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November-December 2019 – Vol. 27, No. 6

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Radio Guide

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Well, this hadn't been the first time this had happened. A quick breaker reset and we should be back up and running, I thought to myself."

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Cover Story

Arrakis Systems – 40 Years Still in the Family

by Ben Palmer – Arrakis

10 years ago (October 2009) Arrakis was on the cover, and featured in the Radio Guide magazine. Wow, time flies *fast*. I had started at Arrakis a year earlier, and looked a ton younger. On the 2009 cover was (starting from the left to right) my sister Melissa, then me, my brother Aaron, my Dad Mike, my Grandfather Clarence, my Mom Gloria and then my niece Eve who was in front holding the ARC-8 console. In fact, we all looked a ton younger. We had just released the new ARC-8 console, which is still selling extremely well today. The article spoke of how my sister, brother and I were in the process of learning the company, and keeping the business in the family.

Over the last 10 years, a lot has changed and, fortunately, a lot has stayed the same. I can report that the company is still in the family 10 years later, and I still work with my brother, sister and father. Sadly, my grandfather Clarence has since passed away in 2014. Eve is now 18 and going to College to work at a veterinary clinic. What's even more special are our coworkers – some having been here for over 30 years! Dale, who tests our boards, and helps with console support, has been here since 1986. Mary (1986), and Ruth (1992) have been the backbone of our manufacturing department, and Allen (1990) as our GM. Even our accountant, Jane has been here since 1997. Over time, we have all become one family.

On this issue's cover you will see my wife Paige and my four children added to the group. Even though we are three generations working at Arrakis now (after the passing of my Grandfather), the company is still firmly in the family, and we have enjoyed every bit of it.

As a family business, we keep it fun. One of the fun things we like to do every year is host a haunted house in my garage. We have over 300 children from the neighborhood visiting each Halloween, and it is a blast. The funnest part is that we get to use Arrakis software and hardware while running these haunted houses. We use the APEX automation to do all kinds of fun things, like automate playing sounds out of different speakers, and flash lights on & off using relays. This year we hooked up our ARC-8 console to a fully functional animatronic space alien! My Dad, Mike Palmer, would then speak to the kids in line and tell them cheesy space alien jokes. APEX and our boards are exceptional for radio, but if you ever get the urge to setup a haunted house, let us know and we would be happy to help give you some tips! Matthew, my youngest son, is pictured with the ARC-8 from this most recent Halloween.


Matthew at the Console

We have played hard over the years, but we have worked even harder. Since the beginning of Arrakis (40 years ago), we have prided ourselves on introducing and releasing new product every year. We typically debut this new product at the NAB show in Las Vegas. Here's a list of some of the product that we have introduced over the last decade:

2010 - ARC-8 was introduced at NAB.
2011 - New Wave Automation was created.
2012 - Digilink-HD Automation was created.
2013 - Bluetooth was introduced for the ARC series.
2014 - ARC-8-Blue was created.
2015 - ARC-Talk Blue was created.
2016 - Simple IP, our first Dante AoIP analog & digital nodes were introduced.
2017 - DARC Virtual, our software AoIP console was created.
2018 - DARC Surface 8 and APEX automation were both introduced.
2019 - ARC-5 was created. DARC Surface 12 was added to the DARC Surface family.

The biggest trend we have seen over this last 10 years has been a marriage between analog and digital. For example, the ARC series had the first USB channel added to broadcast radio boards, which directly connects the console to a Windows or MAC PC. This gave you the ability to send and receive digital audio on one single USB cable.

In 2013, we added Bluetooth to the ARC series, which allowed you to connect any Bluetooth enabled device to the board wirelessly. This was very popular from the start, and the majority of our boards we now sell, ship with the Bluetooth feature.

In 2016, we added Simple IP nodes. These can take any analog or digital signal and send it to the Dante AoIP network. Once on the Dante AoIP network, you can retrieve the audio anywhere.

Each one of these innovations have taken the traditional analog console and given it powerful digital capabilities. Digital has not replaced analog, rather it has been paired, and works in harmony with analog.

It has been interesting to watch the growth of AoIP in the radio industry. Although it has grown steadily over the years, and has been preached at every tradeshow and in every magazine issue, I believe that many may still feel nervous to implement AoIP in their studios. This may be because of perceived cost, or they may feel it isn't helpful or necessary for what they want to do. I also hear from some studios that it can't be implemented alongside their older existing system, and would require them to start over from scratch. Fortunately, these concerns can all be addressed within the AoIP infrastructure itself. I am hopeful that this article can help clear up a bit of these misconceptions around AoIP.

In 2016 we introduced DARC. It is our AoIP product family, and consists of 3 elements:

Element 1 - Simple IP node

Every AoIP setup will have nodes. This is where you connect your analog or digital inputs and outputs, such as microphones, headphones, speakers, automation systems, etc. The node is what ingests the audio feed, puts it onto the network (in our case, using the Dante protocol) and gives you access to that audio anywhere on your standard ethernet network. Once on the network, the audio feed can be sent to your transmitter, Internet stream, etc. These nodes are also used to connect your current analog console. You can send audio to your console, from your Dante network, into your analog input channels, and you can also take the mixed analog console outputs and send them back to your Dante network via the Simple IP node.

These nodes make it possible for you to take your existing analog studio equipment, and put them directly into the AoIP infrastructure. And what is even better, you can do it in small steps. With Dante AVIO nodes for example, you can do this one source at a time, for less than $200.

AoIP, and Simple IP nodes will replace all your existing complex studio wiring. This is a huge bonus. One common story that I hear, is of a studio that had been setup with complex switchers and wiring. Years later documentation goes missing, and they have no idea what goes where and what each wire does. This is a nightmare for anyone, especially engineers. With AoIP you can rip out all the old wiring and replace it with single ethernet cables, and ethernet switches. Using software such as the Dante Controller, you can then see any and all your equipment on your computer, and you can programmatically route your sources to the appropriate places. This is a powerful component of AoIP.

Element 2 - DARC Virtual Software Console

The DARC Virtual Software console is an optional component for our AoIP family. Your studio can have all of its audio routed via AoIP using the nodes, and you can leave your AoIP studio at just that. But if you decide to go with DARC Virtual, you will then be able to take advantage of many more features that are built into AoIP.

DARC Virtual is our audio mix engine. Running on a Windows PC, it can be a standalone software console that replaces the need for a physical console. Using the Simple IP nodes (or any Dante enabled device), you can take any source on your Dante network and then mix and manage your audio just like a regular console. The output of the DARC Virtual buses then get fed back to your Dante network, which then get sent to your transmitter or Internet stream. You can control the DARC Virtual console via a mouse, or using a touchscreen.

The beauty of a software based console is the cost savings, along with increased flexibility. You can change the console size from 4 channels to 16 in a click of a button. You can instantly swap inputs and outputs via the Dante controller. You can create different user profiles for each individual show. You can control your console from anywhere in the world using remote access software. It is everything a standard console is at its soul, but then some.

Element 3 - DARC Surface Console

The DARC Surface is another optional component in our AoIP family. It is for studios who want a digital AoIP console, but also want a physical interface, with physical slide faders and buttons. DARC Surface compliments DARC Virtual and the AoIP system. All audio is mixed in the PC using the DARC Virtual software, and the DARC Surface controls the DARC Virtual mixer, giving you an alternative from only using a mouse or touchscreen.

AoIP in the beginning of its existence was fairly expensive, but with the introduction of the DARC family, is it is now very affordable. On top of that, with AoIP, you can start small and add to it as needed, while keeping upfront costs to a minimum.

It has been exciting for us to introduce AoIP into the Arrakis blood, and it will be exciting to see how it evolves over time. One thing is for sure, 10 years from now, the Arrakis family will still be creating haunted houses in our garages, and making new innovative product that marries analog with digital. – *Radio Guide* –

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Studio Site

You Say You Want a Resolution

Seeing and Sounding "20-20" in 2020

by George Zahn

It's a been a few years since we advocated making some studio/audio New Year's resolutions, but there are some important timing issues coming up in early 2020, as well as some inexpensive things we can all do to improve our sound for the coming year. If we can't follow through on those self-promises to shape up physically, how about some changes that can make our stations more fit for the coming year?

Changing even some small studio gear can have a significant effect on our staff morale and sound. We are also facing at least one major change that may affect your computer hardware in everything from offices to your automation. See if some of these ideas won't help make 2020 brighter!

"Window" of Opportunity

Resolution #1 Get out of Windows 7 before support lapses on January 14, 2020. If you have a computer running Windows 7, you likely have been seeing reminders for at least a month, but don't take them lightly. If you're using Windows 7 now, any security updates or patches will cease after January 14.

Simply put, that means your Windows 7 computer will be open and vulnerable to malware and attacks, and it will be open season for those hackers looking to capitalize on the open gate. If you have a newer computer running 7, you may be able to upgrade to Windows 8 or 10. If it's an older computer, it may be a cost you have to bear, but a new or newer Windows 10 computer is likely needed, especially if your computer is accessing the Internet or if you trade files on thumb drives, FTP, cloud storage, etc.

We had three computers running 7 simply because we had some software that ran well on the old OS, but we've swapped them out for new Windows 10 computers with minimal hiccups. The biggest aggravation is re-installing some software or establishing new preferences, but that's a minimal inconvenience compared to having ransom ware or other infection disable a critical computer. The holiday shopping season may cause an unusual crunch for new Windows 10 computers, so sooner is likely better than later on this resolution.

Resolution #2 may dovetail with the one above. How about creating one (or one new) digital editing suite at your station. If you have logjams in studio, waiting to record or edit spots or shows, you may be able to recycle an old Windows 7 computer to make it a closed (non-Internet) computer just for editing. Again, you are still prone to problems that may come in on thumb drives or other media, but it beats making that old computer a doorstop.

One other tip: Some Windows 7 computers will be able to step up to Windows 10, although they may not function as quickly as a new unit. If your old Windows 7 computer can handle 10, why not upgrade to 10 to provide security and use the slower computer for editing. Switching to 10 would allow for Internet access as well.

Should you have some budget flexibility, upgrading or having enough professional audio licensing software licenses is important. If your station has been working with Audacity or another free piece of software, it might be worth sampling a trial version of some of the paid software editors to see if there's enough upside to buying new software.

Most paid software, including Adobe Audition, WavePad, Pro Tools, and many others, will have more of the important functions and ease of use than you might have imagined. One important trade-off to consider is the type of license. Some software is cloud based and you can subscribe monthly to the service and you get standard updates. Some software offers a lower one-time price, but you may not get any new updates. It's important to check the details before making a purchase.

"Screen" Test

Resolution #3 is a holdover from a few years ago: Simple studio accessories that we get used to seeing every day, can really send a bad message to guests on-air in our studios. Have you just come to accept the faded or discolored (and sometimes disgusting) windscreens on your microphones? This is a quick and cheap spruce up, and it may well be worth experimenting with some cheaper windscreens that replace the original manufacturers recommended models at a lower price. Beware that some of the cheaper models may not be as plosive-proof as the higher end screen. A clean new screen may not necessarily perform any better, but changing them will improve appearance, especially to visitors.

Other simple upgrades to consider are new shock mounts or better booms in your studio. These can enhance sound at least a bit, and may help improve sight lines during interviews or panel discussions.

Resolution #4 might cost a bit more, but if you're looking for consistent sound, but are using different microphones in different studios, that can be the issue. This can run into significant cost depending on how many microphones you're replacing and what choice of "house" microphone you make.

As a rule, you get what you pay for, and I'd be reluctant to swap out my Sennheiser MD 421 microphones for our regular studio mics. Other managers will stick to their ElectroVoice RE 20, Shure SM 7B, or a wide variety of other models for their choice. It can be very subjective, and a good way to know is to borrow and try one out.

Hitting the Road

Resolution #5 is creating a remote recording kit. Our station actually has a rather large rolling "mobile studio" – our version of Mary Poppins' magic bag. It's a heavy duty tool bag on wheels that can hold a small mixer, 4 mics and stands, a Zoom recorder and all the needed cables and an extension cord. A few issues back, I covered this and it might be something you'd consider for a 2020 improvement. We use our kit to do interviews and create programming, including doing shows that make recording more convenient for clients.

Resolution #6 this year is really simple: cleaning up your studio rack space. How many devices have been sitting in your rack unused for years? You can save power and let your important equipment "breathe" a bit more with increased ventilation space in your rack room or studio.

Resolution #7 involves monitoring. If your studio amps and speakers are in good shape, but headphones are always falling apart or disappearing, you might consider something that we did at one station where I worked. The manager supplied a new set of decent headphones to each on-air employee every few years. The individual headphones became the responsibility of each employee. If they broke a set, they were responsible for replacing their own set after that. We always had a few dedicated headsets in each studio for guests, but the cans that had the most wear and tear became the responsibility of each individual talent.

Drive to Survive

Resolution #8 is about as critical as the Windows 10 upgrade. How old are the hard drives in your audio delivery system for music, spots, interviews, and other content? Also, are they backed up or mirrored in any way. Please remember that if you're using any kind of digital delivery, your on-air/streaming service is only as solid as your hard drives and hardware. Back up often, and consider having off-site or cloud back up as well.

Changing drives on your studio computers, and server if you have one, is good to do at set intervals. If you're sitting on four-to-five-year old hard drives, you are on borrowed time. Mind you, we consider changing the actual mainframe hardware every seven to nine years or so depending on budgets. Upgrading to new hard drives will generally give you far more peace of mind.

