. These were the guy wires that needed to be bonded to the tower. If there had been fiber glass rods used to connect the wires to the tower, the problem would have been prevented



Guy wires just below the FM antenna – there was no bonding between the guy wires and the tower. Potential problem.

I ran into a somewhat similar interference problem in Florida. We had a double hop STL in Panama City, Florida. This double hop system was a four channel DSP (digital) system from Moseley. The first hop delivered two channels of audio to the first station. The second hop carried the remaining two audio channels to the second station.

Occasionally, the audio for both stations would drop out. Sometimes it would be a momentary drop lasting less than a second, other times it would last a minute or two, but never long enough to do adequate trouble shooting. Many times, days or weeks would go by with no problem at all. Again, all of the systems seemed to be working okay. The problem occurred in good weather, foggy weather, windy or calm weather. It appeared to be completely random.

I wish I could say that I solved the mystery, but that isn't the case. It was finally solved when the station manager received a call one evening from a neighbor of the transmitter site. He asked the manager if we had a tower crew on the tower doing some welding. He had noticed that there was a bright light like an arc welder near the top of the tower. It so happened that the neighbor was an amateur radio operator and he commented that there was a lot of RF noise at times that he could not track down. He told us that he could now see that the noise matched the "arc welding." Now that we knew about the arcing, we determined that the RF noise was interfering with the STL. But, because the STL system was digital, the audio dropped out instead of having an increase in the noise in the audio.

We had a tower crew inspect the FM transmission system and, to our relief, it was okay. The problem was an abandoned 7/8" coax line that was run from an old RPU receive antenna at the top of the tower to the ground. This line ran through the field of the FM antenna and there was no bonding of the line to the tower. This meant that where ever the outer jacket was worn, the outer conductor of the coax was arcing to the tower. The tower crew removed the line and the problem was fixed. When the old transmission line was inspected on the ground we discovered that the line had arced every half wavelength or about five feet. The FM station in this case was a 50 kW ERP station with a four section antenna. The input to the antenna was about 23.5 kW so there was a lot of concentrated RF to cause the arcing.

An old RPU Receive antenna with its transmission line running through the field of a FM antenna. This is a potential interference problem if there is not adequate bonding of the line to the tower.

The moral of these stories is to be sure that *all* of the metallic systems on the tower are properly bonded together. Remember, that the closer you get to the transmission antennas, the greater the amount of RF to cause arcing. If you have conduits, transmission lines, or other metallic items running through the field of the FM antenna they *must* be bonded to the tower. Again, this is not necessarily grounding, but bonding, to eliminate voltage differences between metal objects. Another item to remember is that unused antennas and transmission lines on a tower should be removed to avoid similar problems to the problem we ran into in Florida.

One final suggestion: when you bond a guy wire to the tower be sure to bond the actual guy wire, not just the guy wire grip used to connect the guy wire to the tower. There is an epoxy coating on the interior of the grip that may act as an insulator and prevent a good electrical bond to the guy wire.

Hendrickson, CPBE, CBNT is the retired Chief Engineer of American Public Media Group. He has been involved in Broadcast Engineering since 1969. Over this time period he has been involved with all aspects of broadcast engineering from the technical to the budgeting. He may be reached at: mikehlakeville@gmail.com

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User Report

GatesAir Intraplex LiveLook Software

by Timothy Schultz

We all know the expression, "A picture is worth a thousand words," and that's exactly what the GatesAir Intraplex LiveLook software does for the IP Link streaming audio codecs; it shows the user, in a graphical format, the end-to-end performance of their Internet Protocol (IP) links.

By way of background, KCLU is a community service of California Lutheran University, delivering comprehensive local news and National Public Radio programming to listeners in Ventura, Santa Barbara and San Luis Obispo counties via five transmitter sites. Our flagship station, serving Ventura County, is KCLU-FM, Thousand Oaks. Southern Santa Barbara County is served by KCLU(AM), Santa Barbara and its companion FM translator. Coverage is extended further north into the Central Coast region by KCLM, Santa Maria and its companion translator in San Luis Obispo.

While KCLU-FM still uses a traditional 950 MHz STL, the other stations mentioned above are too far removed from the KCLU studios in Thousand Oaks to have their programming delivered by a simple one or two hop microwave link. So, for years, we used the tried and true Intraplex IX-STL hardware and paid for point-to-point T1 circuits into Santa Barbara.

However, when KCLU expanded its coverage into the Central Coast region, we looked for a less expensive alternative to the point-to-point T1 solution and felt that delivery of streaming audio over the Internet had matured to a point where it would be safe to use. After comparing several products, we chose the GatesAir Intraplex IP Link. Soon after putting KCLM on the air, we replaced the point-to-point T1 links to Santa Barbara with IP Link systems; the return on investment was about 18 months, due to the monthly cost savings of the tariffed T1 circuits.

The IP Link monitors packet loss and shows the user both instantaneous and long-term error rates – but that doesn't tell the whole story. For example, unless a stream actually went down, which would cause an entry in the IP Link's alarm log, there's no way to tell when the packet losses occurred or how severe they were. Did the losses occur all at once, or were they spread out over the course of several seconds, minutes or hours? Is this a recurring problem that shows up at about the same time every day?

The LiveLook software can show you all of this at a glance. LiveLook is a Windows PC application that grabs all of the real-time packet information from the IP Link and saves it on the PC's hard drive. Each saved file contains up to a week's worth of data (user configurable). LiveLook continually plots the most recent hour of real-time data on the screen in the Live View window. Stored data files can be recalled from the hard drive and viewed on the screen by selecting the History tab. Viewed graphs can be saved/exported in .png or .svg formats. The line colors are customizable for each graph and up to four lines can be shown in each graph pane.

In **Figure 1** you can see a sample screenshot of the Live View tab. This is a view taken at the KCLU studios of the return streams from the transmitter sites, which we use for confidence audio. As you can see, the most packet loss errors are coming in on the second stream in each window, which happens to be green in color. Both of these streams are coming in on the network connection provided by the university; we supplement this connectivity with a different ISP using an independent cable modem.

Figure 2 shows a historical graph for a week's worth of data for this same network. I chose this particular week to highlight the struggle the university has in supplying enough bandwidth for its students.

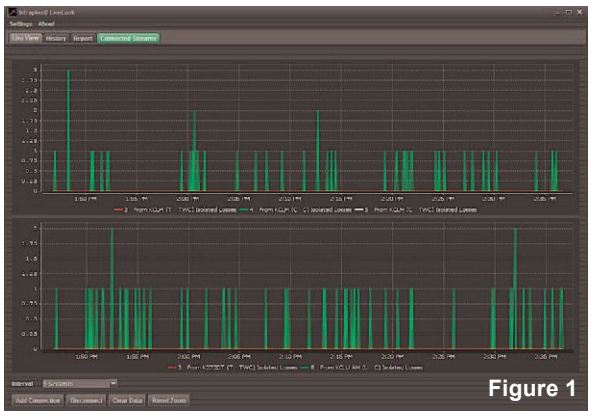
Figure 1

April 14, 2017 was the Friday before Easter, and the students were on break. They returned to the campus throughout the day on Monday, April 17 and resumed their normal habits of streaming Netflix, etc. The data loss rate hovers around 0.25% throughout the day (every weekday throughout the school year) and then drops off after midnight as the students go to sleep.

