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Cover Story

The Simian Pro

From Broadcast Software International (BSI)

by Jody Brogan

The Simian system is far more than a just a radio automation system. It's truly about everything you really need in a radio studio. Though it is a full-function automation system that you can count on to work reliably 24/7, it's also an easy-to-use and full-featured live-assist system. A DJ behind the mic, with Simian in the front, has everything they need to do a great show. You want natural sounding time? It's there. Temperature? Yes! You want to run with a satellite provider and have a sound as good (or better) than a board op sitting in the studio? Simian can do all this easily ... and it's done it for years.

Simian isn't a free radio automation system, where you "get what you get" – and good luck with tech support. Nor does BSI nickel and dime you for every feature – including the things you'd expect. You want Simian to fire with the board? Of course ... and BSI won't tell you that will cost extra! Nor is Simian a system that will cost you the equivalent of an expensive car (as some do!). It's a full-featured system which *includes* all the bells and whistles, and it comes with professional broadcast tech support (on the rare instances you might need it).

When you are looking for an automation system, what do you want? You really want something that *doesn't* sound like automation. You want something the listeners can listen to and not know it's automation. You want something that doesn't "hiccup" on the air and is more reliable than that part-timer who failed to show up for his show – you want 24/7/365 reliability. It would almost be a lot easier to tell you want Simian *doesn't* do: It won't answer your phones. It won't shovel your sidewalks. It won't make you coffee. It will never show up with a hangover, nor complain about having to pull a double shift. These are the things it *won't* do!

It will perform flawlessly. It will interface with your satellite programming and sound live. It will mix songs, and do it *very* well! It can announce what's coming up with hooks of the song, or even announce brand new music. It can give the weather and accept updates automatically. You can remotely take control from your remote broadcast and not even need a board op at the station. Saying the time and temp are easy. You can rotate announcers and announcements – you can make things happen *on time*, *every time!* You can play a whole song without chopping it off to hit the network. If you need to automatically back-time into news or fixed events, that's no problem. Or if you want to increase speed and maintain pitch of audio to fill a window, Simian can do that too.

What Simian *can* do is incredible! It's a full-featured radio station that listeners truly can enjoy! It's not a jukebox or a glorified MP3 player. It's a professional broadcast system.

Simian began its life 15 years ago, and went through a significant revision just three years ago with Simian Pro. This upgrade included changes in networking ability to allow for multi-station use and sharing of resources. It also went from 32 bit to a 64bit/32bit engine, allowing for full compatibility on all current platforms of Windows.

Simian's reputation is built on reliability and ease of use. But it's also known to be one of the few truly full-featured, cost-effective digital systems available to broadcasters, from the largest markets to community stations. For smaller stations, that may not need every bell and whistle or gateway/remote clients, a less expensive version of Simian (Simian Lite) is also available. Whether it's Simian Pro or Simian Lite, users can expect excellent customer support for the rare instances of needing it. Documentation is well-written and easy to follow, and the actual software is very intuitive. Most users get the hang of it in an hour.

Interfacing Simian via computer to other station hardware, is fairly simple and user intuitive. Documentation is very thorough, so nearly everything you might want to do has probably already been done and documented.

For those wishing a "test drive," a demo version of Simian Pro can be download from BSI's website, so users can install it and work with it for one hour. It can be restarted as many times as you want, at one-hour increments, so self-training is easy. Simian Pro is a more advanced version with more features, while Simian Lite offers features most community stations need at a lower cost.