Resolution #9 In case you missed many stories over recent years of stations being hijacked by hackers, my final suggestion for this coming year is to make sure that you are not one of those stations which has its primary audio distribution system on the same computer that accesses the Internet. Isolating your primary audio distribution is an absolute must.

Utilizing any other computer to give your on-air staff Internet access beats having your critical every day audio delivery system vulnerable to a hacker. Here's the other catch. Even though you may pay someone to release the lock they place on your computer which is keeping you off the air, there's no guarantee that the criminal who hacked your system will ever really release the lock. In fact, some who may claim to have the "keys" to unlock your computer may well be a middle agent and have no means of releasing your system, leaving you financially short and still with no audio delivery.

Don't play with fire. Isn't a basic computer sitting around your office or available for maybe a few hundred dollar a good insurance policy to give your on-air staff access to the Internet without risking your most valuable asset, your on-air sound?

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

Identical Transmitters – Different Problems

by Scott Schmeling

We may not think much about it, but our brains often store what you could call *Trouble Histories*. When we find the solution to a problem we store it in the old grey matter. Then, when we're presented with a similar situation we *remember* the cause and (more importantly) the solution. This is especially helpful if this problem occurs multiple times. Plus, the speedy repair makes you look like a genius – if anyone is around to notice!

I had a "situation" recently that brought this to mind. I have a couple nearly identical CCA 10 kW transmitters. In September of 2015, after a short duration power failure, one of them didn't come back on line and I couldn't bring it up by remote. A trip to the site showed me that the "wall breaker" had tripped.

Well, this hadn't been the first time this had happened. A quick breaker reset and we should be back up and running, I thought to myself. This particular CCA has a little additional relay that brings the transmitter back up automatically when power is applied. I reset the breaker and heard the blower and filaments turn on right away. After the 3½ minute (I believe) time delay, the low power contactor should have energized – but it did not. After another try with the same result, I started digging into the manual and schematic. These transmitters come up at low power first, even if you press the HIGH power button.

K3 is the low power contactor. It applies one side of the 240 Volt supply voltage (this is a single-phase transmitter) to one side of the high voltage transformer primary and *ground* to the other side of the primary, effectively putting 120 Volts on the primary of the transformer. (Half normal voltage on the primary results in half normal plate voltage on the PA tube.)

K2 is the HIGH power contactor. It applies each side of the 240 V to each side of the transformer primary.

Both K2 and K3 have *auxiliary contacts* that are wired in such a way that the auxiliary contacts are in series with the coil of the other contactor (K2 coil wired through the K3 auxiliary contact). This prevents *both* contactors from being energized at the same time.

But I didn't have *either* contactor energizing. I found the auxiliary contact on K2 was preventing low power contactor K3 from energizing, so I by-passed the aux contacts on K2. After the time delay, K3 energized, and the wall breaker *tripped again!* Obviously by-passing those aux contacts was not the best idea! I was time to dig a little deeper.

After multiple troubleshooting steps (which I will not go into) I discovered that K2, the high power contactor, was "stuck" in the energized position (opening that aux contact and preventing K3 from energizing).

These contactors (K2 & K3) are a larger size and can be fairly easily disassembled. I took the contact cover off K2 and found a contact set that had sort of spot-welded itself together. I was able to free it up pretty easily and decided to file the little pits out of the contact to make for a better contact. (It goes without saying that while doing this work I had turned the wall breaker OFF, removing all power from the transmitter. I had also used the shorting stick to discharge all capacitors – and any other contact I could see!)

K2 Cover Off, Aux Bypassed

After freeing and filing the contacts I manually exercised the contactor a number of times to verify that the assembly was moving freely. When I was satisfied it was good, I put the cover back on and took a close look around to be sure *everything* was back where it should be. I got ready for another test.

With fingers crossed (crossing fingers is an accepted Engineering practice) I turned the wall breaker on. the blower started and filament voltage was visible on the meter. I watched the seconds display on my watch and when the delay had been met ... K3 energized and I had *low power plate voltage!* I pressed the LOW power button just to keep it there for a while. After ten minutes or so I pressed the HIGH power button and everything came up to where it should be – *finally!*

This was one of *those* problems. It didn't make sense until you took a deep look into the control circuitry to understand exactly what happens when (and how), as the transmitter transitions from off to full power.

Now let's jump ahead to the middle of September, 2019. Four years later, almost to the day, and another CCA, essentially an identical transmitter. Initially, this transmitter was not starting. No blower and therefore no filament voltage. (So far this is a totally different sounding problem.) When I pressed the Filament ON button I could hear the contactor energize but nothing else happened.

In the control sequence of just about any tube-type transmitter there is an air interlock that must be satisfied before filament voltage is applied. With no blower, nothing else is going to happen – period! The first thing I checked was to be sure the blower blades moved freely – they did.

The blower has a 240 Volt motor and, checking the fan voltage, I discovered one side was open. Following the schematic, I traced the wires to the blower contactor K13. The voltage was good going into the contactor but not coming out. Fortunately, CCA used 3-phase contactors so all I had to do was move the wires to the un-used contact and the blower worked again.

I let the filaments warm up for about 5 minutes (and let me say ... waiting that 5 minutes seemed like an *eternity!*) and pressed the LOW power button. The contactor energized and the transmitter came up to low power.

After a couple minutes at low, I pressed the HIGH power button. The contactor energized – there was a loud ***snap*** – and the wall breaker tripped! (Now it sounds familiar!)

I was convinced that the problem *had* to be with the contactors. I'm not going to tell you how many times I opened up K2 and K3 and checked the mechanical movements. Everything looked fine for these two contactors, yet the transmitter would not go to high power.

If you're familiar with CCA transmitters, I had removed the lower front panel so I could have access to the components around the contactors – not great access but better than crawling in from the back door. As to be expected, when I hit the HIGH power button there would be a flash before the breaker tripped. But from where I was, I couldn't see exactly where the flash was coming from. If I'd had someone with me (which we are *supposed* to do) there would have been eyes from the front and back and the location would have been obvious. But I didn't have that luxury. So I started opening connections at various points in the power supply. When I disconnected the lead going to R1 & C3 (which form a surge suppressor) the snapping and tripping stopped! So I reconnected everything except R1 & C3 and the transmitter would ran up at full power just like it should.

So – this is a case where *remembering* the solution from four years ago was actually a bad thing. I had convinced myself that it *must* be the same thing and wasted too much time searching in the wrong direction. I guess the wisdom here is to remember those previous solutions but don't let them blind you to the current situation.

One more tip: take the time to find LED replacements for the miniature lamps inside your push button switches. They're more than just pretty lights – they are also diagnostic tools. In the case of the CCA, the bottom half of both the LOW and HIGH plate voltage buttons are "Ready" indicators. They tell you when the time delay has been met and you can apply plate voltage. I don't know about you, but I feel a little idiotic when I press the button and nothing happens. If the bottom half of the button illuminates, I *know* the transmitter is ready for plate voltage.

Dialight has an LED replacement (the 586 series) for the #85 lamps used in the CCA push buttons. They look the best when you choose the same color LED lamp as the button.

I have one other very quick transmitter story. I have a solid state 5 kW AM transmitter that failed recently. It wouldn't come back up by remote so one of the guys went out to check. When he said it smelled like something was burning I decided he should leave and I should get over there right away. When I turned RF on I got the same indications he did ... and then I started smelling it too. Let's just say, "Sometimes you just have to follow the smoke!"

Please let me take a couple seconds to wish all of you a very Merry Christmas and hopes for a very blessed New Year. And 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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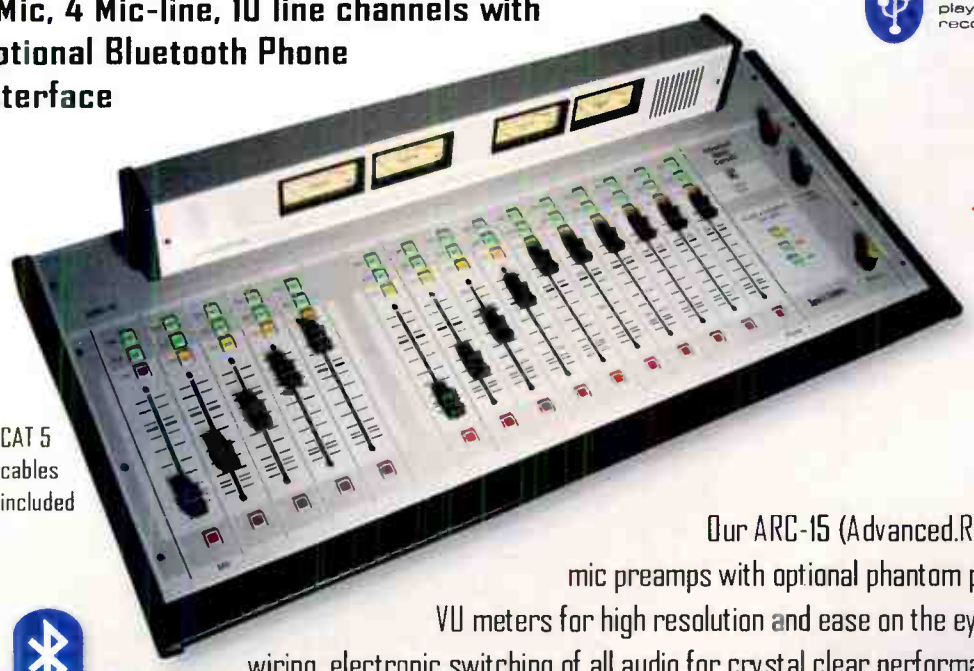

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...the Bluetooth phone interfaces work with BOTH cell phones and Bluetooth headset enabled land lines.

Political Season Is Upon Us

By Gregg P. Skall, Womble Bond Dickinson (US) LLP

We're on the cusp of what may turn out to be the most profitable, and yet, most contentious and possibly most dangerous political advertising year for broadcasters in history. Political issues are already appearing in significant numbers. Not only are candidates beginning to advertise heavily, but political PAC's are collecting huge sums of money destined for broadcasting and social media advertising. Yet, with the irregular, seasonal nature of political advertising, it is helpful to remind broadcasters of some fundamental lessons of the past. Every new political season brings some of the fundamental questions back for clarification, including: Are issue ads entitled to lowest unit rate? Is the broadcaster exempt from liability for false statements? Must the broadcaster allow opposing views on its air? Many think the answers to these questions are "Yes," but think again!

As the political campaign season heats up, increasing numbers of issue advertisers and broadcasters will again focus on broadcasters' obligations to provide equal time or lowest unit charge to groups or individuals opposing particular issues on the various ballots, and some advocacy groups will argue that the mandatory access, equal time and lowest unit charge rules apply to them. The answer is actually quite simple.

Legally Qualified Candidates:

Section 315 governs equal opportunities and lowest unit charge and Section 312(a)(7) governs mandatory access. None of these provisions apply to issue advertising. Sections 315 and 312(a)(7) of the Communications Act are clear in that they apply only to "legally qualified" candidates for elective office, and §312(a)(7), applies only to legally qualified candidates for federal elective office, i.e. President, Vice President, Senate and U.S. House of Representatives; it does not apply to statewide or local election candidates.

The only FCC rule or policy that ever did apply to issue advertising was the Fairness Doctrine, which was repealed in 1987 and it's corollary, known as the Culman Doctrine, that applied to ballot issues, also repealed in 1992.

Stated simply, here are the rules that apply to political candidates:

- The Communications Act states clearly at §312(a)(7) that all legally qualified and *bona fide* write-in candidates for ***federal*** elective office are to have "reasonable access" to broadcast facilities.
- Any ***positive*** use of a candidate's voice or picture, in a context not otherwise exempt, constitutes a "use" of the broadcasting station and, thus entitles the candidate user to the station lowest unit rates.
- The ***"use"*** also triggers the "equal opportunities" provision of §315 of the Communications Act. Fleeting appearances and disparaging uses of the candidate's voice or picture by an opponent do not trigger §315, nor will any of the recognized exceptions in the statute, which include: (1) bona fide newscasts, (2) bona fide news interviews, (3) bona fide news documentaries, and (4) on-the-spot coverage of bona fide news events (including political documentaries).
- A ***"use"*** by a legally qualified candidate for public office, state or federal, imposes an obligation upon the licensee to afford equal opportunities (upon requests made within seven days) to all other such candidates for the same office.

Issue Advertising

Possibly the hottest area of political advertising over the next twelve months is going to be political issue advertising. The most active area of fundraising has been, and is likely to be, funding for political action committees which are not subject to most of the FEC restrictions imposed on federal candidates and their authorized committees.

In mid-October, the FCC dropped a bombshell on broadcasters running political issue ads, such as those placed by PACs. Responding to 11 issue ad complaints filed jointly by the Campaign Legal Center and Sunlight Foundation against television stations back in 2014, the order provides detailed new requirements regarding information required to be placed in the station's political on-line public file, much of it not previously thought required by many diligent broadcasters. For any message that communicates "Political Matter of National Importance" as defined by §315e(1)(B) the station must provide the following information in its political file.

> *For each such request, **all** political matters of national importance mentioned in the ad, including names of **all** legally qualified candidates and the offices to which they are seeking election, **all** elections for federal office (with or without a candidate name), and **all** "national legislative issues of public importance" referred to in the communication.*

It will consider context in deciding what constitutes "Political Matter of National Importance," but at a minimum, a message that includes (a) any references to legally qualified candidates for ***Federal*** office (this refers only to federal candidates, although some ads concerning state and local candidates may qualify as raising "political matters of national importance"); (b) any reference to a federal office (for example "our next Senator" or "our person in Washington") or (c) discussion of a "national legislative issue of public importance" would be included.