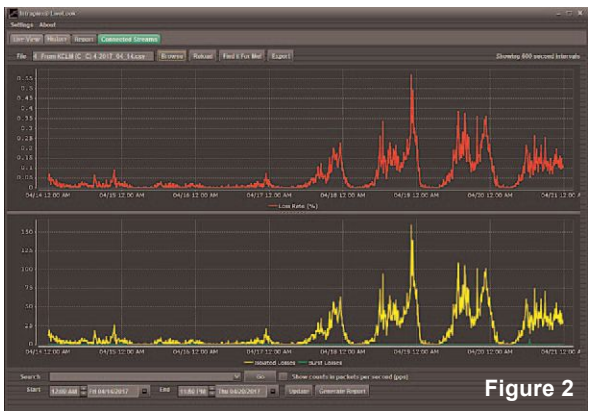
Figure 2

In my experience, LiveLook will run on just about anything (WinXP on up) as long as it has Java installed. I have LiveLook running at the studios and at the transmitter sites using the same PC that runs the remote control software along with other applications; LiveLook is not a very resource intensive application, as it spends most of its time merely logging small amounts of data. The LiveLook software is free, but a license key is required for the IP Link.

LiveLook does not need to be installed at each site; I simply chose to deploy it that way for best data integrity. One could choose to centrally locate the LiveLook PC, and monitor multiple sites from one location, such as at a NOC or even one's office. The LiveLook application can traverse a NAT router, so it can be just about anywhere, but the IP Link will only allow one LiveLook connection per stream at a time.

The one feature I probably get the most use of is LiveLook's ability to send me an email message when a stream is in trouble (typically, it is down). For each stream being monitored, one can configure a threshold for how long and for what percentage of packet loss there needs to be before sending out an email alarm. If you don't want an email for a particular stream, simply turn it off – it's not an all or nothing proposition.

As we all know, any Internet connection from any provider will drop from time-to-time for any number of reasons. Loss of service can range in duration from a few seconds to a couple hours. It's been my experience that these service interruptions occur much more frequently on "The Internet" than they did on the legacy point-to-point circuits they are replacing. To overcome this reality, I send multiple streams via multiple ISPs and use stream-splicing within the IP Link, to ensure as best I can that the audio packets will arrive at intact. So, if a particular stream drops for a few seconds or even a few minutes, I don't need to get a page, because I'm not off the air. However, if it drops for a significant block of time, I want to know so that I can get on the telephone to the ISP to figure out what is going on. Perhaps I'm fortunate, but in the four years that we've been streaming audio using the IP Link, I've only been off the air for a few minutes due to two ISPs performing overnight maintenance with slightly overlapping schedules.

Here's an example of how the data captured in LiveLook was able to help me identify and solve a problem. For almost 3.5 years, one of the two ISPs providing service to the KCLM transmitter site had run clean (occasional outages excepted). Then, on August 3, 2016, it went nuts. The latency on the circuit would intermittently run high at random times throughout the day – up to a couple thousand milliseconds.

I was able to compensate for the huge variations by adjusting the buffer size in the IP Link, but that increased my audio delay. Okay, so what happened? Records showed that the ISP had made, "some improvements to the network," but I couldn't get the details as to what changes they actually made. At first, they were in a state of denial – "No problem found," and they'd close the trouble ticket. Well, if you only test the circuit for a few minutes during the day or in the middle of the night, you likely wouldn't see the problem. It took me months of arguing and providing LiveLook graphs, along with other ping and tracert results, to eventually convince them I wasn't making this problem up. Finally, in January 2017, after months of complaining, they were able pinpoint the source of the problem: an over-subscribed circuit (99.04% utilization) between the main and remote central office serving my location.

Figure 3 is an example of the problem taken a few days before it was actually fixed. Most of the latency hits were of short duration, but on this particular day, the problem lasted for almost two hours.


Figure 3

To make matters worse, on February 10 at 3:44 PM, my packet loss rate shot up (see **Figure 4**). I suspect some other customer on this already overloaded circuit began streaming something, like a surveillance camera, because this error rate never changed 24x7 (well, in all honesty, sometimes it actually got worse than what is shown).

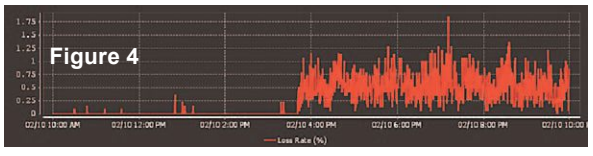
Figure 4

When the ISP finally added more bandwidth between COs, both problems instantly disappeared. In reading the Service Level Agreement (SLA) for this particular ISP, this error rate and intermittent high latency were both outside of acceptable limits.

If you have, or are planning to use, the IP Link to stream audio across the Internet, then LiveLook is a great tool to have running in the background, collecting link performance data. It's just like logging readings on a transmitter; it's always good to be able to look back on how something has been performing when comparing it to how it is currently performing – and just like owning any tool, such as a spectrum analyzer or even a Crescent wrench, you may not use it every day, but when you need it, you've got it.

Timothy Schultz has been a broadcast engineer for 40 years and is currently an independent consulting engineer. He placed KCLU-FM on the air in 1994 and continues to serve as its Chief Engineer.

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Maintenance Guide

Logging Revisited, Etc!

Document Your Transmitter Site – Part Deux

by Tommy Gray – CPBE CBNE

Since the last issue [Mar/Apr-17] I have received a lot of email from folks who were happy to read my comments about logging your transmitter sites, and who were also happy to be reminded how important this task is. I have to admit that sometimes I am strapped for time and don't do all the logging I would like to, on each visit, but I try to consistently do enough that I can track potential problems and head them off before they happen.

For instance, when I log the currents of the tubes in my transmitters, I can tell when a tube is developing an issue or is nearing end of life. This allows me to know many times, weeks before it has to be changed out. When you do this regularly, you develop a feel over time for just about how long you can expect a tube to last and what kind of tube life you can expect out of the jugs in your transmitters. One other important thing about logging is that, in order to get a failed tube covered under warranty, you will probably have to know what its operating parameters were at the time of failure, as well as how many filament hours were on the tube. Many rebuilt tubes have, for example, 3000 or so hours of warranty. When you fill out the warranty claim form, you will be asked that information.

I realize that tube type transmitters are going away and are being replaced by solid state boxes, but at this point in time, I would venture to say that the majority of small market stations and clusters still have tube boxes exclusively. The main reason for that is the cost! Now there are the recurring tube costs to deal with, and tubes can sometimes be high, but overall it is much easier for a small station to replace a tube every 12-18 months rather than to do the debt service necessary to purchase a solid state transmitter. When you factor in, however, the cost of replacement modules and spare parts that solid state transmitters sometimes go through, there is not a lot of savings. The primary advantage of the solid state transmitters, at least while they are in warranty, is the reliability and ease of maintenance they offer.

Having said that, let's compare the difference in the cost of the transmitters. For example (and this of course depends on the manufacturer) a 20 kW tube transmitter might cost $50K while its solid state counterpart might cost $130K or more depending on options (and brand). Take those figures to your banker and you will quickly find that the monthly debt service is dramatically different. Now personally, I like both types of transmitters. I especially like the convenience of built-in control through Internet based GUIs, etc. Being a "Geek," so to speak, I love being able to login to my transmitter from my cell and see and control everything. I like the fancy colored "App" style displays, etc., instead of simply hitting keys and listening to a robotic voice tell me how my transmitter is doing. But then there are some nice transmitter remote control units out there that offer similar, and just as capable, interfaces that can do virtually the same thing, and in the same manner as the fancy built-in GUIs. The convenience factor may be lost somewhat though. Most solid state units have built-in data ports where you can plug in a network cable, set an IP address, and you are on-line. You can still however, as I said, get similar capabilities with hard-wired remote control units. Most major brands of remote equipment offer really great options and capability. Many also offer multi-station monitoring on a single screen (laptop, desktop, tablet, etc.).