Here are just a few of the Simian Pro features:

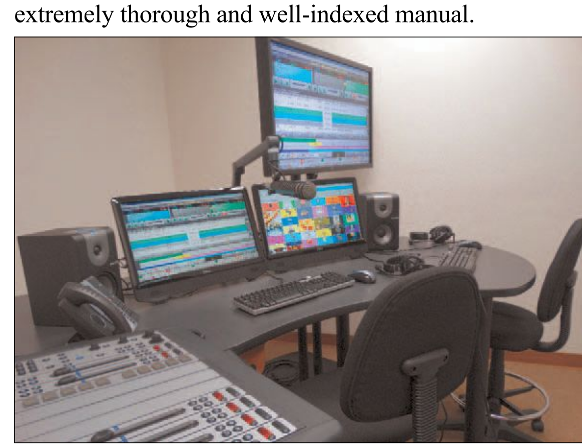
- Ability to remotely control the system via Gateway/Remote clients on iPhone, iPad, and PC.
- Full satellite rebroadcast handling.
- Relay control of external devices.
- Full bi-directional serial communications.
- 16 configurable pass-through mixers.
- Record Decks on-screen, for immediate, on-the-fly recordings *or* timed recordings.
- Backtiming and FlexTime features.
- Ability to retrieve and announce current weather information and display full forecasts to the DJ.
- Over 80 Macros that pretty much allow you to do anything you want.

Updated features within Simian Pro 2.3 include:

- A Simian File Sync Utility, allowing for your audio files and logs, trigger sets, hotkey sets, and more, to all automatically be synced and backed-up without the need for third-party software.
- Configurable Segue Fader Curve to set the shape of the fade of the segue including cross-fading.
- Hardware Connector Functionality for easier interfacing with popular broadcast consoles.
- Email Notification Engine for sending emails for errors (as chosen by you), so you are instantly updated to playback issues, missing files, program log changes, macro errors, or any number of changes or issues. Again, these are chosen by you.

With the many features all included, and easy-to-follow macros that can do more than you could imagine, voice-tracking, a necessity in today's radio world, couldn't be easier. Just as you'd expect, it's easy to voice track and make timing modifications so that "ramp is walked perfectly" – every time! Modification of logs is easy, and automatic. And whether it's a last-minute change from traffic or something new happening in the studio – some last minute cut-in – Simian automatically accepts the changes to the revised log.

Simian has a partner in the production version of Simian, so you can use an alternate studio to voice-track. Without human intervention, the on-air log automatically updates and the files get moved to air. All this is accomplished through a set-up that most competent engineers or IT people can accomplish, and many, many operators do without any assistance. Part of the reason this is possible is because of the extremely thorough and well-indexed manual.



Whether you are looking for a replacement for your old analog or digital automation, replacing your difficult to operate or unreliable system, tired of overpriced support or being "nickel and dimed" over features, or starting a new station, Simian is the answer to your station's success.

Jody Brogan is the president of Dover - New Philadelphia (OH) Educational Broadcasting, which is the parent organization of WDPE LPFM, an educational, non-profit radio station. Brogan, together with a small board and about 16 station volunteers, completely manage the entire operation of WDPE through Simian. Whether the station is running unattended overnight, or live/live assist with the morning show or any of the other numerous live shows, Simian gives the station a "big market sound" on a small market, non-commercial budget."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Engineer X

The Best Friend a Studio, or Manager, Could Have

by George Zahn

In this column, a slight departure from our listing of the pros and cons of various hardware and how they indeed can make our broadcast lives easier, and sometimes more complex at the same time. There's not a one of us that can't say we get a little tickle in the tummy when a new piece of gear arrives. Whether we're the manager paying for it, the talent using it, or the engineer connecting it, the equipment we highlight here is one of the driving forces behind what we do every day.

Sometimes to the point that we don't even think about that element of our profession being there for us every time we need it.

Today this column is about one of the other elements that drives us every day, even though these "entities" may be on the periphery for some of us. While they may not be as predictable and, some might say, dependable, as the equipment we use, they do what no equipment can: think and create, often taking unmanageable ideas and creating finished and functional products.

For now, I'm going to refer to this helpful element of our broadcast life as *"Engineer X."* Maybe you're lucky enough to know one, or maybe happy just to work with one. If you're still not sure whether you have, or know, an *Engineer X*, here are just a few quick identifiers:

The Basics

Engineer X has a flashlight, a Sharpie permanent marker, and a "greenie" – a precision screwdriver – available in pocket at all times.