While a "national legislative issue of public importance" includes any matter that is the subject of controversy or discussion at the national level, a "national legislative issue of public importance" is narrower and includes issues that are the subject of federal legislation that have been introduced and are pending in Congress at the time the request for airtime is made.

When broadcasting a national issue of legislative importance, the station must place in its public file:

1. Whether the request to purchase broadcast time is accepted or rejected by the licensee;

2. The rate charge for the broadcast time;

3. The date and time in which the communication is aired;

4. The class of time purchased;

5. The name of the candidate to which the communication refers, the office to which the candidate is seeking election and the election to which the communication refers;

6. The issue or issues to which the communication refers (all issues discussed must be listed);

7. For a request made by, or on behalf of candidate, the name of the candidate, the authorized committee of the candidate, and the treasurer of such committee; and

8. In the case of any other request, the name of the person purchasing the time, the name, address and phone number of a contact person for such person, and a list of the Chief Executive Officers or members of the Executive Committee or of the Board of Directors for such person.

And importantly, for each ad that references a Political Matter of National Importance, whether or not it is designed or placed for a candidate PAC, you must also include:

*1. The names of **all** candidates for federal office referenced in the broadcast message;*

2. The respective offices to which all such candidates are seeking election;

3. All elections referenced in the broadcast message; and

4. All National Legislative Issues of Public Importance.

Finally, remember that the Communications Act and FCC rules require that, whenever a station broadcasts any political matter or a matter involving a controversial issue of public importance that is paid for or furnished by any form of an entity, the station must obtain for its public file a list of the Chief Executive Officers or members of the Executive Committee or of the Board of Directors and make it available in its on-line public inspection file.

Sometimes the station is provided the name of one officer, but not the other names required to be placed in the file. In such a case, the Commission stated that here, or whenever the station has a reasonable basis for believing that sponsor information appears to be incomplete, it has an affirmative obligation to inquire further, with that obligation being satisfied by a single further inquiry to either the sponsoring organization or the third party time buyer. ***But it must make the inquiry.*** While the response is not required to be placed in the public file, broadcasters should obtain the response in writing and maintain it as evidence of its effort should a later inquiry be made.

Network Placements

It should be noted that, increasingly, networks, both regional and national, are taking political issue ads and pushing them down to their affiliates. Supplying political advertising messages without prior approval of the licensee impinges its ability to maintain control over its station and FCC rules require that the licensee maintain full authority and power over the operation of station, including complete control over the policies, programming and operation of the station. This includes, without limitation, the right to decide whether to accept or reject any programming or advertisements and the right to preempt any programs in order to broadcast programs deemed by the licensee to be of greater national, regional or local interest. To exercise that right, the licensee must have the opportunity to make decisions with respect to programming or advertisements that have the potential for controversy and, by definition, that includes political issue advertisements.

This also raises concerns over network placements that may contain a positive "use" by a legally qualified candidate, which would give rise to a requirement that that affiliate offer equal opportunities to opposing candidates. Stations should review their network affiliation agreements to determine what rights they have to require the network to make that equal opportunities offer on behalf of its affiliates. Note that the FCC's "network exception" policy would relieve the affiliate of the requirement to offer its own lowest unit rate to opposing candidates claiming equal opportunities in response to network placed candidate ads.

We've scratched the surface here on the issues of political advertising. For those seeking more information, our firm's political broadcasting manual is available at Womble Bond Dickenson Political Broadcasting Manual. **[https://www.wombleborddickinson.com/sites/default/files/2019-11/PoliticalLawManual_2018_General.PDF]** However, regarding political issue ads, be forewarned that the manual has not been updated regarding the FCC's new policies as discussed above. A notice will be provided when the manual has been updated.

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

Gregg Skall is a partner of the law firm Womble Bond Dickinson (US) LLP. He frequently lectures on FCC rules and regulations, represents several state broadcaster associations and individual broadcasters and other parties before the Federal Communications Commission in their commercial business dealings.

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Transmission Guide

Divide and Conquer

The Smoking Power Divider

by Gary Minker

Things that are smoked are often highly desirable. Smoked meat, smoked fish – there are many things that are fondly thought of when saying the word smoked. Smoked is one of those multi-use words that can be both a noun and a verb. In the electronic language, the same inference of noun or verb is still applicable, but none of them are typically fondly thought of, though when used as a verb, the act of smoking something can carry a dramatic *wow* factor with wide eyes – a sort of smile and a head bob up and down. This assumes that the thing that smoked did not belong to you.

Burnt, charred, toasted, cooked, baked, roasted ...*smoked!* There are so many synonyms for such a fabulous word that the Radio and Electronic industry is rife with their uses and connotations. Often, the use of these words is accompanied by other objects de'arte like charcoal, soot, and molten metal. As I have mentioned in previous articles, courtesy of Mr. Richard Pryor, "Fire *is* Inspirational" and when it happens to someone close to home, doom and gloom often lurk about.

The Failure

Like many failures, the smoking parts went un-noticed until things got quiet and the coverage tanked. Picture, if you will, 8 levels of panels in circular polarity. Two faces of panels in a wide peanut pattern, covering a skinny piece of geography. A simple design, with dual 4" feeders stuffing dozens of kilowatts into a left half of the antenna and dozens of kilowatts in to a right half of the antenna. Simple right? Left brain covers one half of the license and right brain covers the other half of the license.

It was a bright, sunny day with a surface solar load temperature of only 148 degrees Fahrenheit, a stiff breeze and power levels well within norms – then the right half of the island suddenly got very quiet. The left half was pretty much normal, well, except for the minor V.S.W.R. issues that made it back through to the transmitter – considering half the load just disappeared from the hybrid.

If it were not for the lone V.S.W.R. sensor in the transmitter, looking at the composite load of the hybrid and dual antenna feeders, the failure of fully half of the antenna might have gone completely un-noticed. Even with this massive malfunction, the transmitter thought it was just having a tough day and folded back, but did not shut off.

Don't Know When to Quit

Since the one, of what should have been three, Reflectometers didn't correctly assess the situation, and let the transmitter keep pumping power into the damaged system, things continued to heat up.

Being the responsive type, the local Engineer received a call from some of the inhabitants of the area asking her if the station was OK. She replied that she thought so, but once she called the transmitter and found that there was indeed a high V.S.W.R. alarm and the output power was low, the tune changed quickly.

Some quick testing with some simple on-hand equipment, revealed that left Twix was running with a forward to reflected ratio of about 23 dB, and right Twix was not so good with a ratio of only 3 dB. With similar looking forward signal levels, the Engineer assumed that the splitting hybrid downstairs was still in OK shape but the 3 dB Return Loss ratio, when divided by 2 for Insertion Loss, looked frighteningly like the insertion loss of the 440 feet of transmission line in the system, which indicated that something large up top had departed.

Speed Dial Kicks In

All together now ... who do we call? First we call our Line Sweeper, next we call our Tower Crew. We put them both on a conference call and get everyone on a common date, and we all show up together for the party. Line Sweeping 101 says that you don't bring just one to the party, especially when the party is far away, hard to get to, or has other unpleasant extenuating circumstances.

Too Obvious ... or Was It?

Assuming that the directional coupler ratio testing was correct, before we even got there, the "fire" was clearly going to be upstairs. Once climbing up to the Power Divider, the fire was definitely located between the end of the 4" feeder elbow and the input to the Power Divider Tee. The big question was why? As much fun as it is to write articles under the heading of "Don't Do That," and as much fun as it is to try to tell people "Not To Do That," there are people who, no matter how many times you tell them the truth, or show them the facts, they will continue banging their head on their desk, long after it hurts.

This failure was brought on by a fabrication error. The fire started in a short cut section of pipe that jumped from the main vertical trunk feeder sideways, across the tower face to the Power Divider input, between an elbow and a Tee section. The outer portion of this cut section was divine looking. It was beautifully polished and cleaned with a pristinely soldered pair of flanges crowning both ends.

The inner conductor was another story. I refer to another article about using a pipe cutter on inner conductors. http://www.radioworksrfconsulting.com/pipecuttr.doc

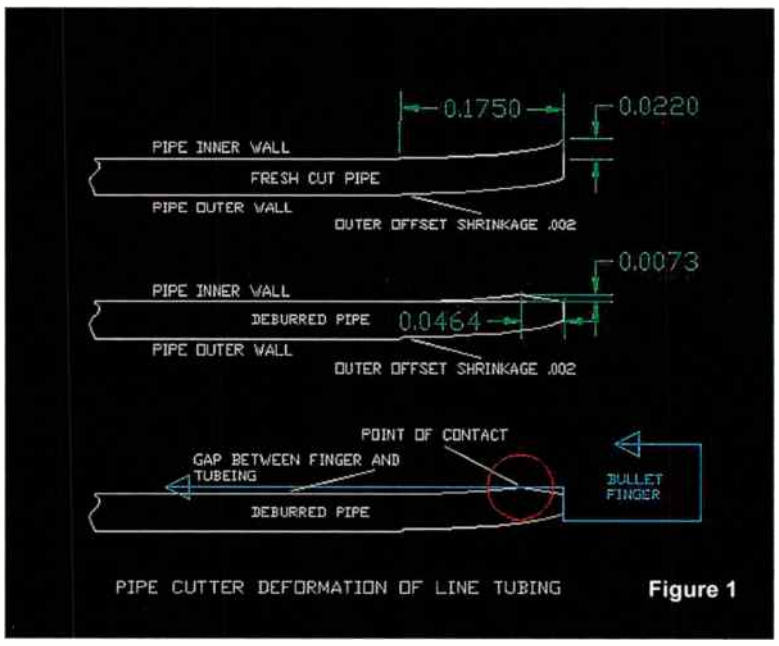

Figure 1

Figure 1 shows three actual measurements of different types of cut-off wheels and techniques of cutting. The inner conductor was cut on both ends with a pipe cutter, and the poor connection on the one end was worse than the other end and it simply burned the bullet fingers off, from the extremely concentrated points of contact from the rolled tubing edge, current, and lack of sufficient heat dissipation. Pipe cutting is an extremely controversial subject, but time and time again, with inadequate filing or de-burring, the use of a pipe cutter on inner conductors has proven to be the source of line, bullet, and component failures. One end of the horizontal cut piece survived to be a witness and the pipe cutter roll pinch was so severe it was clearly visible to the naked eye.

The Total Damage

With questions on a repair like this, comes some simple thoughts. Is improper, or incorrect technique permissible?

The questions of what compromises something improper or incorrect abound? Who needs to make this decision? Who is on site during the construction, who knows the difference, can be aware of these issues, and stop them in process to correct them before they turn in to a failure down the road after the warranty runs out by 24 hours? Who on site has the horsepower to effect these changes and to make sure that the corrective measures are adhered to, document the issue, and insure that this is not a problem going forward? All of these things, and more, are problematic. In this case, because of the way that this Power Divider was constructed, and due to the location of the failure, the fire not only sooted the entire divider in both the ascending and descending splits, but the center feeder transforming match was totally destroyed.

When the transmitter failed to shut down because there was no monitoring on either of the individual feeders or the hybrid reject load, the diminished level of RF was still sufficient to promote the on-going fire in the matching Tee, and the meltdown continued through the soot and carbon until the power was removed. Fresh oxygen was continuously pumped in from the dehydrator while soot and smoke was expelled through the multiple outer wall breaches from the arcing and molten metal pooling.

A Lesson Learned

This system was doomed from the start. There was no one on site to watch the construction techniques of the crew and consultants. The assembly techniques and greasy finger prints on the inner conductor caused any number of issues with the system, that resulted in this and other lesser burn problems in the branch feeder system. Once the fire started, there was no one, and nothing there, to watch it burn.

There were no active reflectometers on either of the main transmission lines, or the reject load. The feeling was that all of the components were installed so over-sized that they were too big to fail. Where have we heard that before? The reject load on the hybrid splitter exploded from the excess power forced backward to it from the line failure. This reject load failure had never been an issue from other branch feeder failures that resulted in pattern and coverage issues – along with extra tower lights of the wrong colors. The reflected power from branch feeder failures was well within the capability of the reject load but a 1 kW load on a 30 kW transmitter is a bad pairing. With the hybrid reject destroyed, the reflectometer of the transmitter in question, and with no metering on the two main trunk lines, this system was set up for failure and it did just that.

There are places to save dollars when designing a system and there are places *not* to skimp on dollars. Play out the failure scenarios when designing a system. Bounce the design off of a couple of people that you trust, and pay the money for a third party inspector to be on hand during your construction phase, so that errors like pipe cutter technique and greasy fingered bullets won't come back to haunt you. Seemingly simple things can look so harmless but, when you really dig, there is merit to many things that will promote safety and long life of your equipment and personnel.

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Transmitter Site

Transmission System Maintenance

by Dave Dunsmoor

It's been discussed often that the replacement engineering talent pool has been dwindling for the past many years. So to assist those prospective engineering interns who are working their way into the business of broadcasting, I'll offer, from my own experiences, some of the more common procedures in maintaining up a broadcast facility.

There have been many articles written by those who are far more experienced than I, concerning the more in-depth aspects of broadcast engineering – specifically FM transmitter tuneup procedures, antenna patterns (and problems/solutions), AM directional array maintenance, grounding, lightning damage avoidance and so on. I'm going to limit my discussion to some of the things that I've run into over the past many years. Yeah, some of the examples I'll cite are going to be "dated," but its the thought process that I want to pass along for consideration.