If you have attended a major trade show in the past few years, you would have probably seen some of these remote units on display. I had the opportunity a while back, to examine one I especially liked, where they were monitoring at least a dozen stations or more from a regional cluster of stations, and all on one screen.

Now you may think that your old transmitter is outdated and not capable of doing what the newer ones will do. In many cases you are correct. If you will look at possibly upgrading your transmitter site with a new remote control and an Internet connection (when available), you can gain the convenience and great monitoring capabilities that many of the latest and greatest offer, by simply doing a little on-site interfacing and wiring.

Keep Cool!

Summer is upon us once again so I thought I would deviate a tad here and mention something a little different, that bears a closer look. If you are still running your transmitter sites without air conditioning, as many are, I want to share a few statistics with you. For example, we

(Continued on Page 22)

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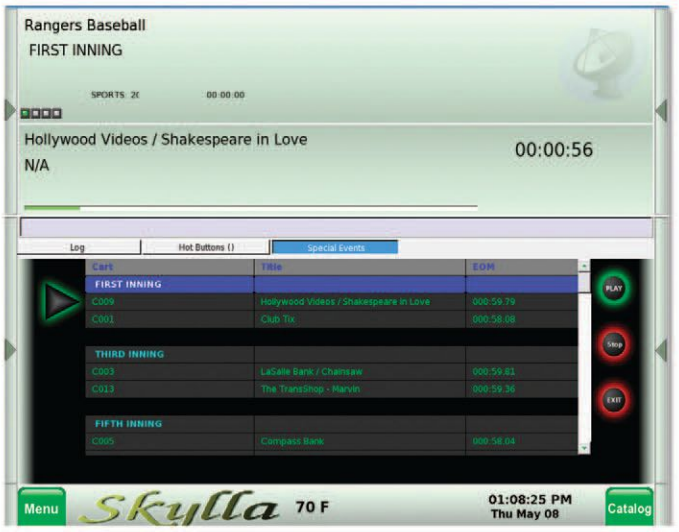

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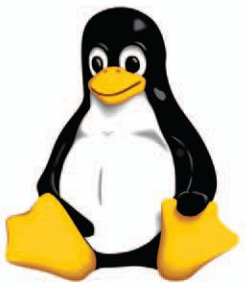

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Logging Revisited, Etc!

– Continued from Page 20 –

had a site (25 kW tube type transmitter) that was getting about 10-12 months out of the IPA tube and about 8-10 months out of the PA tube. Do what we would, even with proper filament maintenance and good exhaust venting – not to mention proper air flow in the building – we just could not squeeze any more life out of the tubes. We took great care of the transmitter and site but that is all it would do. We chalked a lot of it up to the rebuilt tubes we were using, but I felt it was due to the heat. After 2-3 years in service, the owners finally started putting in air conditioning at some of the sites. This site one was one of the first. *Immediately* we started getting 2 years or more out of the IPA and the PA tubes started lasting consistently 18 months or more – the last one removed from it lasted almost 2 years!

A bonus was that the building and transmitter required almost no cleaning as there was no dirt being sucked in by the fans, etc. The last time it was opened up for cleaning, it only required a little dusting, wiping off of the insulators, and checking the wiring for loose connections, etc. It looked like it had been cleaned just days before! After that transmitter proved to be such a success, they ended up doing all their sites with similar results. I can tell you that it made our job a lot easier!

One thing I failed to mention here is that, not only did the tubes last longer and the transmitter stayed much cleaner, the downtime almost totally disappeared! We only change the tubes when logging is showing they are going away. We know when to change them and the only downtime we have experienced is a few minutes from a faulty filament breaker on the main transmitter. The downtime consisted of switching the patch panel to put the aux on-line and vice versa! The amount of maintenance required to keep the sites up and running has gone down significantly. If I would give it a figure, I would say it has gone down by 60% or more! If you want to dramatically increase your tube life, consider air conditioning your transmitter site(s).

One thing to mention is that, instead of a single unit, you should install dual units with either a controller thermostat that will even out the load by alternating the units, or put a separate thermostat on each unit, and set one higher than the other. About once a month or so, swap the settings so that the other unit becomes the primary. This allows the units to share the load and not have one unit be the primary all the time. One other thing is to make sure that a single unit can handle the load by itself for a time, should one of them fail.

I should mention that you need to keep your exhaust fans, and put thermostatically controlled louvers on them, So if (I should say when) your AC fails, once the temp rises to a preset value (usually 15 degrees or so higher than your AC temp), they will open up, turn the fan on, and exhaust the heat out of the building to keep you going. Remember to remove any exhaust ducts from your transmitter and let the unit(s) dump heat into the building when on AC, so you can keep the building sealed and clean. That is how I do it and it has worked well for me for many years. I also realize that there are differing opinions out there in this regard, but I can tell you I have had great success with this method.

4CX15000A Tube – Courtesy of: www.engineeringradio.us/blog/

Since I have a little more available space, I want to take this opportunity to mention something that is important to maximizing tube life for your transmitter. Hopefully you are already doing this – but if not you should. And that is something called "Filament Maintenance." Here is a simple explanation. When you install a new tube, set the filament voltage to the exact value the tube specs dictate. After 200 hours or so, tweak your tuning and then lower the filament voltage slowly until you see the power drop off. Bring it back to a value where the power comes back and add about 0.2V (point 2 Volts). This will get you started. As the tube ages, you may have to increase it gradually to maintain full power. There are some good white papers out there with a full explanation of the proper procedure. One such document can be found here: http://www.cpii.com/docs/related/22/AB18.pdf

NOTE: Please follow manufacturer's recommendations for your particular tubes.

More Next Time!

Tommy Gray is a retired veteran broadcast engineer currently staying busy doing engineering in the gulf south, through "Broadcast Engineering & Technology LLC," a Louisiana based Consulting and Contract Engineering Firm serving the U.S. www.BEandT.com

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Operations Guide

Tower Leasing

by Mike Hendrickson

At some point many of us have been asked to handle tower leasing, either as a tenant or as a landlord. This article will give you my opinion about technical items that should be included in the lease.

The lease will have several sections. Generally, there will be a section that includes a legal description of the property and its location. There will also be sections that cover liability insurance for anyone leasing space on the tower or ground. There may also be a section addressing what happens in the event the site is sold to a new owner or the site becomes unusable. The rate and term of the lease will be covered in another section. These sections should be handled by an attorney.

Engineers should provide input to the attorney on several other items. These include the engineering of the structure, location of equipment on the tower and ground, interference issues, safety and any other issue that may affect the technical operation of the site.

The first step in tower leasing is to know the local rate for tower space leasing. There are firms that will, for a fixed fee, provide you with price survey information about the rates for tower space rental in your area. It may be worthwhile to obtain this information. My experience has been that most broadcast owners do not charge a high enough rate for tower space.

As part of the negotiations for the space leasing on the tower, you will need to determine if the tower will safely support the proposed installation. This will require a structural study of the tower. In my opinion, the tenant should pay for the structural study done by a structural engineering firm of your choosing. You should receive a complete structural study and an opinion letter as to whether or not the tower will meet TIA/EIA 222 revision G standards. This study and letter should be signed by a professional engineer that is registered in your state.

You will need to supply the structural firm the blueprints of the tower as well as any details of modifications to the tower. If you do not have the blue prints you will have to have a firm do a tower mapping to obtain all of the existing structural information about the tower.