Tool of the Trade – "The Greenie"

Engineer X will drive hundreds of miles to get a station back on the air, even if it's just finding a wasp nest in a busted LNB downconverter.

Engineer X can adjust deftly, when talking tech with other engineers or instructing the greenest of interns.

Engineer X is patient, even when finding snack chips inadvertently spilled into a CD player.

Engineer X builds everything, from the quietest distribution amps to simple passive direct boxes for music broadcasting.

Engineer X finds and creates systems that make set up of repeat events easier and more efficient.

Engineer X can pack two vans full of equipment into one van ... OK, maybe I'm exaggerating here.

Engineer X is always willing to check or double check automation systems and other key functions that allow other staff to have a social life. The common phrase of Engineer X is: "Weekend ... what's a weekend?"

Engineer X is always thinking, "How can we improve this," even when things are going well.

There's More

But *Engineer X* has to exceed those parameters, and that's what makes them *Engineer X*.

Engineer X can be found building home made Marti masts and deciding which way to deflect off distant surfaces to get the signal to the receive antenna.

Engineer X is just loco enough to wire a light bulb in sequence when no other parts were available on a late night emergency repair, buying time to keep a station on air until the right electronics could be purchased the next morning.

Engineer X devises a scheme that would become the direct-to-stereo radio recording, live sound effects production, monitors, and house sound for a national radio program recorded in a vintage theater. The system works flawlessly for more than one hundred recordings over the life of the nationally-distributed show.

Engineer X will express cautious pessimism as you describe what seems like an "unmake-able" device, only for you to discover the device to be working, tested, and on your desk a few days later.

When the station needs a "multiple" mix-minus device, one mix minus for a standard phone hybrid, and others for ISDN or CODEC lines, *Engineer X* makes one box that does it all.

Engineer X finds a way of using the anachronistic, modifying old unused cart machines to play individual legal IDs at each remote station in a network with the press of one button at the flagship studio.

While on that topic, *Engineer X* looks at a satellite control system with eight simple control channels. The problem is the network needs more than a dozen options. *Engineer X* simply creates an encode box for the studio and a decode box for each station, using the eight control channels in a hexadecimal scheme that gives more than enough control and switching options.

Engineer X creates a "Cry Baby" tone generator that attaches to the remote end of a dedicated phone circuit to keep "Ma Bell" from accidentally disconnecting the circuit and allowing the station to check the circuit on the station side at any time.

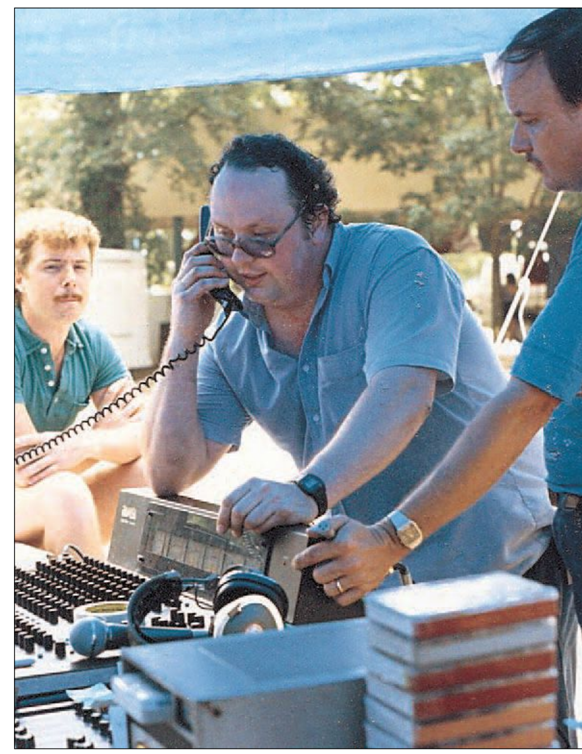
Engineer X assists and leads a team helping to clear a 450 foot cable path up the side of a heavily-wooded mountain to place an RPU transmitter and antenna at the peak, sending signal to another tower across town – then relaying back to the home station. All this for just a singular, one-day jazz festival event.