I guess we'll start at the antenna and work back from there. Let's start with an AM antenna system ... that might be the easiest. At AM frequencies, the power into the antenna is determined by current. An RF current meter at the input port of the antenna provides this numerical value, and the known antenna impedance is used to calculate the power (which is to be held within -10%, and +5% of the licensed value) by the formula $P = I^2 \times R$. The "R" value is determined by whomever sets up the antenna system, and the legal limits for the "I" values are (or should be) recorded at that time. The antenna impedance may warrant re-evaluation at a later date, following any repairs or changes to the structure. If so, then the new values (if they've changed) are recorded and used to calculate the antenna current values from that date onward. This regular calculation is the easy part.

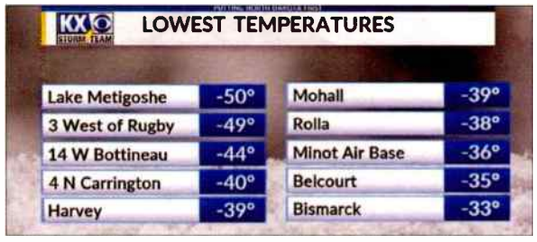
But, what does one do when the antenna current begins to consistently drift out of the legal tolerance values? Is it a seasonal change due to ground water levels changing? Is it due to vegetation growing inside the fenced in area surrounding the antenna (your antenna base *is* fenced, right)? Is it due to deteriorating (or damaged) ground system radials? Have any of the antenna tuning house components (typically capacitors) failed? If your antenna is one of the skirted types, have any of the skirt wires come loose? Has the transmission line suffered damage? All of these possibilities (and more) could be the cause, and therefore warrant a close, thoughtful physical inspection of all parts of the antenna system.

If seasonal changes cause the antenna current to drift more than previously noted, a careful inspection of the ground system is certainly warranted. The standard 120 radials are there to maintain a constant reference for the vertical portion of the antenna to radiate effciently the transmitter's RF energy. If they are damaged (by nearby construction for example), or if they deteriorate due to soil conditions, repair or replacement is called for. I've done the replacement of a ground system, but as a contract engineer, that can take a lot of time. The station may be better served by hiring a professional who does this as a business, who then can do this in far less time, and with much less downtime.

ATU (antenna tuning unit) components can be visually inspected, and usually a failed capacitor (for example) will be very obvious – it will have been blown apart, or the "magic smoke" will have leaked out. Poor (oxidized) connections can often be determined by the use of an IR thermometer – look for increased temperature readings, then clean, and tighten all physical hardware.

Any of the wire(s) which connect an ATU to the antenna can work loose over time. Heat/cold cycles and wind induced vibration are two common causes. For a "skirted" antenna, the skirt wires coming loose can cause the antenna current to vary widely. The feed line to the antenna (or any of the various connections inside the ATU) can appear to be solid, when they are not. Physical inspection and "hands-on" inspection of each connection is appropriate. Yes, you shut down the transmitter to inspect/repair this type of problem! RF burns take a long time to heal – I know this to be so! This problem is usually just a matter of repairing physical connections to resolve.

If you're troubleshooting a directional array, then you also add in the distinct possibility (probability) of the switching contactors (or the control circuits), being the source of the problem. Again, a close physical inspection will be the first step. The switching solenoids really do need their full rated voltage to operate properly, so the first step might be to confirm that, during the switching period, *full voltage* is being supplied to the contactor's solenoids. This might seem to be obvious, but really should be checked to confirm that the contactors are "fully" engaging in each switched position – and that the moving arm is free to move *fully* in each direction, and moves smoothly, with no debris holding up the movement. Be careful to note that all (*ALL*) wire connectors are tight and not corroded. If solid wire ("Romex" type house wire) was used for the control wiring, then standard crimp connectors are not suitable. There are crimp connectors designed to be used on solid wire, but you cannot be sure of this after they are on the wire. At this point, if the wire wiggles in the connector in even the slightest amount, your only option is to either obtain and use the correct connectors, or solder the connector to the wire. And this has to be checked at both the tuning house and transmitter phaser end. *All* connections must be secure. Yeah, it takes a while, but it must be done, and is best done before cold weather sets in. Here in the northern plains, winter temps can often dip to -30F or lower, with accompanying winds and snow. I can tell you that troubleshooting a problem in these conditions is seriously difficult!



I can't offer any specific personal advice for dealing with the heat and humidity found in the southern states, but the idea is the same as in dealing with cold and snow: be prepared ahead of time to safely deal with expected (and maybe more importantly, unexpected) conditions. Don't rush out the door thinking that this will only take a few minutes. That might be true, or it may not, or your car might fail, or .... the list goes on. Keep a container with water, snacks, extra clothing, cellphone charger pack, maybe an amateur radio transceiver, shovel, chains, rope, snowshoes, or whatever in your vehicle – or at least readily available to grab as you head out to solve a trouble call, or even just a routine trip. And do just like we do when hiking in the mountains – let someone know where you're going, and approximately when you expect to return.

A far less obvious (or likely) cause of deteriorated signal coverage, or widely varying antenna current, may be the electrical connection between each section of steel tower sections. Usually, once the tower sections are bolted together during initial construction, they will provide good electrical connection good for the life of the tower. However, if varying antenna current (or noise on the signal) is noted during high winds, this would be the time to have the tower inspected by a qualified crew. Let them know before arrival what the problem is that you're wanting to resolve so they can have on hand whatever might be needed. This might involve tightening or replacing bolts, bonding tower joints with straps or even tack welding. They can advise what is appropriate. This is *not* a job for the "handy do-it-yourself" engineer.

Transmission line ("coax") problems are generally the result of physical damage suffered during or after installation. The stray (or intentional?) bullet is an obvious source of failure, but I've seen coax partially crushed by the overzealous tightening of the stainless steel mounting straps by the tower crew (what were they thinking?!). This usually doesn't result in an immediate failure, but the change in the cable's dimensions causes an impedance bump which will deteriorate the loss budget of the system. The same thing happens if the nylon support structure inside larger coax fails and the center conductor shifts position. It may go completely unnoticed if, for example, it's in a low level signal path with plenty of overhead. But if it's the transmission line for a full power FM station, the reflected power will begin to (usually gradually) increase over time, and eventually fail. This is a good reason to keep records of the various metrics associated with the transmitter operation. Forward and reflected power readings using an instrument with good repeatability and accuracy is good.

Having access to a network analyzer, at least when the antenna and coax is initially installed for a reference baseline, is even better. This way, changing VSWR numbers can be analyzed in greater detail to see just where along the line a problem is located. VSWR readings give a good "overall" picture of the condition of the antenna and coax. A network analyzer, or time domain reflectometer (TDR) gives a detailed view of the system, foot by foot. If you can offer an approximate "distance to fault" to the tower inspection crew, that will significantly decrease the time spent on repair, or determination of whether replacement is the better answer.

If you find such serious damage that the original coax cannot be used, what do you do while new coax is being ordered and replaced? For an STL, usually a section of RG-8 can be used for short distances without loosing too much signal to line loss. Perhaps LMR-400 can be used. While a little more involved in installing the connectors, it does have lower loss figures. I ran an AM station at reduced (1 kW) for a few days on RG-8 while new 7/8" coax was being delivered. And, one of the operators mistakenly bumped the power up to full daytime power (5 kW) for a while with no apparent damage to the coax, so that option is there. For larger coax sizes, you may be able to adjust power down to the point that the transmitter will operate until the line can be replaced. If that can't be done, then running the exciter alone into a single bay antenna (either onsite, or at the studio) may be an option. The primary area of desired coverage should then be covered, and you're still on the air. These suggestions are from a pragmatic point of view, the legal change in licensing aspects should be discussed with a Director of Engineering.

So what I want to leave you with is this; use your imagination, be thoughtful and don't hurt yourself while solving the perplexing puzzles that often occur unexpectedly!

Dave is mostly retired, and does backup engineering for Air-1 and I-heart Media as requested. He can be reached at: mrfixit@min.midco.net

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Tips From the Field

Tools and Tips

by Michael Bradford

I received a call from a client radio station about hum in the headphone circuit. They said it could not be heard on-air but was driving the air-staff bonkers. This station has two Auditronic 2500 series consoles with a whole spare console with rack-mount power supply for parts. I have amassed a box-o-parts over the years to include knobs, meter bezels, bulb holders, ICs and often-used resistors. As I had recently re-capped all the modules on both "hot" consoles, this hum was a mystery.

I was already on the road, so it didn't take long to detour just a little to arrive in the early evening. There was a Tiger's game on, so I could mess around with the console with minimum interruption to programming and a chance for the board-op to shoot down the block for a coffee refill. I plugged in my personal test headphones to eliminate the control room set (with the then 12-foot long cord) as a possible culprit. There it was ... hum, loud enough to disturb the seasoned operator.

As I didn't have my 'scope with me, I opened the console top cover to investigate the power supply tucked behind the module bulkhead; I never liked this situation as it increased the heat and dust accumulation in the power supply assembly and nearby modules big-time. In any case, I reached for my trusty butt-set to monitor the relative DC outputs from the power supply.

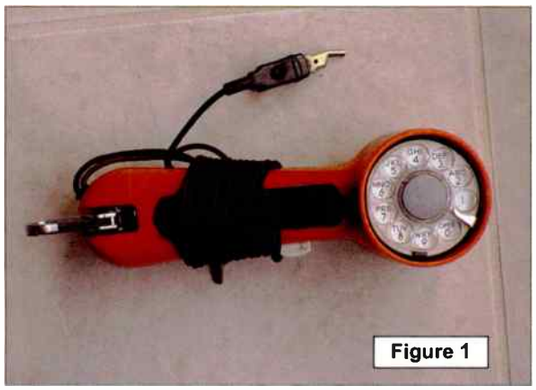

Figure 1

This butt-set is almost as old as I am, but serves the purpose. (**Figure 1**) It has a "talk" mode and a "listen" mode. In "listen" mode, actually bridging circuitry, you can clip one lead to ground and the other to either + DC output or – DC output terminals on the power supply and virtually hear any residual hum. On the [+] side, clear as a bell. On the [–] terminal, there it was ... hum loud enough to be easily heard in the butt-set and, obviously, the headphones.

As I have that spare console with rack-mount power supply, I decided this was a good time to swap out the internal power supply and install the rack-mount power supply. As luck would have it, I had a long extension cord for that spare power supply and locating it in the rack nearby was a simple task. Thank goodness, the screws holding the internally-mounted power supply were accessible from the top. The AC input and DC outputs both use plugs, so getting the old supply out was simple.

I switched the feed of the Tigers game to the production room console and unplugged and removed the faulty assembly. Using that long extension power supply cord, it was easy to locate the spare unit in a nice, cool spot in the control room rack cabinet..

I turned the main console back on and the headphones were quiet as a church mouse. Now to rebuild the original supply.

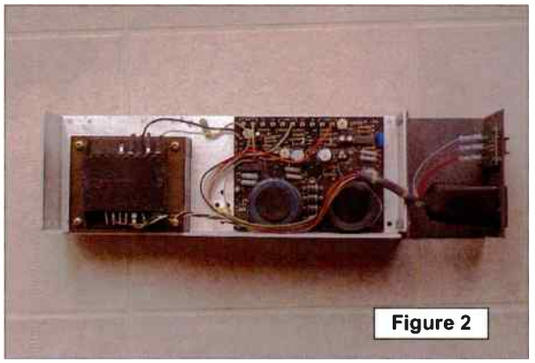

Figure 2

Step one was to order the necessary electrolytic caps for the supply from Lightner Electric. This company purchased the Auditronic parts supply from Wheatstone and they have everything referenced to the original Auditronic parts lists. The "guts" of the supply is an analog, brute-force power supply (**Figure 2**) and uses easy-to-obtain parts. I made a list from the console parts listing and called Lightner.

Figure 3

Within four days, the new filter caps were in my hand. Note the shorting straps on the large caps (**Figure3**). I learned the hard way, years ago, not to handle large capacitors that have set around un-shorted, unless you are looking for a possible shock from static build-up. All vendors and major transmitter builders always send large-value caps with a shorting strap across the terminals. You may recall the PCB capacitor boogie of the 1980s, where power-pole transformers and large transmitter capacitors with PCB oil had to be removed and replaced. Many people unfamiliar with these large format capacitors were zapped while handling these bad-boys. If you ever receive large capacitors from a supplier without the shorting-straps, be sure to short the terminals carefully before handling or installing them. As replacing the caps requires disassembly to get at the bottom of the circuit board, I like to number the ICs (**Figure 4**) to easily keep track of what goes where.

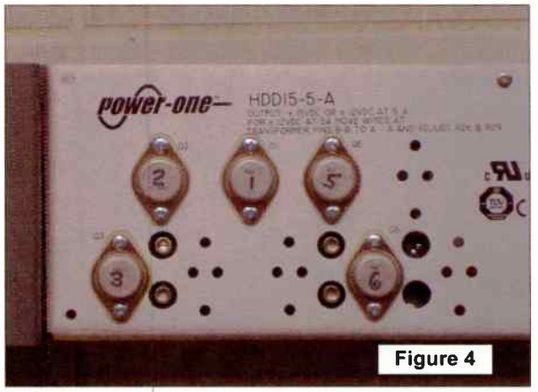

Figure 4

Removing the small filter caps requires some de-soldering and I like my Aven #17536 de-soldering pump for the task (**Figure 5**). It's small, ESD safe, has replaceable tips and is made in Ann Arbor, Michigan, right next door to me. I used new insulating pads for the regulator ICs that have the heat-transfer paste built in. The finished circuit board was ready for use in about 1.5 hours (**Figure 6**).