A detailed listing of everything that is presently on the tower will be required by the engineering firm. This will include the antennas, transmission lines, lighting, and the sizes of the electrical conduit for the tower lighting. Most firms will also request detailed pictures of the tower from the ground to the highest point. I've normally used a digital SLR with a zoom lens to obtain very sharp photos of the tower even when the top of the tower is in excess of 1,000 feet high. These photos permit the structural engineer to verify all of the items on the tower.

There needs to be a section included that addresses how any interference issues will be resolved. This needs to be carefully worded and placed in the lease. Generally, I recommend wording to the effect that the tenant must accept spectrum conditions at the tower site as they exist at the time of the installation. Further, that even if future interference should occur, if the levels of the interference are within the limits set by the FCC, it will be the responsibility of the tenant suffering the interference to correct the problem regardless of who or what is causing the problem to their installation. The interference clause is very important. Many of the cellular companies are going after radio stations for interference problems even when the level of the interfering emission is well within the FCC limits. I have had personal experiences with a cellular company complaining about an interfering signal that was more than -100 dB below the carrier. I also had experience with a lease that stated we, as a tenant, were responsible for correcting all interference issues, regardless of the level of the interference, and the origin of the interference. We ended up fixing interference problems on the tower that were not caused by us.

Another major item that needs to be included in the lease is a section that covers safety issues. As the owner of a tower with transmission equipment, you should have a policy that covers RF safety. You need to include this in the lease. It may be necessary for various transmission facilities to operate at reduced power, or be off, when there is work being done on the tower. This needs to be covered in the lease and agreed to by the tenant. As part of the RF safety and interference, you, as the tower owner, should have a detailed chart listing the location of each antenna, the frequencies in use, (both receive and transmit), and the powers.

(Continued on Page 28)

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– Continued from Page 26 –

From this chart you can develop a standard policy that will address RF safety and possible reductions in power. Your attorney will address how this should be included in the lease.

You should have a section in the lease that states, before anyone can enter the site or climb the tower, they must supply a current certificate of insurance, even if all they are going to do is check equipment on the ground. The lease should include required minimum amounts of insurance – both liability and workman compensation insurance. You should also require advanced notification before *anyone* does *any* work on the tower. Typically you should receive a notice at least a week in advance unless it is an emergency. Even in an emergency, you should receive at least 24 hours notice. Remember, the tenant had to locate a tower crew and get them to the site. This is not done quickly. When the crew was contacted the tenant should also have contacted the tower owner.

The lease should include a detailed listing of the proposed installation. There should be a prohibition of any hardware that may rust and that all mounting hardware must be approved by the tower owner. There should be a listing that includes the size and type of transmission lines and other cables, the antenna manufacturer and model, and any other equipment mounted on the tower. There should be a listing of the frequencies and powers that will be used.

The tenant's equipment that is located on the ground needs to be covered in the lease as well as the equipment on the tower. The lease needs to address whether the tenant is supplying their equipment shelter or will be located in an existing building. If the tenant is going to be located in an existing building, the exact location in that building should be determined so the location information can be inserted into the lease.

The lease needs to address the issue of utilities. My personal opinion is that the tenant should be solely responsible for obtaining all utilities. If the tenant wants access to any generators at the site, there should be specific provisions in the lease about generator usage.

The lease should state that all equipment that is mounted on the tower must be labeled. The label should be a durable metallic tag that lists the owner.

After the lease has been signed, and prior to the installation, you need to have certificates of insurance from all of the companies that are going to be working on site. You need to inspect all of the equipment that is going to be installed on the tower. This is to verify that what was specified in the lease is in fact what is being installed on the tower. After the installation is completed you should have an inspection of the tower by your tower crew to verify the installation meets the terms of the lease.

Once the installation is completed you may receive a letter from the tenant or its agent requesting blanket permission to change equipment on the tower at any time. Do not sign this type of letter. If you do, you may be giving the tenant blanket permission to possibly increase and change equipment without notifying you. Only give permission after you have reviewed the specific changes that are proposed and only for those changes.

One final item that you should know about is the use of lease brokers. These are firms that are retained by tenants, typically cell phone companies. The broker contacts the tower owner and threatens to cancel the lease unless the owner reduces the lease by a certain percentage. The broker then receives a commission on each lease rental fee that is reduced. This threat should not mean anything if you have a well written lease with a cancellation penalty section. You should also remember that a cell phone company has a substantial investment in the installation at your tower site. It will cost them hundreds of thousands of dollars to relocate to a new site in an effort to save a few hundred dollars per month.

Many owners and managers think that a tower lease is not that big an issue. A lease may bring in an additional several hundred to several thousand dollars a month in revenue, but it may cause major headaches as well. A properly written lease will address many of the potential issues.

For more information I suggest obtaining and reading the National Association of Broadcasters book, *Broadcast Towers: A Step-by-Step Guide to Making Money on Vertical Real Estate.* Another resource is your consulting engineer.

Hendrickson, CPBE, CBNT is the retired Chief Engineer of American Public Media Group. He has been involved in Broadcast Engineering since 1969. Over this time period he has been involved with all aspects of broadcast engineering from the technical to the budgeting. He may be reached at: mikehlakeville@gmail.com

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Engineering Perspective

Think Again

by Rolin Lintag

We can easily get carried away with our daily grind. Failing equipment, on-air issues, and those meetings, can keep us busy the whole day. It is not unusual for us to plan out the day in the morning and then get an email from Corporate, directing you to implement those computer updates right away if you don't want a ransomware to render critical work stations useless. While you are putting out fires, we need to continue mowing the grass on our backyards and weed out some ideas that may be growing for too long. For example, one idea that is being painted, that may escape the untrained eye, is that signal quality is all that matters to remain competitive. It may not sound like conventional wisdom to say it, but ***Signal quality is not all that matters.*** However important signal quality is, it should not be the ultimate goal of the Engineering Department. If it is, it can be our activity trap, draining us of our resources, and still be regarded as mediocre by the station management. Before I'm labeled as an infidel for butchering a sacred cow in our industry, let me explain.

Reliability is More Important Than Quality

At the end of the day, engineers are expected to keep the broadcast system on the air *consistently*. I'm not even hinting that quality is not important. I'm just saying that reliability comes *first* – that is the first hat we need to wear. Other hats, like signal quality, come after reliability. Engineering is one department in the station that is expected to prevent loss of income or assets, not necessarily to make more money. Keeping our broadcasts on the air – all the time they should be on the air – saves the station from possible air-time and ratings losses. The bottom line of the balance sheet will definitely suffer if the station is off the air for *any* reason. Yes, you have digital streaming anyway but the over-the-air signal is king as far as your FCC license is concerned. No matter what happens, keep that over-the-air signal on air!

Despite what manufacturers say, even new equipment can fail. We have been around long enough not to believe in fairy tales. Nothing in the station is exempt from the bath-tub curve and the law of entropy. Add to that the pressures that manufacturers go thru in coming out with new products. Marketing 101's "It is better to be first than better," makes manufacturers susceptible to a, "sell-it-now-then-service-later" mentality. It is just a matter of survival. Sad to say, companies come and go, while we are stuck with the equipment we bought, for the next few years of our career with that station, if we are lucky enough. Reliability and dependability do not only apply to equipment, as we sometimes painfully experience with our partners in this industry.