Engineer X designs the layout, and leads a team undertaking a monstrous broadcast of an annual holiday fireworks display, with remote broadcast setups at multiple venues around his city, including PA at each audience venue for one of a largest local broadcast events.

After doing this for years, legend has it that, after E*ngineer X* was let go because of supposedly being "too old" to do all that set up, the successor, many years younger, suffered severe health issues immediately after the new engineer's first attempt.

Maybe these examples have brought memories to mind from your own engineering interactions. If these don't conjure up similar stories, you may not have been lucky enough to have worked with *Engineer X.* If even a few of these instances have made you remember a colleague or friend from the past or present, you know how fortunate you are to have encountered *Engineer X*. If your *Engineer X* is gone, I feel your loss, and the profound void of trying to replace a broadcast guru, true professional, mastermind, and friend.

In sharing just some stories of my *Engineer X,* the late Jay Crawford, who worked for countless radio stations across the Midwest, I hope that all of us as broadcasters can take stock of how we have been so professionally affected by the engineers who have worked so hard, both in predictable and sometimes wildly unorthodox methods, to make broadcasting better and to improve our stations.



Jay Crawford (*1950-2016*) at a remote, when Xavier University operated WVXU-FM.
From WVXU.org Website – Credit, Mark Tipton

I hope each of you reading this has encountered an *Engineer X* in your career. Just as any hometown recipe, we each feel that we have the inside track on "the best." In my opinion, it's like comparing Babe Ruth and Hank Aaron – different external conditions, different eras may yield different results. But to have simply experienced from them and learned from them – in my case from Jay – has been one of the greatest joys of my life.

My loss is recent, and it's been difficult to write about it, but if you're lucky enough to have your *Engineer X,* tell them you appreciate what they do. If you've lost your *Engineer X,* I hope you'll keep their legacy alive by sharing their stories and celebrating what the best engineers bring to our lives every day ... and into the future, by the innovations they have made in their lifetime, that will affect lifetimes to come. We stand on their shoulders. Thank you, Jay Crawford and each and every *Engineer X.*

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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Transmitter Site

A Continental Upgrade

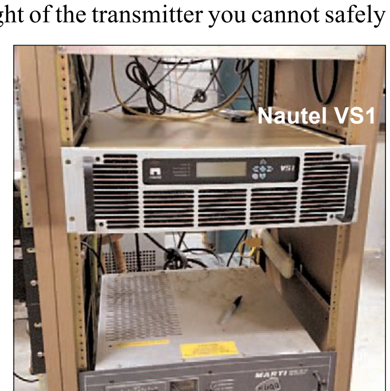
Replacing the Exciter and IPA With a Nautel VS1

by Mike Hendrickson

A few weeks ago I received a call from Steve Heaton of Community First Broadcasters. Steve and I worked together for about 20 years. Together we installed a Continental 816R2B 21.5 kilowatt transmitter at KUOO (FM) in Spirit Lake, Iowa in 1990. This transmitter has been an excellent performer and has not needed much maintenance, aside of replacing the PA tube. The only problem that I can recall occurring with this transmitter was the PA blower motor failing due to a blown fuse a couple of years after the installation of the transmitter.