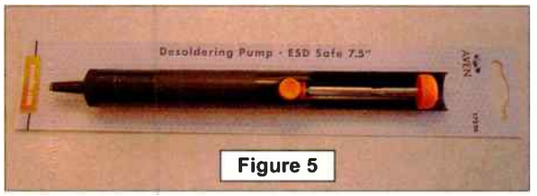

Figure 5

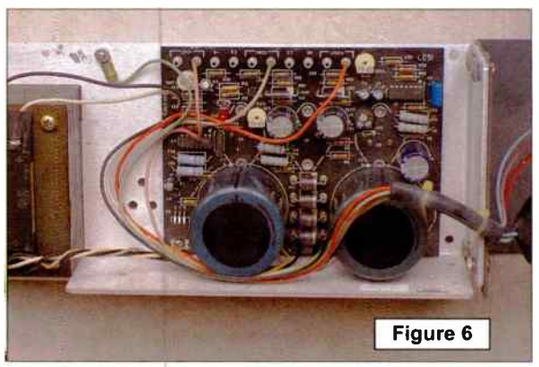

Figure 6

A few days later, I received a distress call from a fellow Engineer; he needed a replacement relay for a coaxial transfer switch control. Seems the spare relay he had on-hand was missing the center locating tab and when replacing the relay he did not notice it until it was too late and plugged it in backwards. The resulting puff of smoke was not a good sign. I had the proper relay in stock and kept the "bad" one for show-and-tell.

I'm off to help a friend locate and repair a driving relay for an RF contactor that doesn't want to change from daytime to nighttime pattern with regularity. It's hard for one man to be at both ends of a 300 foot long control cable at the same time. I enjoy helping and it's a great time to coffee-up and share battle stories. Until next time, be safe out there.

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

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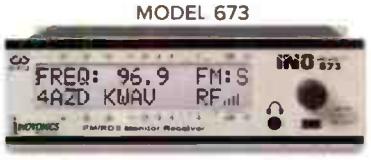

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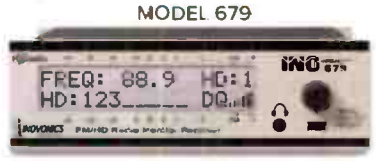

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Tower Topics

Time for Tower Talk

by Steve Callahan

Yes, friends, it's that time again to talk about your towers. We all have them ... and we all need them. Winter's coming and this is the perfect time to take a look at your tower.

You have a significant asset standing out there in the swamp or on that hilltop. You can't do much broadcasting without your tower so you should be keeping an eye on it. I know that there are just 24 hours in a broadcast engineer's day and you can't always get out to the tower when you want to. However, I hope this article will compel you to head out and take a look.

If your tower is relatively new, that is a good thing, but even a new tower needs regular maintenance. If your tower is newly constructed, then a couple of months after it goes up, you should have the guy wires tensioned. That wire strand will stretch after the initial installation and it should be re-tensioned to prevent any "galloping" guy wires. Your friendly, neighborhood tower crew should bring their dynamometer and surveyor's transit to do the job right. Never, *never* just crank on the turnbuckles until they are as tight as piano wire. They should be adjusted on a calm day as the tower will lean slightly in the wind and the downwind guys will appear to be loose.

Make sure that the turnbuckles have safety "figure eights" through them to get them secure and make it harder for vandals to unwind them. While you're at the tower, check the ASR (antenna site registration) signage and RF warning signage. There are several on-line sources that make some excellent quality and professional looking signs. Mount the signs on the inside of the chain link fence to discourage theft. If you are at an AM tower, walk around the tower base fence and make sure that it's secure and can weather the winter.

Everything OK at the tower base?

It's an easy FCC fine if the inspector finds that the public can crawl through a hole in your fence and get to your hot AM tower. I was at an AM tower recently where someone had stolen all of the barbed wire from on top of an AM tower fence. Thankfully, all of the ground system was intact and there was no obvious damage to anything at the tower base. For the life of me, I don't understand why anyone would want 300 feet of rusty barbed wire.

If you are the proud owner of a hilltop or mountain top FM/TV tower, head up the hill now while it's still accessible. Take care of any obvious repairs now, rather than have it fail on its schedule later, when the site is hard to access. If you don't have a basic tool kit secured at the site, do it now. Why tramp through two feet of snow with a tool box?

Like at the AM site, make sure your signage is correct and still there. You should place one ASR sign at the tower and another at the last place of public access. This would be at the gate at the base of the mountain so that the public would not have to trespass to get the ASR information.

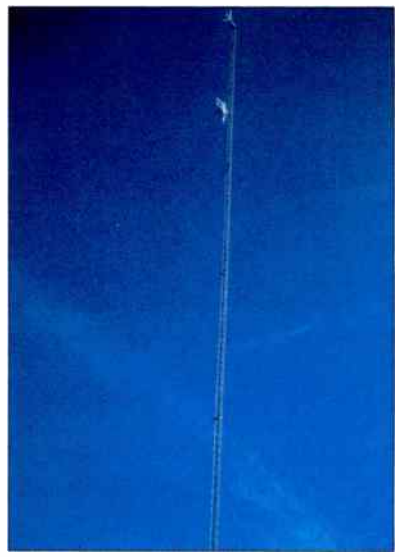
Cover the light level sensor and make sure that all of your tower lights work and that the appropriate beacons are flashing. You do perform that check every quarter and log the results, don't you? While you're looking at the tower lights, take close look at your tower paint, if the tower is required to be painted. While your eyes are looking up, see if there's any loose coax or other appurtenances on the tower. I know of a tower that has several abandoned antennas just hanging on by a rusty bolt. Take them down now before they come down and do some real damage.

Clear the weep holes on hollow leg towers.

With winter comes snow and ice, and towers need to survive winter winds that can combine with rime ice to make some very threatening stresses. I've read some very interesting studies on rime ice that were conducted by the U.S. Army's Cold Regions Research Laboratory in Dartmouth, New Hampshire. A layer of ice around a vertical member of a tower can increase the stress on that member significantly. We can't do much to prevent rime ice but we should do all we can to make the tower strong enough to handle it.

When was the last time you put a clamp-on ammeter on your FM antenna heaters? How would you know if one, two or more of your bays had burned out heater elements? Just having just an "Antenna Heaters On" status indicator doesn't tell you much. The next time you have the transmitter off and your trusty tower climber is up there, turn on the heaters and have him feel each bay. If they are all operational, put a torroid transformer on the heater power feed that goes up the tower and then calibrate your remote control to show normal heater current. Any deviation will signal you to a problem up top.

Using a torroid is also a great way to make your daily tower light monitoring more informative. Having a status light that says "Tower Lights On" only, tells you half of what you need to know. A torroid that monitors all of your tower light current can be calibrated to show you when any beacon or side light is out. It will also show you if your beacon is flashing normally. If you have a multi-tower AM array with lights, put a torroid on each tower's light feed to get you the information you need from each of your towers.



How do the antennas look on the tower?

There's been a lot of talk recently about having to light towers that are less than 200 feet above ground level. The Society of Broadcast Engineers has produced a very understandable explanation of the new regulations and I encourage you to take a look to see if any of the changes now apply to you.

I can't say enough about properly maintaining pressurized coaxial cable at a broadcast facility. If there's no pressure in an FM line, the black coax on the tower heats up during the day due to sunlight and the air inside also heats up and expands. That heated air is forced out of the coax at the leak point and causes a vacuum which then draws cold, moist air into the coax at night. I had a tower on a hill top in Maine which experienced this scenario and fortunately there was no arcing over in the coax, but it did require a wintery visit to the mountain top to fix the leak, drain the water from the coax and pressurize the line. If your dehydrator is dead, and before you spend the big bucks to replace it, there are several companies that can fix any model dehydrator for relatively small bucks.

A company called Phartronics used to make a nifty pressure sensor which, when placed in the air line to the tower, would develop a DC voltage output proportionate to the air line pressure which you could then use for remote control monitoring. However, a search on Amazon.com will produce many pressure transducers.

A trip to your tower doesn't have to be an expensive exercise in repair-after-the-fact. Keep on top of the projects that need to be done to keep your tower and tower site in good repair and ready to handle any weather condition that will come your way.

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

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StudioHub

Tech Topics

Odds and Ends for Year End

by Bob Reite CBT

The Fussy Exciter

An RVR TEX-20 exciter came in for repair. The initial complaint was that it "runs too hot." The fan was turning, but making a bad noise and not turning fast enough. A replacement fan cured this complaint. Since the customer uses this exciter as a roving spare, I wanted to make sure that it operated across the entire FM band.

Well it turns out that it did not want to lock on any frequency between 90.1 and 99.9 – the bottom end from 88.1 to 89.7 was fine, as well as the top end from 100.1 to 107.7 In addition, if it was set to any frequency ending in .9, it transmitted ending in .1 instead. The problem was traced to the actual frequency setting thumbwheel switches. The switch for the 10s position as well as the .1 position only generated binary 0001 instead of the required 1001 when set to number nine. Oddly enough, they worked correctly when set to number eight, giving 1000. In fact each setting was correct except for number nine.

Due to the age of the unit, a replacement switch was no longer available. However, all the other switches worked correctly. With a good vacuum desoldering station, it was possible to disassemble the switch cluster and move the parts around.

One of the bad switches was moved to the 100's place, which only gets set to zero or one. The other bad one was moved to the .01 place, which in the United States is only set to zero. After reinstallation of the modified switch, the exciter was able to transmit on any legal frequency.

Fears Were (not) Well Grounded

Summer time is thunderstorm season and many equipment failures occur due to lightning damage. Numerous articles have been written on things that one can do to mitigate the risk. After losing a cable modem, a Comrex Bric-link and a router, for the second time during the Summer, I was called in to figure out why they were failing. My immediate thought was that the cable modem, landline ground and power grounds were not bonded together as required by 800.1 and 250.70 of the National Electric Code. I started tracing things out and, while the phone and cable ground were using the same ground rod outside of the building where these services came in, there was no connection to the power service ground. I then worked my way from the main service disconnect for the building where there was a nice piece of #4 solid wire, but following it did not lead to a proper grounding electrode – in fact it led to nothing at all! Outside the building was what looked to be the ground rod that perhaps at one time was connected to the service equipment.

This is the point where I called in the industrial electrician to clean up the mess. Fortunately he found no other problems with the installation and fixed the grounding system to comply with the current electric code. It's been two years and more thunderstorms during the summer, but so far no more damaged equipment.

Repurposing a Media Access Exchange Receiver to General Purpose Computer

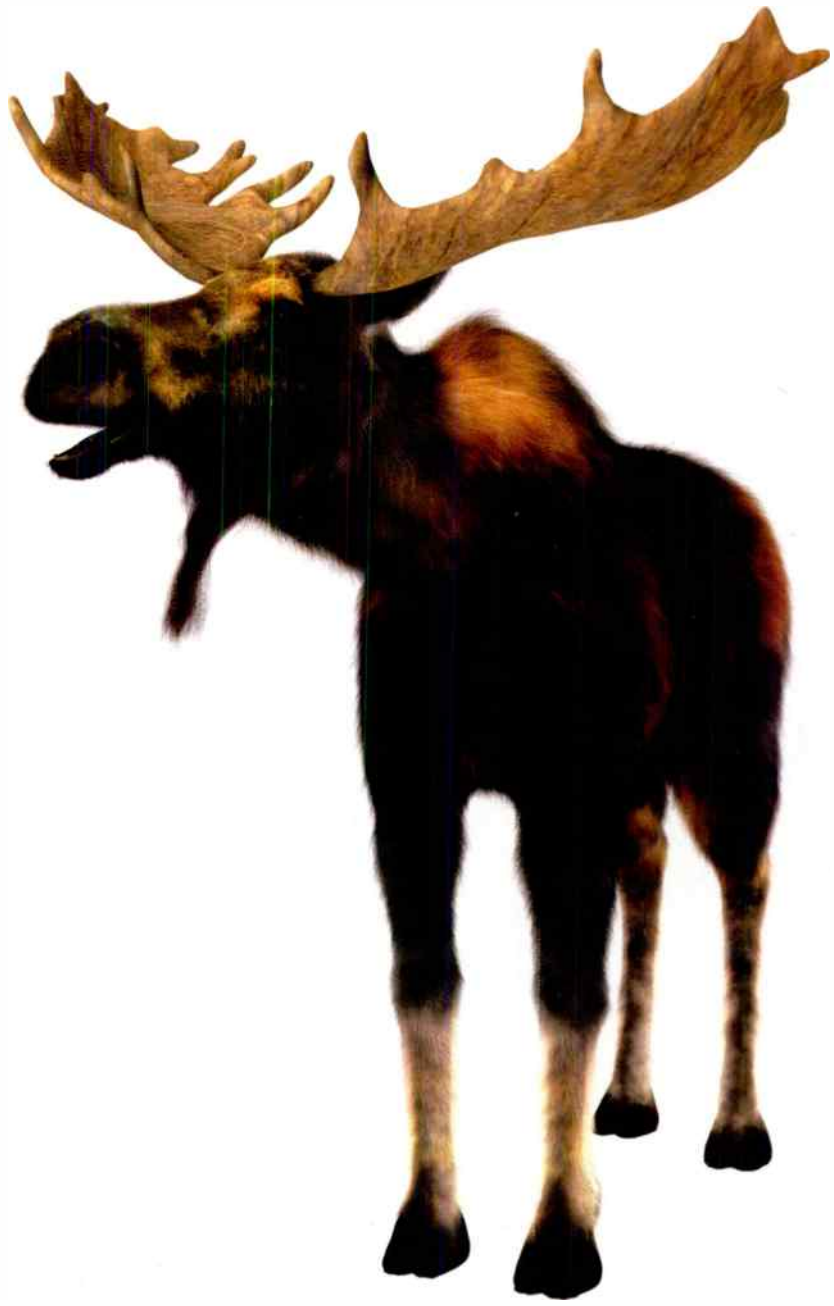
I forgot to mention in the case above that they also lost a Dell general purpose computer during the second thunderstorm. However, no great loss. It was so old that it was still running Windows XP, so it was well past due for replacement – it would have not even handled an upgrade to Vista. But the owner of the station was now in an "out of money" condition due to having to replace two Bric-Link units. Sitting in the rack was an old "Media Access Xchange" satellite receiver from back in the day when the station carried sports programming. Inside, besides some custom RF and audio boards there was an 80 GB hard drive and a mini ATX motherboard with a 1.5 GHz 1M 400 Pentium processor.