New is not necessarily better. I resist the thought that our station spends all that money for new equipment, just to be a Beta Tester of products that are just making their mark in the field. ***Signal quality is there but reliability remains to be proven.*** It is safer not to be the first to jump onto the bandwagon, if your war chest is not big enough or your rapport with the GM is shaky at best. When an engineer recommends for an equipment purchase, he invests his reputation with the equipment manufacturer.

There is more than enough brouhaha about quality from the dealers' quarters. However, station guys like me need to aim my gun on reliability and maintenance. One manufacturer claims that quality is their middle name. It just so happened that some parts they use come from Europe and the boards need to get acclimated with the rest of the design made by U.S. engineers. The only time the whole equipment comes together is on the field, and the next four months were spent in getting rid of the bugs. ***The sweet promises of quality are soon forgotten when the honeymoon is over.***

I'd say most, if not all, companies who lived long enough to be around in this industry, can play well in the quality game. The real arena is in reliability and service. It is time for those who want to sell equipment to start talking about reliability, maintainability – service, service and service – to keep our business. That is the only way manufacturers can be fair with us and survive in this industry.

Activity is Not the Same As Accomplishment

The Chief Engineer of one station I knew finally got the financial approval he wanted for a new antenna. However, he failed to emphasize that his project is meant to saturate the city with Grade A signal and not necessarily to extend

(Continued on Page 32)

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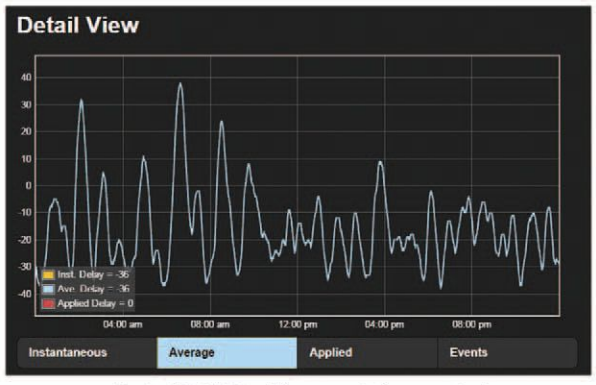

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INOVONICS BROADCAST

Think Again

– Continued from Page 30 –

the reach or fare better at the fringe areas. Field surveys came in and the Sales Department felt they missed something too big to miss, after those promising presentations they gave to their clients. Is it unfair for the GM to think that Engineering sold them a lie?

Another station CE promised a better signal with a solid state MW transmitter of the same power but failed to quantify how much. The modulation did improve, but more could have been gained with a good audio processor for much less the cost. The GM still gets the same listener complaints from fringe areas so the CE is now talking about how short the tower is. Sound familiar?

Engineers can be accused of selling a lie, if we don't say it for what it is. We might as well leave politically correct speech to politicians and let our "No" be "No" and our "Yes" be "Yes." Easy for me to say, I know. We have to package a number of concepts in "layman's terms," right? This is one area of our job that is best shown by "walking the line" and some of us tekkies got it, while some have no clue.

We need to pin down thoughts with hard facts:

• Just what exactly will the new digital transmitter do, in business terms? Is your proposal the best use of the limited dollars the station has?

• Is 80% of your resources directed towards achievement or activity?

• You may look busy to the chin, but what are your real achievements?

Activity keeps us busy. Achievement accomplishes a clearly defined goal. Making sure that our goals are clearly defined to all concerned, can save us from a lot of explaining (the painful kind) in the future.

Attitude First, Aptitude Second, Skills Third

Those job specifications on the SBE website and trade magazines are scary enough for normal human beings. Our industry expects candidates to be good in IT, good in studio production, experienced in news gathering, knowledgeable in transmitters and be reliable under constant work pressure. On top of that, he is expected to repair down to the component level, even if every gear in the station is now using SMT and uses field-swappable modules. It is understood that he is on call 24/7 and can be asked to work on weekends. He also needs to carry 50 pounds of gear and climb ladders and squeeze into confined spaces.

There is undue emphasis on skills, as if the recruiter is shopping for robots that are programmed to do broadcast engineering work. We have to be aware that if the attitude is right, aptitude can be turned into skills.

None of us became a broadcast engineer because we were born with a DMM in the left hand and a soldering iron in the right. We trained ourselves to recognize concepts and be familiar with particular systems and equipment. What many of us call experience is actually familiarity with a particular brand/model of equipment after spending time with it. If one has the ability to learn and the right "can do" attitude, he is a better find than the know-it-all pro with an inflated ego. Then all you need is a good mentor to come in for the student who is ready to learn.

However good a Master Jedi is, a hard-headed Padawan will not learn, will he?

Engineering bosses should look beyond the skills in determining who should join their team. Requiring engineering leaders to broaden their reading beyond the technical manuals can go a long way in building a top flight Engineering department.

Motivation is More Effective Than Orders

Attitude is the vehicle but motivation is the fuel. It helps little to hire people with great attitude then assign them under a supervisor whose motto is, "Get it done because I say so." The effectiveness of leaders is measured by the kind of social weather they create and the culture they develop within the group. You can see how good a station is with what kind of leaders it keeps. We can whine and complain that there are very few qualified engineers available in the market but fail to see if our organization is worth joining in the first place. Our own employees, present or past, can be our best recruiters or our worst reference.

Has the station defined its core values? Are people motivated to excel and keep creative ideas flowing – even from the Engineering department?

If military intelligence is an oxymoron, creativity and engineering need not be ironic?

Two parenting principles are good guides for all CEs and DoEs. Lead by good example, and practice what you preach. But it is so hard, isn't it? That is why there are few who make it to the top and stay there.

It Is All Between the Ears

Or is it?

Although both are between the ears, our mouth is below our brains for a reason.

It helps to think again.

Rolin Lintag Asst. Chief engineer for KRON4 in San Francisco. Send him an email at rlintag@kron4.com and he won't think again to respond.

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Audio Guide

Audio Quality

by Sam Wallington

Every few years, I teach a multi-week class on mixing live sound. The goal of the class is to help people learn to listen well and mix artistically. During one class, I bring a bunch of different microphones so students can listen to them and we can talk about how to place them most effectively. While they listen on good quality headphones, someone plays an instrument (most recently, it was a violin) or someone with a nice voice talks. I never fail to be delighted as faces light up when the students hear the difference between a $100 microphone and a $400 microphone with the spoken voice – and even more so when people exclaim, "Wow!" when they hear the difference between that same $100 mic and a pair of high-end condenser mics.

That delight reminds me of why I was first attracted to radio. There is something truly amazing about wirelessly transmitting great sound, evoking emotions and opinions within me. Maybe you share my joy of driving, volume cranked up, singing along at the top of my lungs. Perhaps the best measure of the quality of sound is how much I want to turn it up.

When was the last time you were truly delighted by something you heard? For me, it was a thunderstorm a few weeks ago. I love God's sound system – I have yet to hear one that can truly reproduce the amazing sound of thunder. (Though Disneyland's Captain EO came close just after the attraction was launched – sadly, the last time I was there it was distorted).

My addiction to great sound has caused me to collect great recordings and great equipment on which to listen. Unfortunately, it seems to be getting harder to find amazing cuts, with the possible exception of some recordings in the classical, Jazz, and Bluegrass genres. Why is that?

There seems to be a lot of discussion around whether anyone cares anymore about sound quality. People use 99-cent earbuds (even if they paid $20 for them) and seem to think they are sufficient. So why go to the trouble of creating, capturing, preserving, and providing the best possible sound?