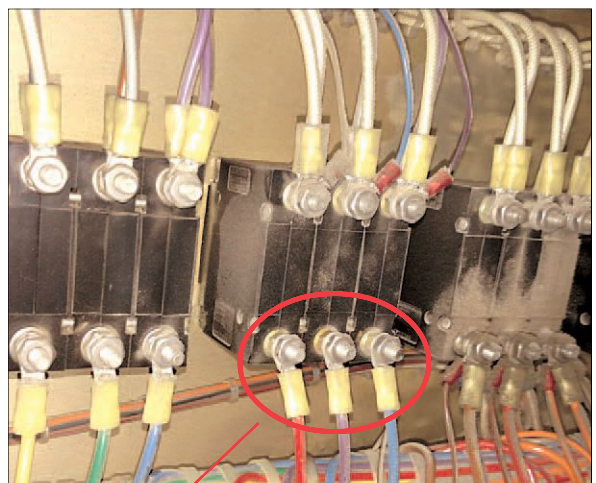
Even though the transmitter has worked well for 26 years, recently it developed some problems. Steve noticed that the PA tuning had become difficult to maintain. There was also a lot of AM noise and the IPA output had dropped to 25% of the normal value. He contacted Continental to find out about repairs or replacement of the IPA. Continental informed him that the parts were no longer available to complete repairs and recommended replacement of the entire IPA of the transmitter. He was informed that the cost would be roughly about $6,000. After investigating his options Steve decided the best route to take would be to replace both the IPA and exciter with a Nautel VS1, 1 kilowatt transmitter. The cost for the Nautel transmitter, which included a built-in exciter, was in the same price range as the IPA from Continental. By installing the Nautel transmitter as the exciter and IPA, Steve gained the advantages that go with a recently designed and manufactured exciter.

The existing installation of the Continental transmitter had the exciter located in an adjacent equipment rack. Steve decided that the existing exciter should be removed and the VS1 installed in the now vacant space. The only problem we ran into was that the VS1 is over 26 inches deep – and the rack was 26 inches deep. This made installing the rack rails difficult, but it was accomplished. Because of the weight of the transmitter you cannot safely install the transmitter using only the front panel rack mounting screws. You also want it on the rack rails to permit you to slide the unit out in the unlikely event you need to service it.



The location of the VS1 did present the problem of getting electrical power to the VS1. The VS1 requires 180 to 264 volts, but the racks had been wired with 120 volts. Initially we had decided to power the Nautel transmitter on a circuit breaker from the building power circuit breaker panel. However, after we had inspected the existing installation, we realized there was a better way of powering the VS1. That was to run power from the driver power supply circuit breaker in the Continental transmitter to the VS1. Since the VS1 was going to be running at 400 Watts and the power source was 208 Volts AC, the power consumption, according to the factory data, would be about 5 Amps. The circuit breaker in the Continental transmitter is a three pole 10 Amp device. We would only be using two of the three poles of the breaker.

Driver Circuit Breaker - Rear View



This fed the existing driver power supply.

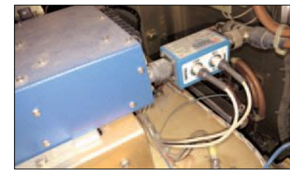
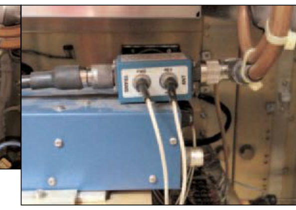
Back of Continental power distribution and circuit breaker panel.

We made the AC power connection by removing the wires on the load side of the IPA breaker. These wires are on the lower side of the breaker and are red, violet, and blue. The lugs on the wires were covered with tape and the wires secured to prevent accidently contacting a live connection. Since we only needed 208 VAC single phase, we connected to only two of the breaker lugs. The new wiring was routed along an existing cable bundle and routed through the conduit that connected the transmitter to the equipment rack.

The removal of the wires from the breaker disabled the IPA shelf, amplifier and metering. We discovered, after we had made the changes, that we should have made another change as well. The metering for forward and reflected power in the transmitter is done by an active, rather than passive, wattmeter. When we disconnected the power to the IPA shelf we disabled the IPA power metering. This was a matter of convenience and not safety, since the VS1 has an internal power meter and VSWR fold back protection.

We examined the schematic and determined that the metering could be restored by supplying power to the IPA metering card from the transmitter's 28 Volt supply. The original voltage supplied to the card was an unregulated 40 VDC. There is a voltage regulator on the card to lower the voltage to 12 Volts. Thus the 28 Volt would work quite well. The load on the 28 Volt supply would only be a few milliamps.