Not any better than the dead Dell, however the BIOS was new enough to allow booting from a USB drive. After calling the actual owner of the receiver and con-

(Continued on Page 24)

#MisheardLyrics

“Got a moose, got a moose, can you do the fandango?”



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Odds and Ends for Year End

– Continued from Page 22 –

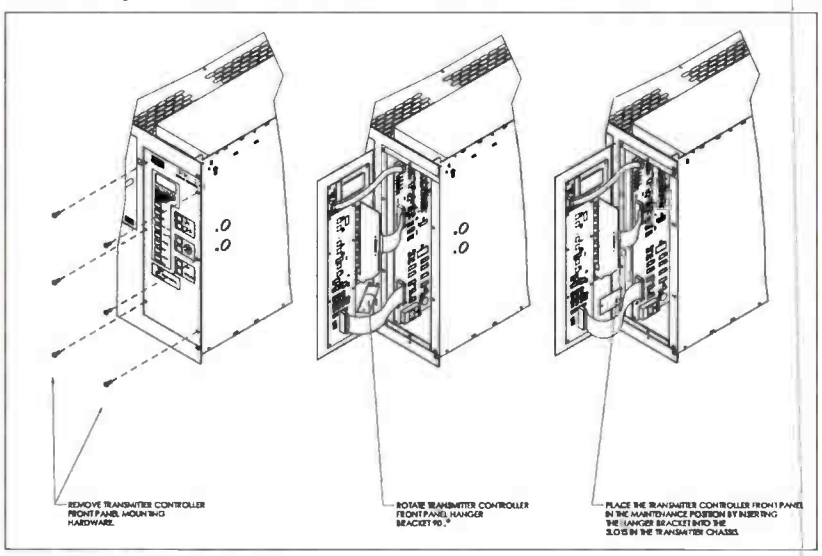
firming that they did not want it back, I proceeded to install Wary Puppy Linux on the internal hard drive.

Wary Puppy is a Linux distribution especially built for older computers. I found that I had to disconnect the IDE cable from the audio boards, as they no longer served a purpose and the connection was interfering with the new OS installation. The GUI does not look like most Linux distributions, but all the computer is needed for is if someone is at the normally unattended site and wants to look at the router or Bric-Link via the web interface – so Wary Puppy is more than adequate for their needs. In addition, having a rack mounted computer eliminated one more item cluttering the floor.

Notes on Servicing the BE Model FM 500C1 Transmitter.

I installed this transmitter new, over ten years ago for a college station and while this model is no longer available new, the only thing that had to be replaced in all those years was the fan for the FX-50 exciter that was purchased with the power amp section.

Similar to the AM-1A AM transmitter product, the settings memory is held by a 9 Volt backup battery. Unlike the AM-1A however, there is no hinged access door, nor is there a handy test switch, so one tends to forget about the battery. The first symptom that the battery is going bad is that, after a power failure, the transmitter will restart at the lowest possible power setting. I should have replaced the battery then and there, but since the transmitter was working OK, I figured I'd do it later.



Well later came, and now the transmitter was intermittently refusing to turn on at all. Figuring the worst, I made a site visit and installed my loaner spare and took the FM 500C1 to the lab. There I found the logic to randomly go into "disallowed states." Since I now had it somewhat apart, I discovered the hidden and forgotten about backup battery. Installing a new battery got rid of all the problems and the transmitter now remembered the prior output power setting when AC power is restored after a failure.

To get at this battery, part of the front panel on the right side is removed. To remove it, unscrew three phillips head screws on the left side of the sub panel and the corresponding three middle screws on the right. Do not loosen the very top and bottom screws on this side of the transmitter, as they are now the only two screws holding the transmitter in the rack on the right side.

You will now have the front panel dangling from three ribbon cables. But BE thoughtfully provided a hanger bracket that will support the panel on the left side of the opening. Rotate the hanger bracket 90 degrees so that the lugs on it will engage the slots in the main chassis. The backup battery is located at the very bottom of a circuit board inside, that the front panel plugs into.

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

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Engineering Perspective

Self-Control

by Sam Wallington

Though I grew up in a loving household, it was fairly common for someone to lose their cool. They would yell, hit or throw things as they spent their anger. Because I grew up in that environment, I thought it was normal and behaved the same way. In fact, it was so normal, I thought there was nothing I could do about it. Anger is an uncontrollable emotion, right?

Fast forward a couple decades. I found myself in a leadership role, heading up a small department of engineers and IT professionals. Mostly things went well, but every once in a while, something would happen and I would get angry. I'd yell, slam doors, and storm out of the building. Once outside, I would stomp around the building a few times to blow off steam. Finally, I would return to my desk, sometimes I would apologize if I felt I had said something too strong, and we would all go back to work.

One day, my boss called me into his office. Usually, he would just talk to me from behind his desk, but that day he came and sat down next to me on his couch. He described my outbursts and, though he was kind, he told me in no uncertain terms that my behavior, if it continued, would get me fired. He explained to me how, as a leader, I had responsibilities beyond making sure people did their job. I was responsible for creating a reasonable work environment, and when I "lost it," I made people uncomfortable at best – more likely fearful or frustrated. I am sure I said something, but I do not remember what – I was pretty shocked. What I thought was normal was something that could cost me my job.

During work over the next few weeks, sure enough, a few things left me feeling anger. But – and I was truly surprised by this – I could actually control those feelings. I could defuse my anger, at least enough to calmly and quietly exit the building and take a walk. There was no yelling, no doors were abused, and though my team probably knew I was angry, all the fearsome noise was gone. Once I knew I had control over anger, within the next few years I found I was not becoming angry about things that used to infuriate me. Now, it is rare for me to feel anger, and regularly people comment to me about how hard it is for them to imagine me angry.

Sometimes when I watch people, I wonder if the skill I learned that day, when my job flashed before my eyes, is actually somewhat uncommon. As I grow in leadership, I realize more and more the importance of controlling myself. Yes, controlling anger, but extending to so many other things: Controlling what I say (there is rarely a need to talk about someone who is not present, for example), not saying something that I really want to say, yet would not help the situation (I regularly want to tell someone that I already knew something they just shared with me, but it does not change anything – other than my ego and their embarrassment – for me to do so).

When my kids were little, my wife and I intentionally taught them self-control. For example, if they were inappropriately out of control (play is different and very acceptable!), we would ask them to sit down and fold their hands. There is something amazing about a young child folding their hands – it somehow "shorts out" excess movement and thought and helps them re-center and calm down. This "trick" is a parental superpower which was taught to us by some friends. Now our kids are in their late teens, and self-control is generally not a problem. They can control their actions, whether physically or verbally (they are teens, so "can" does not necessarily mean "always do"), they can make choices against peer pressure, and they can choose to do the right thing, like homework, even when much more interesting

(Continued on Page 28)

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Engineering Perspective

– Continued from Page 26 –

things are available. Interestingly, they are sometimes annoyed by friends who are unable to control themselves and who act out, say hurtful things, lose their temper, etc. So in a way, this has come full circle, and, thank God, the anger cycle is broken.

If you will permit me to be a little nosey, are there areas in which you do not exhibit self-control? When a problem walks into your office, does the problem overtake your self-management? Do you do what I did and blow your top? Do you "shoot the messenger?" Do you say things like, "That guy is such an idiot! I told him already..." Those are all examples of lost self-control, even if you are not slamming doors and screaming.

There are a few practices I have been working on, putting in place to help with self-control. As strange as it may sound, the first one is simply making the choice to have self-control. If we honestly decide to take control of our emotions and behaviors, change becomes possible. In my case, this choice was motivated by my desire to keep my job, but I have since learned that the choice can be made any time, and if we mean it, it will still be effective. One of the best ways to do this is to imagine how you want to be perceived, how you want to be influential – and maybe how you want to be promoted. Does the way you act and react now accomplish those goals?

Another practice is to intentionally switch to asking questions in a heated moment instead of making statements. When a problem comes to your attention and you find yourself losing control as a result, start asking questions. They might be clarifying questions. When did it happen? How many items were lost? Are we still on the air? Was anyone hurt? You can also choose to ask yourself questions such as, "Why does this bother me so much?" or "How can I respond kindly?"

Sometimes I will plan my responses before the problem arises. Say, for example, my team is working on a difficult project. There are lots of opportunities for things to go wrong. I can expect problems, so I can also plan how I will respond when they happen.

I have told my team that I like mistakes. I like mistakes because it means the team is trying something they are not yet great at. It means they are stretching our capabilities and capacity. It means we are not afraid to try and fail. It means we can learn from whatever went wrong. All of these are great and valuable things. But for this to work, I must be able to control myself when the news about a mistake reaches me. If I scream, "You did what!?!" I have just lost both credibility and the opportunity for all those good things. If instead, I can say, "Tell me what happened" or ask if everyone is OK, we can turn the mistake into a gain.

Like anything, self-control takes practice. Like I mentioned above, sometimes we can practice using imaginary scenarios: If my child, who is old enough to handle that crystal vase, ends up breaking it, how will I act? What will I say? Then, if the imaginary becomes reality, I can execute my planned response. There is a balance, however. I could become paranoid imagining all the possible problems! Accordingly, I'll use this kind of practice when the outcome is particularly important – like raising kids who do not fear their parent's reactions.

Other practice happens automatically. There will likely be an opportunity to practice today. Something will go wrong, something will happen differently than you expected or hoped, or you will be blindsided by some difficult news. Once it is over, look back and evaluate how you responded. Do you like what happened, or would you like it to go differently next time? Use that input to bias your brain toward the direction you want it to go. The next time something happens, there's a decent chance you will have moved somewhat toward your goal. Keep evaluating and repeating.

If you have been on social media anytime in the last few years, you know that self-control is becoming a lost art. People say literally anything. Yes, sometimes it is for the shock factor or to look cool. But so much of it is just a lack of self-awareness being turned into self-control. It is the same thing on radio talk shows. The left is pounding on the right, and the right is pounding on the left, and so few are actually listening to the other side (true, the fight creates ratings, and those ratings might help you and me remain employed!). But, personally, I do not want to live there. I want to go to bed each night knowing I contributed to making the world better. I did not lose my cool, I was kind to everyone with whom I interacted – and as a result, I like who I am becoming. The report card is not always all A's! I still say and do things that do not contribute. But I love that my home is different than my parent's home. Rage and anger do not live there. What a huge benefit to learning the self-control I did not have when I was younger!

Sam Wallington is VP of Operations and Engineering for Educational Media Foundation, and has 36 years of experience in broadcast engineering. He can be reached at swallington@kloveair1.com

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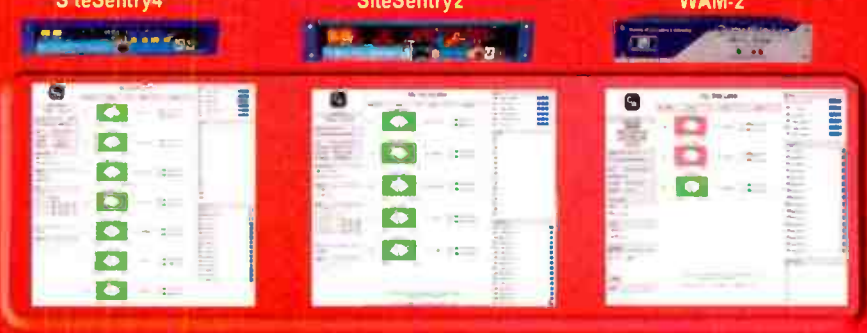

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– Continued from Page 30 –

• *Use Combination Locks Wherever Possible* – for access to your tower site and locations. This lets you minimize the number of keys that have to be duplicated and distributed, and is easy to change the combo when it becomes necessary, without the added expense and trouble of cutting and distributing keys. Make sure that you do have a spare set of keys to everything you own – either with you, or in your vehicle. You *will* need them some time when the Engineer is not around. Keep notes of what all the keys fit and how to access all the sites. Keep a journal or notebook at the remote tower site and mandate anyone who enters the tower building to log tower readings and that they were on site. Keep your "vital" records (License) inside plastic sheets in a binder. This includes STL (License) path information.

• *See That All Filters on Transmitters and Your HVAC Units* – are changed, or at least checked at least monthly. Dust is a killer of many transmitters and other equipment. This goes for computers as well. Keep a Shop Vac or industrial vacuum cleaner in the equipment room at the studio and also at the transmitter site to help keep your building and equipment clean. Cans of compressed air are helpful to get into small places the vacuum can't reach – just use them first to stir up the dust and then vacuum it all up at the end.