My favorite answer to that question was given by my then 10-year-old daughter. Before I tell you the story, though, you need to understand that I have a lousy pair of speakers in my truck. Good radio and amp, but bad, cheap, factory-location speakers. For a long time, I ran a pair of studio monitors in the back seat of the cab, but got tired of them rolling around on sharp turns and bouncing all askew during trips to transmitter sites; I think I just gave up (besides, where do I put the kids?). I need to spend some money and install some real speakers! Anyway, my daughter and I had gone to a bookstore; she found a book she wanted, and I bought a Dave Brubeck CD missing from my library. When we got in the truck, I unwrapped the CD and put it in the player (lousy speakers and all). As we started to drive, she stopped everything, listened for a few seconds, then turned to me and said, "This is a really good recording, isn't it?"

I admit, she (and I) might be biased, but it blew me away how a great recording of a great performance actually stopped a 99-cent earbud kid in her tracks – even on lousy speakers.

That experience renewed my interest in making any audio I worked with the best it could be. I visited the high-end consumer audio exhibits at CES (where each vendor sets up in a separate hotel room so customers can hear without distraction), and spent a couple hours wandering from room to room, listening to great recordings played over ultra-expensive amplifiers and speakers. What a great way to re-calibrate my ears – I highly recommend it! I ended up buying a mid-level speaker system that was shockingly close to systems costing 10 times as much.

I used those speakers to take a deeper dive into why our station audio was – to be blunt – terrible. My team had turned an un-used room into a listening room with a variety of speakers, some great headphones, a little mixer, and put some audio analysis software (Nugen Audio Visualization Software) on a Mac Mini to visualize different aspects of the sound (such as frequency spectrum, phase, etc). Then we spent a while connecting feeds from all over the studios, trying to figure out where the sound was being damaged. The listening setup allowed us to do an A-B comparison of audio from various points along the signal chain. As we discovered differences, we began designing and implementing fixes. Some were easy, some were difficult and expensive – and we are still not completely done.

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These facilities were built at the dawn of the digital revolution, so were wired using mostly analog practices, with digital installed as possible. For example, the on-air consoles were first-generation digital boards and we wired the facility using "66" style telco blocks and the same 22-gauge, multi-conductor shielded cable we had always used.

"66" Style Telco Block

As we investigated the sound quality issues, we were surprised at almost every turn. We found that the production team was not all using the same techniques to ingest audio into the system. Some were ripping the CD using computer software. Some were playing the cut on a CD player and recording it into the system. Some ran the audio though a sample rate converter; some did not. We discovered that some audio was being rate-converted multiple times. Accordingly, we began the work of (returning) the facility to a single rate, and ensuring that once digitized, no audio ever changed rates or went through another analog/digital conversion until it landed in the uplink – and ultimately, the processor, transmitter, and in a few cases, the listener's HD radio.

With some rented test equipment, we discovered that the "66" blocks and "same-old" wire were not reliably passing data, but were instead dropping or corrupting packets. We put on a Band-Aid for a while by carefully re-punching or soldering wires until they reliably passed digital data – all while budgeting, buying, and installing proper AES3 100 Ohm digital cable and interconnects, and then moving to AoIP and Livewire™.

We invested in really high-end rate conversion equipment, so that in the rare case we had to play audio that was not at 44.1 kHz or house-standard 48 kHz, we could ingest it without damaging it. That included the decision to validate the quality of ripping software used to ingest CD audio.

With the exception of mic processors and limited use (primarily for effect) within DAWs, we eliminated as much audio compression in the studios as possible. We changed the use of finalizing software so we would only use it gently – or, preferably, the production personnel would ride gain artistically when needed.

Most painfully, we learned that the consoles themselves, probably because they were first generation digital, or perhaps just because of age, were putting what sounded like a wet blanket over the audio. Everything that ran through the main on-air consoles was being damaged (big ouch!). Because of the major expense of redesigning and rebuilding the main studios, this was one of the more difficult problems to resolve.

The part that is not yet complete is in the satellite distribution system we use to send audio to the stations. The old equipment's MPEG2 compression encoding/decoding algorithm just does not pass great audio through to the transmitter sites. Parallel to the main control room rebuilds, we have invested in new satellite gear that can support AAC-HE and other modern coding schemes, plus the ability to upgrade to new schemes as they are developed and tested. Further, by supporting AES67, it will become possible to simply make the transmitter sites a digital extension of the studios, with no more rate changes or compression needed (satellite bandwidth costs permitting).

Of course, along the way, we have had to revisit the audio processing at each transmitter site. Most of the boxes are good, but they had been set to try to deal with the wet-blanket, dropped packet, rate-changed, over-compressed audio they were receiving. Naturally, we have had to compensate and correct there as well.

One area we have not yet tackled is the product we receive from the record companies. Some of it is great, but some lacks the beauty of a great performance effectively captured. I know of a station that has negotiated the opportunity to re-master some of the recordings they receive, and it does make a difference on the air. This option should be good for the record companies and artists as well, because their product will sound better on air than if our processors have to try to deal with sometimes mis-handled or over-finalized masters.

Now that you have heard my tale, may I invite you into my world? What part(s) of your audio chain could be better? Is your processor's AGC beating the audio to a pulp, or is it set to bring out the best? Are your consoles damaging the audio? How about methods of moving audio around the studio? When is the last time you re-calibrated your ears by listening to an amazing recording on a great system? I invite you to take a look – and a critical listen – in the hopes of soon driving down the road, singing at the top of your lungs, thinking, "Wow, my station sounds amazing!"

Sam Wallington is VP of Engineering for Educational Media Foundation, and has 34 years of experience in broadcast engineering. He can be reached at swallington@kloveair1.com

Safety Guide

Good Habits Promote Safety

by Dave Dunsmmor

Radio engineers often find themselves working in places and at times that are – at best – inconvenient. (If the station is off the air, you can add in "pressure packed" as well.) Nevertheless, at no time should your personal safety be sacrificed.

Whenever the topic of safety issues is raised, I immediately recall to mind the old line: "Keep one hand in your pocket when finger-poking around." And that is a very good place to start. It has saved me a trip to the hospital (or worse) at least once.

Avoiding Danger

Of course, keeping your hand in your pocket is only good insurance up to the voltage it takes to punch through one's shoe soles (or jeans if kneeling on the concrete floor), which usually is not as much as you might think. Personally, I will not poke around bare-handed in anything that has more than about 25 Volts in it while energized (40 Volts is the point at which a Fluke DVM shows "HV" and I like to stay under that).

The one exception I will admit to is when I am doing IPA cathode current balancing or tuning and loading for lowest reflected power in the Continental 816 transmitter. Then one must put one's hand inside the center cabinet with the 10 kV power supply filter capacitor on the floor. However, I always make very sure that I am balanced on both feet first.

And, yes, I also have learned the hard way to remove jewelry! This was a requirement when I was in the Air Force, but I did get lax once while changing the spark plugs in an old Pinto wagon. During the process, I got my wedding ring between the wrench and the positive battery post. After the major spark light show (and yelping sound effects) the ring now had a couple of notches, and I had a circular blister on my finger.

It was years ago, but the memory is still fresh!

The blister lasted about a month before it went away, but years later I still have the ring , and it still has two little notches in it. I have never forgotten to remove my rings and watch since.

A Safer Way

I want to emphasize here that there is a better way, one where you do not have to worry about insulation and electrocution issues: ***Power down. Connect the test equipment. Stand back. Power up.*** Then you can safely watch the meter or oscilloscope, and as a side benefit you now have both hands free so you can be recording data, symptoms noticed, sounds, smells, etc. The point is: never connect a piece of test equipment to live circuits in a transmitter.