• *Be Prepared.* Keep spare tools in your vehicle including an air pump, WD-40 and duct tape. Keep wasp / hornet repellant available at the tower site and in your vehicle, if you live in an area prone to such varmints. Insure you have several flash lights in your building and one in each control room. Check your batteries in those flash lights, and in your smoke detectors too. Insure you have a First Aid Kit or at least band aids at the tower site – trust me, someone will need them!

• *If You Have a Generator, Check It Monthly* – but exercise it weekly. Insure you have extra oil and coolant and check the fuel level. Log it in your journal and write down the hours it has exercised. Know who is local that can work on it if there are problems, especially for off hours.

• *Walk Around the Back of Your Radio Station Buildings* – and see if anything is out of place such as loose cables, vandalism etc., or strange visitors including cats, rats, snakes, deer, bear or ground hogs, that have paid your company a visit! It's not just tower sites where this is important – even studio buildings in urban areas can have uninvited guests. If you have a remote vehicle, occasionally drive it yourself, inspect it for damage and keep a good service record. You may notice something that someone who drives it every day overlooks.

• *Insure Transmitter Information From the Factory* – (or broadcast consultant) such as your TPO (transmitter power output) is located at the remote tower site and is in a plastic sheet in a binder. This will be helpful to quickly find for an FCC Inspector. Good idea to put a label with the TPO on the transmitter. Place a copy of all facility licenses in a plastic sleeve and put them in a binder at the transmitter site and at the radio station. Locate a manual on every piece of equipment and insure you have it at the tower site or radio station for easy engineering repair access. Help your engineer write up the wiring charts and layout for your studio and for the tower sites, so that any other engineer in the future can read and understand how everything is hooked up at your place. And don't let your engineer be afraid they are going to be replaced by revealing all the details about your radio station. The H.B.A.B principle ("Hit By A Bus") is real, and there should be no secrets about how your radio station works that are held by one person, including you.

• *Keep Records on Your Equipment* – and take pictures of all your equipment. If you ship a piece of equipment off for repair, be sure and tape your business card to the equipment or use a Label Maker placing your company's name somewhere on the equipment! Or just put one of your station bumper stickers on the equipment top – the company will certainly remember it that way.

• *Be Pro-Active.* Ask your engineer what they need to do their job better. Sometimes it's just an extra roll of tape. Write down an engineering plan for the year and determine what you think your plan (new equipment) may cost. Communicate with your engineer to determine what equipment needs replacing now and in the future.

Again, much thanks to my friend and associate Paul Tinkle for the inspiration for these points, taken from *"The Manager's Engineering Notebook"* By Paul F. Tinkle, Thunderbolt Broadcasting, Martin, TN. His wise words and timely and sincerely appreciated.

Jim "Turbo" Turvaville is semi- retired from 41 years in full-time Radio Engineering and lives in Rural Wheeler County Texas in a "tiny house" where he maintains a small clientele of stations under his Turbo Technical Services (www.jimturbo.net) operation providing FCC application preparation and field work.

Shop Talk

Misc. Tech-Tips and Thoughts

– Continued from Page 34 –

back on locally. That means you cannot log in remotely to turn the APC back on. Standing in front of the transmitter, and going through the menus until you locate the APC menu, will be required to turn it back on.

There may be a software fix for this in the future, but we will all wait to find out.

Gates Air transmitters are still on my favorites list. All transmitter manufacturers have these kinds of surprises, so it's not a big deal.

LNB Voltage Test Accessory

Here's a nice little accessory you can make for yourself out of some items you mayhave around your shop. It's made from some RG6, a male F connector, two alligator clips, and a female-to-male F adaptor. The adaptor converts your male F connector to a slip-on, slip-off male connector. The clip leads go to the probes on your multimeter, and the slip-on connector goes to the female F connector on the back of your satellite receiver. I know you can just use the probes from your meter to check voltage, but there is a chance you could short out your LNB supply and kill it. It you have steady hands you may not need my little accessory, but it makes testing LNB voltage safer and a little easier.

Energy Onix Parts and Support

Some of you own Energy Onix brand transmitters, and most of you know that Bernie Wise is no longer with us. That leaves owners of his transmitters wondering what they will do if they need parts or technical help. I have good news for you. A gentleman by the name of Russell Laferty based in Auxier, Kentucky is here for you. If you need parts or technical help, contact Russell at 606-794-8895. He will be glad to help.

Bird Meter vs. Transmitter Output Power Meter

Rod Zeigler, who works as an engineer for the Nebraska Rural Radio Association, responded to my article about Bird meters and transmitter power output. He writes:

Steve:

You asked in the article about calibrating Watt meters whether or not you could trust what your new transmitter is telling you. Until about 5 years ago I implicitly trusted what the transmitter was telling me barring any information to the contrary.

We had a major power supply failure that required outside engineering help to figure out. After the repairs were done [by] the contract engineer [when he] went through all of the metering to make sure it was calibrated. What he found was that it was not and we had only been making 80% power, even though the power meter and plate volts and amps meters said otherwise.

We checked his finding with at least 3 other meters to verify. These metering circuits were calibrated and we have been running at true, full power since. An external Watt meter had not been part of the installation, so all we had to go on was the transmitter itself.

From now on, I will be skeptical until proven wrong on any new transmitter installation. I also gained an increased appreciation of those engineers that have been there and done that a great number of times in many different places. The nuances he picked up on, that made him check our calibration, were lost on those of us who have watched the same box over the years.

– Good article! Regards, Rod

Thanks Rod! You have given us some more to think about in the area of power output meters agreeing with each other. I appreciate all the letters that have come my way through this column. Feel free to contact me at the email address at the end of this article. Your comments are always welcome. If you have something to share, let me know. You will be helping other engineers in the process. Merry Christmas and Happy New Year!

Views expressed in this column are those of the author, and do not necessarily represent those of Radio Guide.

Steve Tuzeneu, CBT, is a staff engineer with the Bible Broadcasting Network in Charlotte, NC. He is a member of the SBE, and an extra class radio amateur. My email is stuzeneu@sbe.org

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Small Market Guide

Balanced or Not Balanced That is the Question

by Roger Paskvan

In any small town, there is a limited number of resources, and a pool of experience, that is gained over the years of working on the same electronics at any small market station. This is one of those stories that defied logic and should have been a ten-minute fix – but become a 30 hour nightmare.

One of our stations has a Gates 5, all solid-state AM transmitter. When it works, it really works well and runs a long time. When it fails, it's one of the hardest things to fix in the building. This story begins with our program director mentioning that the AM seems to quit for a short while, then comes back on and sounds fine. He clarified the statement by saying, "I don't mean the transmitter goes off the air, the modulation just quits and then returns." Somedays it's a few minutes and sometimes it's hours. Turning it on and off, can make it come back to life and it runs the rest of the day. We started logging this problem, utilizing the silence sense to know when it goes off. Sometimes it ran for days without a hiccup – other days, several outages, usually short segments. This went on for weeks. We checked the logs for dead ads and logging problems, played with the compressor, but all seemed well and running fine.

Finally, it was concluded that there must be a modulator problem in the Gates 5 and troubleshooting the PDM was the hardest place to start. Introducing a sine wave tone on the input, we traced the audio path through the interface board and the PDM. This transmitter is a class D pulse width-modulated transmitter, so the square wave is width-modulated that eventually turns into an amplitude modulated signal. The off condition occurred once, but just bumping the case made it start working again. The Gates 5 also has a unique audio input circuit. The ending balanced audio goes into a differential amplifier then to the modulator. Okay, no audio at the output, must be the chip, so it got changed – a well spent 59 cents. All worked again and we let it play for the next few days. All seemed well until day number three – audio quit again. This time we took the PDM board out, re-soldered everything, and couldn't find anything unusual. We let it play, and it quit ten minutes later. Same problem, no audio at the output of the differential amplifier. Did the 59-cent chip go bad already? Well ... we replaced it again. All worked and it ran for a full day, then quit. It's like the Gates 5 was just teasing us!

In frustration, I called Gates and talked to their field service. They were very helpful and gave us some things to try. The next night, we replaced some regulators, resistors and components that could have some impact on this problem. The transmitter ran for almost a week and then started to do the same thing. No modulation with no audio on the differential output IC on the PDM board. This was really taxing our years of engineering experience. What a stubborn problem. I talked to an engineering friend who said, "Check that there is audio on the input to the board when this fails." A small audio amplifier showed a nice +5 audio signal at the input. So here we are, two veteran engineers with years of experience and we can't fix a simple audio problem? How embarrassing!

A second call to Gates became a begging, "please help us" type call. The Gates engineer brought a second person on the line and we explained the problem. He said you're fixing the wrong thing. Your problem isn't in the transmitter, it's in the processor or the audio chain. We had a short discussion on balanced audio and how critical the balance on the audio line is with a differential amplifier. It seems the Gates designers put a differential amplifier in the audio of the Gates 5 to kill hum and noise. He went on to say all common mode things, like hum will cancel at the differential amplifier. The balanced audio, being equal and out of phase on each lead, will go straight through. He said to look at our processor output and see if we had a true balanced output. Your problem is external!

Okay, armed with a two-channel oscilloscope we checked the processor and of course, everything checked out just fine. Two out-of-phase audio signals, steady as she goes all day. We let the transmitter run and when the modulation stopped, processor audio remained the same. The transmitter had run for a whole week with no problems, then started to do the same thing again. I was wondering why I went into engineering, thinking that sales could be a better place to roost.

This time, I put the scope probes on each leg of the audio input board to the Gates 5 interface. When the modulator quit, our first clue came to light. One lead of the balanced audio was dead. How could that be, there is only a 20-foot piece of 8451 cable between the processor rack and the transmitter. Placing the scope across the processor, all looked great, but things were working again. We decided to replace the processor with another, just in case. The replacement processor and everything else, worked for several days. Was it the processor? Had we won? Late that night, a call from the PD, "The AM is dead again, sorry to have to tell you." More bad news. It quit ... same problem.

That night, the audio stayed in the failure mode long enough to make measurements on the in and out of the audio cable to the input of the Gates 5. Yes, one lead was quitting and the PDM differential amplifier saw it as a problem and nulled it out. I verified the loss of signal between the input of the cable and at the transmitter two times, just to make sure it was real. We both looked at each other and said in unison, it's got to be in the wire. Then, questioning the logic of this, how can a two-conductor wire in conduit fail. Well, a new 8451 cable was run from the processor to the transmitter and, guess what, all was well, and the Gates 5 was running like a new watch. Sometimes the obvious is too simple and it's overlooked. On the small audio amp, we always had audio going into the transmitter which can lead you to think, there is no problem. The oscilloscope provided a true picture of audio on the red lead and no audio on the black lead when the dead audio condition occurred. I assume the cable had a small fracture on one lead and building vibration would make or break the connection at random, causing the audio to go unbalanced. If the Gates 5 did not have a differential input, the condition may not have ever been found. One would assume the volume would just drop slightly and someone would turn up the gain.

The moral of the story, regardless of stupidity, is inherent to how balanced audio works. *True* balanced audio is produced with center tapped A21 UTC transformers on each end of a two-wire cable. The black lead is 180 degrees out of phase with the red lead. (**Figure 1**)

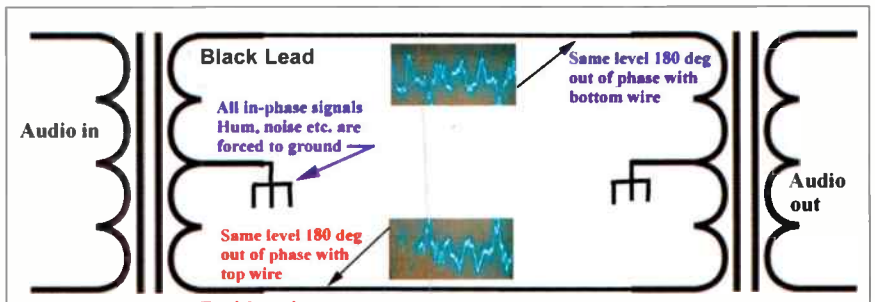

Figure 1

Any signals that are not as this described condition, find their way through the center tap to ground and are cancelled. If you ever wondered why a telephone wire can run three feet below a high voltage power line for miles and not cause any hum in the phone, this is the reason. All common mode signals are eliminated through the transformer center tap to ground – hum noise etc. In modern equipment, the balance is now produced by two active op amps that approach this condition. Can't beat the transformer for balance, but op amps save a lot of money in design. With true balanced audio on an oscilloscope, you would see two signals just opposite phase of each other as in **Figure 2**. This is how all balanced audio should look including Op amp outputs.

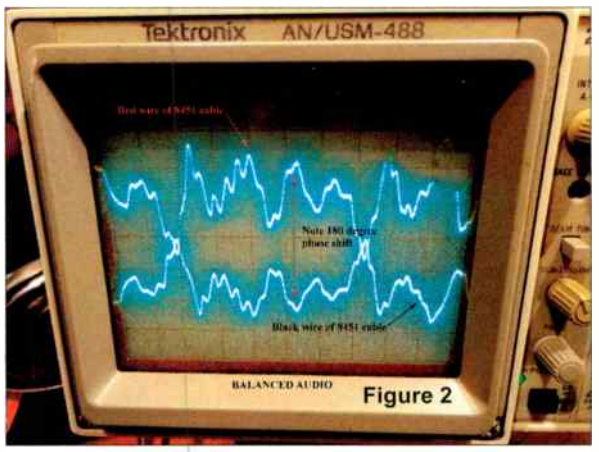

Figure 2

So, the moral of this long story is don't overlook the obvious. In this case, the audio was there, but the phase was changing on the input to the transmitter causing its internal differential amplifier to cancel out the audio as interference. Just poking around a circuit with an audio amplifier probe would not find such a condition, a two-channel scope and knowledge of how balanced audio works solved this persistent problem. The Gates 5 is purring like a kitten every day now. I hope this bit of knowledge saves someone the misery of what we went through to find this intermittent that turned out to be just a simple broken wire.

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

Inside the Box

Basics of Pallet Amplifiers

– Continued from Page 40 –

7. Biasing Circuit and Vcc – Not shown are the power supplies. A biasing circuit for the FET gates is a DC voltage derived from the Vcc. A surface mounted regulator IC is used in the circuit and the output of the IC is fed into a potentiometer which is connected to the gates of the FETs. The Vcc is connected to the drain leads of the FETs. In the past years, +32V is the most common supply voltages used but manufacturers have since migrated to 50V.

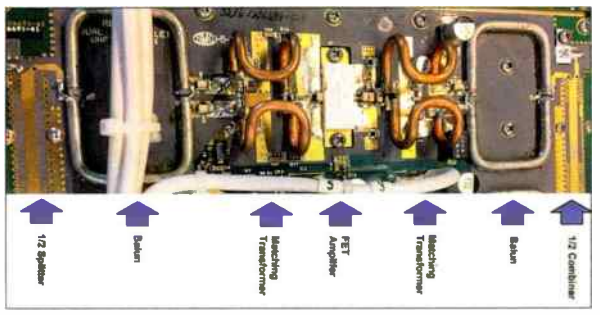

Figure. 4. The stages on the circuit of an MRF6P3300H pallet amplifier. Shown is half of the board. The other half is identical to this one. Notice that all of the passive devices are surface mounted components.

Figure 5 is a simplified schematic circuit of the MRF6P3300H dual FET pallet amplifier. The matching transformer and Balun are made up of miniature rigid lines while the combiner and splitter are made of microstrips. The input and output are 50 Ohms.

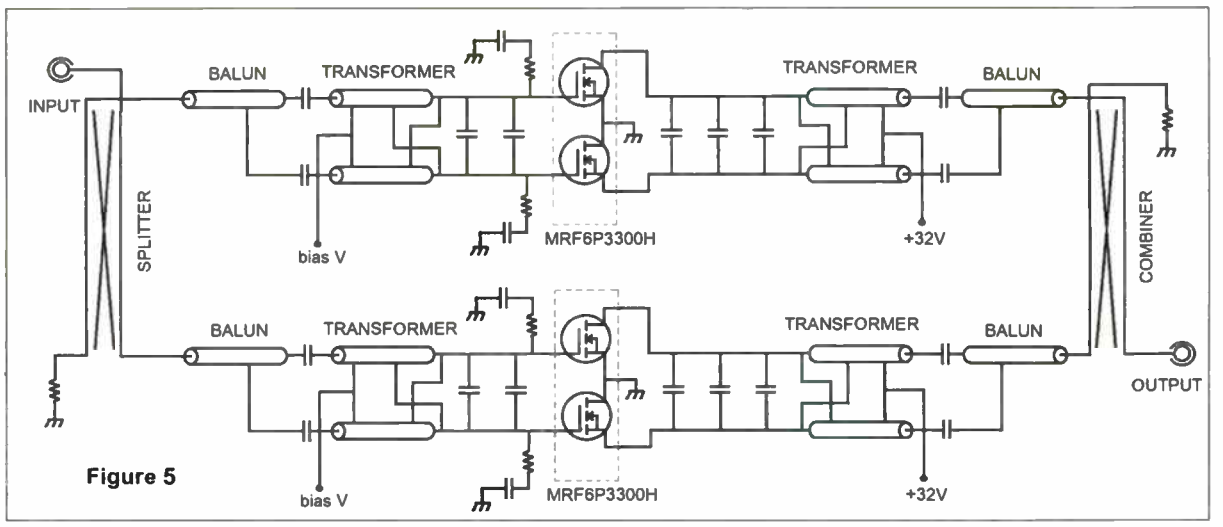

Figure 5

Troubleshooting

A critical part of using a pallet amplifier is the cooling of the transistors. While efficiency of switching amplifiers in AM can reach 90%, in FM about 60%, UHF transmitters with class AB pallets can only reach 20%. That is why these pallets are usually mounted on a large heatsink with axial fan blowers. Manufacturers switch to liquid cooling when higher power is required. The transistors are either bolted to the heatsink or it is soldered into a copper plate and the plate is bolted down to the heatsink surface. Many problems with pallet amplifiers are due to inadequate cooling. We think that if an amplifier works for the first time, it should run properly for the rest of its life. Unfortunately, electrolytic capacitors are used in in pallet amplifiers and these capacitors have a lifetime dependent upon the working temperature. If the heatsink temperature is high, the capacitors will a have shorter life. When the capacitors fail, often times it affects the nearby transistor as well. The gate circuit or the input side fails more often than the output side. It is important, therefore, that the drive level is not too hard on the amplifiers. Lightning or surge can also affect the pallets but antennas are DC grounded and the surge is always dissipated into all the modules, reducing the chance of damage.

In a transmitter, once you understand one pallet amplifier, then you understand all of them, because they are all the same. It is the part that is most numerous, and understanding them means understanding a large part of the equipment. Learning about them is surely a worthwhile endeavor.

Reference: SEMELAB PLC RF Application Note: Push-pull circuits and Wideband transformers. S.J McCarthy, with contributions from P. Smith, N. Padfield, and Dr. J. Walker

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

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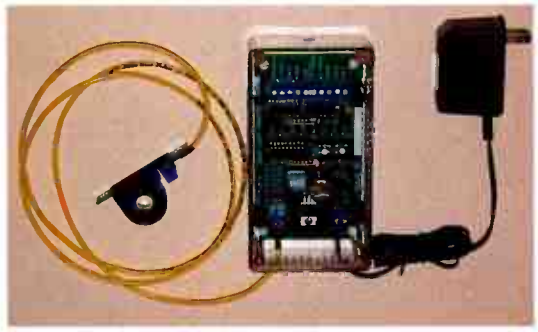

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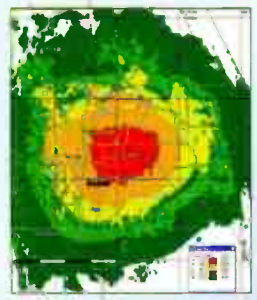

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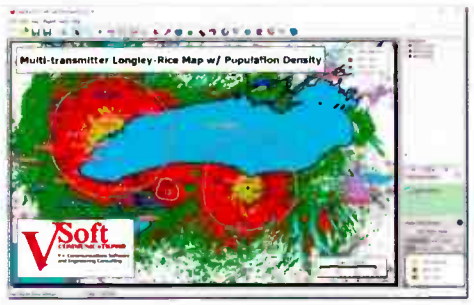

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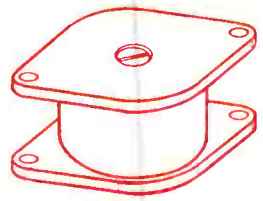

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Radio Station Automation. Depending upon how long you've been in radio, the name may bring up memories of several rack cabinets loaded with reel-to-reel tape decks, carousel cart decks or Insta-Carts, all controlled by stepping relays or the most basic keypad systems. The early automation systems were mostly used to split an FM away from an AM station.

Automation, back in the 60's and early 70's, was mechanical, problematic and not smart at all. One of the common problems was the twin cart tape decks with even and odd time announcements recorded on them. Every minute, one or the other machine would advance a continuous loop cartridge tape with simple time checks on it. For example, the recorded announcer would say, *"The current time is ten-oh-six."* Now if the tape failed to stop at the cue tone or was otherwise messed up, you would need to take the time announce function off-line, switch it to the cue speaker and push the cart start button until the right time came back around on the tape. What a pain! Most likely you were also *live* on the AM station and you had to keep running back and forth while those three minute 45's played in the control room.

Looking back on those first years in radio, I admit I liked working with those older automation systems. Even with all the problems, early automation had an attraction of sorts.

One small station I worked at had the Drake-Chenault "Solid Gold" Automated format on the FM while the AM played the current Top 40 with all live jocks. Drake-Chenault had a nice variety of automated formats.

Software based radio automation has been around for quite a while. At first it required the music to be compressed so it would occupy less room on those small hard drives. When G-Bytes and T-Bytes became available and affordable, more stations began to use uncompressed music. Of course, today, we have more that just the basic software automation. If you ever wished for an automation system where you could just rip in MP3's and program elements like jingles and sweepers, and have it work with very little effort on your part? Hang on, ***nextKast*** is here!

Winston Potgieter is the talented software engineer who developed nextKast automation. He designed it to run Internet radio stations – at least at first. This simple but powerful software soon developed a split personality and three different versions were the result. They are *Standard, Pro* and *Broadcast.* For the people operating hobby Internet radio stations, *Standard* will do nicely.

If you operate an LPFM, depending upon what you program, you'll want *Pro* or *Broadcast*. Commercial stations should take a good look at the *Broadcast* version. In an interview, I asked Winston what he would like to say about his software: "The learning curve on our software is much faster and easier than others but still yields the same professional results."

The price of the software is surprisingly affordable, and when you buy the software you'll get life-time free updates for your version. The software prices currently range roughly between $100 and $400. The Broadcast Version is fully integrated with MusicMaster.com, a industry leading scheduling software which provides real-time access to MusicMaster's database and scheduling intelligence. The two systems can communicate with each other for a seamless scheduling and playout experience. Right now, it will merge with Natural Log Traffic and Billing software, but writing other traffic merge software is planned for the future.

I downloaded the *Broadcast Demo Version* on my laptop and added about 1200 MP3 songs. I did take the time to put the songs in various categories – that took about two hours. Once the software started I was pleasantly surprised that the automatic crossover times sounded nicely tight. You can (and should) take the time to edit each song for the optimum cross fade and intro post points, but on it's own, the automation is okay about 95% of the time.

Nextkast has a built in Auto Gain Control, EQ and Audio Compressor. Regardless of levels, the audio is clean and consistent. Time and temperature announcements are easy, and several YouTube videos are available to help you get started. The system manual comes with the download. This software has many other features, and you should visit **nextkast.com** for more information.

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Final Stage

RADIO ROUNDUP

The Radio Guide Event Register

Email your dates and info to: ***radio@rconnect.com***

2020 CES Conference
January 7-10, 2020
Convention Center – Las Vegas, Nevada
https://ces.tech

2020 NRB Convention
March 25-28, 2020
Gaylord Opryland Resort – Nashville, Tennesee
www.nrbconvention.org

NATE Unite 2020
February 17-20, 2020
Raleigh, North Carolina
https://natehome.com/annual-conference/nate-unite-2020

NAB 2020 Spring Convention
Convention Center – Las Vegas, Nevada
April 19-22, 2020
www.nabshow.com

Texas Association of Broadcsters (TAB)
July 29-30, 2020
JW Marriot Downtown – Austin, Texas
www.tab.org/convention-and-trade-show

NAB Radio Show
September 13-16, 2020
Omni Nashville – Nashville, Tennessee
www.radioshowweb.com

Radio Guide Advertiser Info – November-December 2019

Advertiser - Page	Website
Altronic - 22	www.altronic.com
Angry Audio - 21	www.angryaudio.com
Arrakis - 9	www.arrakis-systems.com
Bay Country - 44	www.baycountry.com
Besco - 44	www.besco-int.com
BEXT - 42	www.bext.com
Broadcast Electronics - 28	www.bdcast.com
Broadcasters General Store - 25	www.bgs.cc
Broadcast Software Intl. - 11	www.bsiusa.com
Broadcast Tools - 39, 47	www.broadcasttools.com
CircuitWerkes - 29	www.circuitwerkes.com
Coaxial Dynamics - 37	www.coaxial.com
Davicom - 41	www.davicom.com
Deva - 34	www.devabroadcast.com
D&H Satellite - 30	www.dhsatellite.com
Econco Tubes - 41	www.enco.com
ESE - 47	www.ese-web.com
FM Services - 44	www.towermonitor.com
GatesAir - 13	www.gatesair.com
Graham Studios - 47	www.graham-studios.com
Henry Engineering - 2	www.henryeng.com
Ice Krackers - 44	www.icekrackers.com
Inovonics - 1, 17	www.inovon.com
Kintronic Labs - 37	www.kintronic.com
Lawo - 33	www.lawo.com
Lightner Electronics - 45	www.lightnerelectronics.com
Logitek - 15	www.logitekaudio.com
Mega Industries/MCI - 36	www.mcibroadcast.com
Nautel - 5, 19	www.nautel.com
Nicom - 43	www.nicomusa.com
Owl Engineering - 47	www.owleng.com
Phasetek - 46	www.phasetekinc.com
ProAudio.com - 48	www.proaudio.com
Propagation Systems (PSI) - 39	www.psibroadcast.com
Progressive Concepts - 3	www.progressive-concepts.com
Radio-Classifieds.com - 41, 45	www.radio-classifieds.com
RF Engineers - 44	www.rfengineers.com
RF Specialties/Nautel -43	www.rfspecialties.com
SCMS - 31	www.scmsinc.com
Shively - 32	www.shively.com
Smarts Broadcast Systems - 35	www.smartsbroadcast.com
Stackley Devices - 46	www.stackleydevices.com
Studio Items - 24	www.studioitems.com
Surcom - 44	www.surcom.com
Telos Axia - 27	www.telosalliance.com
Telos Omnia - 23	www.telosalliance.com
Tieline - 7	www.tieline.com
Titus Labs - 26	www.tituslabs.com
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