Even in lower voltage circuits, taking care about where and how you touch and test is important. True, doing things this way can slow troubleshooting down a bit. But you will never kill yourself by doing things this way.

You may have been told that test gear probes and wire are usually insulated to 5,000 Volts. But remember, that is *usually*. You do not want to bet your life on this one. A friend nearly died as a result of the electrical shock he received when checking an energized capacitor at a voltage of about 2,000 Volts. The probe insulation failing was not the main problem, but more likely there was a buildup of surface contaminants that allowed enough leakage to nearly stop his heart. He was burned, and spent some time in the hospital.

I suspect that leakage is not the only way to suffer an electrical shock. It also seems to me that even if someone is very well insulated from ground while poking around, if they accidentally touch a high voltage source, they will stand a good chance of serious shock as a result of "body capacitance."

In such a case, the inrush of electrons to equalize the charge differential between the source and the individual may indeed be fatal, or at least very painful. While I do not have any supporting data on this theory, it does seem like a good possibility, so again I say: *Power down. Connect the test equipment. Stand back. Power up.*

Unexpected Dangers

Have you ever removed a high voltage capacitor after it has been in service for many years? Perhaps you placed a

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Safety Guide

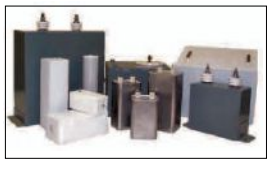
Good Habits Promote Safety

– Continued from Page 38 –

jumper across the terminals, put it in the back of the truck, and hauled it off to the shop. I did this one time many years ago, and after a couple of weeks removed the jumper, leaving the old capacitor just sitting in the corner of the shop.

Some weeks later I thought again about this dusty old capacitor and went to investigate exactly what had caused it to perform poorly (we had had a noticeable hum on the signal). I was very close to connecting the capacitor checker to the terminals when I recalled a story told me by a previous employer.

He had been a Navy SONAR technician, and one day he mentioned to me that the capacitors would pick up a charge from the air. Of course, I knew better than that, but I also knew he stated facts as he saw them. So I shorted the capacitor's terminals again "just in case" with a screwdriver. A large "SNAP!" resulted which removed part of the screwdriver's tip.



Ready to Bite!

I was quite surprised, but very thankful that I had checked first. It was some years later that I learned the reason for the capacitors gathering a charge "from the air." It is known as dielectric absorption, and in short it is the tendency of a capacitor to regain a charge on its plates after removal of the supply voltage and a short across the terminals is removed.

This happens because the charge in the capacitor is stored in the dielectric material itself – not in the plates as it would at first seem. The dielectric is not a perfect insulator, so it will tend to absorb some of the charge, and release it slowly due to the high internal resistance of the dielectric material, eventually building up a substantial charge value. The better the quality and condition the capacitor, the less this occurs.

All of this probably is not an entirely accurate explanation from a chemist's point of view, but the thing to remember here is: *short the capacitor and leave it shorted.* Otherwise, it will bite!

Safety in Other Areas

Safety issues often include the actions of others as well as what you are doing. For example, there are reasons you leave the tower climbing to the professionals. After all, they are the ones with the proper climbing equipment, training and insurance. Have you ever watched them at work to see what is involved and how they conduct themselves? You should. It is instructive – and you might avoid a major problem.

To illustrate: as I watched a crew work one night, a kid threw a bag full of bulbs over his shoulder, and headed up into the dark. I asked the foreman about the lack of climbing gear (harness, belts, anything), and he agreed that he probably should require them. That was the last time that particular crew climbed for this company.

That may have been the way it was done in the good ol' days (A newspaper article relating the construction of a 1,500 foot tower in Oklahoma in the 1950s had the foreman boasting that his climbers did not even have helmets, much less harnesses.), but not today. Today, it is essential to realize the potential liabilities. I suspect that if a fall had occurred, our company would have been in court defending themselves even though they were not directly involved in the tower relamping activity.

It is to your advantage to insist any tower company provides you with references and proof of insurance before you allow them to approach your station. Of course, this can be a double-edged sword if you are working for a company that does not appreciate proper engineering. Sometimes the riggers will turn down your work!

Keep A Clean House

Clear access to the work area is essential. I was called in one time to repair a transmitter that had burned up the phenolic insulator that held the modulator tubes. It had become coated with dust, and the high voltage had arced enough times to cause a carbon path, which then continued drawing current and eventually caught fire. The phenolic insulating plate then completely failed, and the tubes fell into the cavity below and the station went off the air.

Upon arrival, it was virtually impossible to get to the circuit breaker panel due to all the junk stored there by the station. I should have required it all be removed before I started, but in the spirit of "I can do this quickly," I let it pass. Although there were no emergencies this time, requiring a fast trip to the breaker panel, it came close to that.

I replaced the phenolic with some 1/2" plexiglas, replaced the tubes and restarted the transmitter. It immediately came on the air, but began shooting sparks out the top vent above the RF tube. Fortunately, I was able to shut the transmitter down from the front. Yet, it is easy to imagine what could have happened. The point of this story is choose your clients carefully – require them to do things *your* way when it comes to basic safety related issues.

This can be a rewarding business, but often it can be frantic. Never rush yourself. Take the time to think about what you are about to do and how you are going to do it. I have managed to live for all these years by s-l-o-w-l-y learning and applying this idea. It will pay. There is no emergency worth risking your health or your life. *– Radio Guide –*

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Small Market Guide

Old Ways Never Change

Especially in Small Marketville

by Roger Paskvan

One would think that in today's fast paced, high tech society this story would not exist, but unfortunately it did. It was a reality.

We begin with a phone call from an old broadcast friend in a small town in northern Montana. I had emailed my friend telling him that I would like to stop by on my way to Seattle for a visit. He had been the owner of a small home town AM/FM combo for the past 20 years.

When I arrived he rolled out the red carpet and we shared broadcast war stories over the years. This story begins when I asked him if he wanted to get some dinner. He replied, "That would be great but I'm on-call this week and cannot leave the radio, you know, in case we go off the air." For a minute, I thought he was setting me up for a joke, but he was serious. He took his job very seriously and was not about to abandon his post. I kidded around saying they have automatic things now-a-days to call you when the station goes dead. He had never heard of such a toy and assumed it was very expensive. Hard to believe that, in this day and age, stations employees are still slaves to a radio!

Since I was staying for a few days, I called my local broadcast supply house and ordered a pair of silence sense units – having them FedExed overnight to the station – one for the FM and one for the AM. The package arrived the next day and the work began. Most of these devices operate on a loss of audio in either left or right channels, triggering a contact closure after a determined silence interval. *Henry Radio, Broadcast Tools and DM Engineering* dominate the current silence sense marketplace. The more sophisticated models will also allow programming to dial a pager or cell number to display a digital message. Some models require a computer interface to program, via hyper terminal, a program that comes with Windows 7. Others have the standard USB plug and some just use solder jumpers for options.

An external set of contacts can be used in-house to trigger a Sonalert sounder that will beep inside the station to alert logging or programming staff of an off air situation. I rigged up a 555 timer chip stuck to the back of the Sonalert to make it go beep-beep-beep. If a dedicated phone line is connected to the silence sense box, most will dial a pre-programmed number and display a message. After testing and messing up on-air programming, the silence sense was ready to go. Everything worked great. We now had an in-house silence alert that made a lot of noise in the hallway and, after one minute, the unit would call the pre-programmed number and display an off-air message.

My friend was astonished. It was like I let him out of jail. He had been doing it this old way for so many years that technology went right past him. (Why didn't he go to an NAB Show?) Well, everyone was very appreciative for their new found freedom and not having to keep a radio on, every minute of the day.

DM Engineering Silence Sense Sr.

For a few hundred dollars, let technology take over – even in small marketville, where old radio never dies.

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

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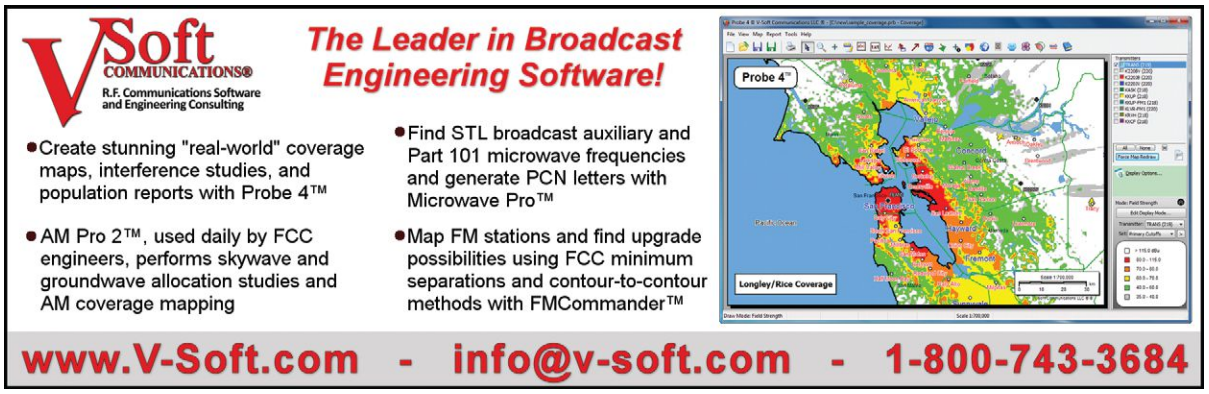

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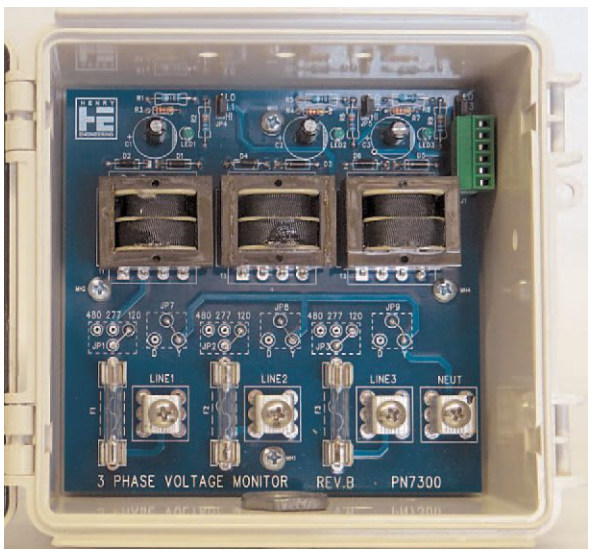
Henry Engineering and Sine Control Technology are pleased to announce a new product: PowerTracker.



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For more information: **www.henryeng.com**

Orban Establishes Legacy Gear Service Center

Orban, the leader in world-class audio processing, has announced the establishment of a Legacy Service Center. The center, to be located in Chandler, Arizona, will provide service for all legacy Orban products (Optimod 8500 and earlier).

Jay Brentlinger, VP of Orban Labs, Inc., will also serve as president of this new entity, Orban Legacy Service, Inc. "Orban products are legendary for their sound and reliability, with some models built in the 1970s still in service today after more than 42 years of continuous 24-hour operation," Brentlinger said. "Orban's factory service kept many of these same models serviced, repaired and updated over the years, and those products may still be in service for many more years to come. Our goal in forming this new division is to ensure that our loyal customers will continue to have the same quality of factory parts and service that they have come to expect over the years."

Brentlinger said in addition to providing parts and service, the service center will offer trade-in programs for older models that have reached end-of-life.

"Jay and his team are well-equipped to keep legendary Orban products running for many years to come," said David Day, Orban's President. "Our sonic quality combined with world-class service and reliability will ensures that Orban will remain the world leader in audio processing for Radio, TV and Internet broadcasting."

For more information: **www.orban.com**

Tieline Releases New Report-IT SIP App

Leading audio codec manufacturer Tieline Technology has released a new version of the world's most popular smartphone reporting app called Report-IT SIP, which streams live, studio quality audio to all N/ACIP 3326 compliant codecs in SIP mode.

"Report-IT SIP integrates the technology in Tieline's award-winning Report-IT Live app and expands the streaming options available for mobile journalism applications," said Will McLean, CEO Tieline Group of Companies. "With Report-IT SIP you can connect to a non-Tieline audio codec at the studio and stream using the award winning features and functionality of Tieline's other apps."

Report-IT SIP can connect to all Tieline and non-Tieline SIP codecs. In SIP mode the app can stream low latency live audio using widely available algorithms including Opus Mono, Opus Voice, G.711 and G.722.

- Simultaneously record up to 20 kHz audio quality and stream up to 15 kHz quality live audio.
- Prerecord and trim interviews, build playlists and insert recordings as "wraparounds" in live broadcasts.
- File reports via FTP automatically using WAV or AAC-LC file formats.
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For more information: **www.tieline.com**

Final Stage

RADIO ROUNDUP

The Radio Guide Event Register

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August 9-10, 2017
Renaissance Austin Hotel
www.tab.org/convention-and-trade-show

2017 Nebraska Broadcasters Assn. Convention
August 15-16, 2017
Embassy Suites, LaVista, NE
http://ne-ba.org/news_and_events-convention.asp

NAB Radio Show
September 6-8, 2017
Austin, Texas
www.radioshowweb.com

Ohio Broadcast Engineering Conference
September 19, 2017
Columbus, Ohio
http://oab.org/engineering/obec/

2017 IEEE Broadcast Symposium
October 10-12, 2017
Key Bridge Marriot, Arlington, VA
http://bts.ieee.org/broadcastsymposium/

WBA Broadcasters Clinic
October 10-12, 2017
Madison Marriot West, Madison, Wisconsin
www.wi-broadcasters.org

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Altronic - 39	www.altronic.com
AM Ground Systems - 40	www.amgroundsystems.com
Arrakis - 23	www.arrakis-systems.com
Bay Country - 43	www.baycountry.com
BEXT - 43	www.bext.com
Bohn/Marti Repair.com - 46	www.martirepair.com
Broadcasters General Store - 13	www.bgs.cc
Broadcast Electronics - 32	www.bdcast.com
Broadcast Software Intl. - 27	www.bsiusa.com
CircuitWerkes - 15	www.circuitwerkes.com
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Davicom - 43	www.davicom.com
DaySequerra - 11	www.daysequerra.com
Dean Technology - 44	www.deantechnology.com
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Econco Tubes - 43	www.econco.com
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GatesAir - 29	www.gatesair.com
Graham Studios - 46	www.graham-studios.com
Henry Engineering - 2	www.henryeng.com
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Kintronic Labs - 33	www.kintronic.com
LBA - 37	www.lbagroup.com
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ProAudio.com - 36	www.proaudio.com
PSI (Propagation Systems) - 28	www.psibroadcast.com
Radio Systems - 34	www.radiosystems.com
RF Specialties - 42	www.rfspecialties.com
SCMS - 19	www.scmsinc.com
Shively - 26	www.shively.com
Smarts Broadcast Systems - 21	www.smartsbroadcast.com
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Titus Labs - 38	www.tituslabs.com
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