The existing installation had a RG-58 coax cable between the exciter output in the external rack and the IPA input in the Continental transmitter. We replaced this coax with an RG-213 coax that would handle the higher power necessary to drive the PA tube – the cable came with the mating DIN connector already installed. The existing driver shelf in the Continental has a directional coupler connected directly to the output of the IPA. We connected the RG-213 coax to the directional coupler in place of the failed IPA. This left the 1/4 wavelength shorting stub that was factory installed between the existing IPA and the PA intact. I highly recommend leaving the shorting stub intact as this is protection for either the internal driver or external driver against any arc over or high voltage being applied to the input connection of the PA.

Before – After (L-R)

Since the VS1 would be located externally, there had to be a connection to the transmitter to mute the RF output when the plate of the Continental was off. This muting function serves to protect the VS1 from a bad load. It protects the PA tube from damaging the grid, and it prevents any unintentional RF radiation to the antenna.

The muting connection really turned out to be easy. Remember how you have always been told, that if you need to install a control relay, *always* have more contacts available than you think you will need. Twenty six years ago when we were installing the transmitter we needed to have a relay interface between the Continental transmitter and the Moseley MRC-1600 remote control (since retired). The interface provided a set of dry contacts for the status display on the remote control. The relay that was used was a 4PDT relay, so we had 4 dry contacts from the relay. One set of dry contacts was available to mute the VS1 transmitter. We simply had to run a pair of wires from the remote control interface punch blocks in the adjacent rack to the DB connector on the VS1, and the muting connection was installed.

The final connections were the IP connection and the audio inputs. The audio input connection was accomplished by moving the composite audio connection from the old exciter to the composite input of the VS1. The IP connection was just a matter of installing the network cable between the router and the VS1.

After all of the physical installation was completed, the final step was to complete the adjustment of the VS1. This was accomplished through the LCD User Interface of the VS1 or the networked Advanced User Interface. The setup included setting the date and time displayed by the transmitter. We also set the frequency, power limits of the VS1, and the input connection that is used.

For the initial testing of the installation, we turned off the RF on the VS1, and disabled the high voltage on the Continental. We then turned on and off the Continental plate and verified that the RF muting control supplied to the VS1 was working correctly. We then turned the Continental off, enabled the high voltage, and turned on the VS1 RF. We set the upper power limit on the VS1 to no more than 100W. The Continental plate was turn on. After we verified that the transmitter was operating properly at low power we turned it off. The VS1 was adjusted for an upper power limit of 400W. The Continental transmitter was back on and adjusted for a normal power output. All of the readings on the Continental transmitter were back to normal and the transmitter problems had been eliminated.

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

Called Out on STL Dishes

by Wiely Boswell

So the 3:00 a.m. call comes in and you are now called out. There is a silence alarm on two of your stations. You have a good alarm system, and even front-of-rack cameras, so you quickly narrow down the problem to an STL digital receive lock issue at the transmitter. Then you are off – on the way to the transmitter site while listening to the radio.

Then, what seems to happen way to often, while in route, it clears up. You keep on to the transmitter site, but now everything has come back up and looks good. You have your Internet backup ready to get the stations back up and going quickly, if it drops again. You are thinking that it was just some sort of glitch, so you leave the audio running on the STL.

At the studio the next day, you are keeping a close eye on the problem and wondering what might be killing the signal. How do you approach an intermittent problem such as this? It could be on the transmit end, even though power and SWR look good. The possibility of interference comes up – perhaps late night conditions brought in another digital STL signal that was fighting it and causing enough errors to prevent sync lock. Maybe it is an analog signal?

The nature of digital STLs can add some difficulty to the troubleshooting procedure. Swapping known, good working units can certainly eliminate the equipment as the cause. To have same-type, spare working digital STL transmitters and receivers are an expensive luxury. I have access to a lot more old, spare composite analog STL pairs than digital pairs, to help resolve issues. It is always good to have friends in the industry around town, to help with spare equipment, and know who has what equipment available for loan. This is certainly a benefit of being part of your local SBE chapter.

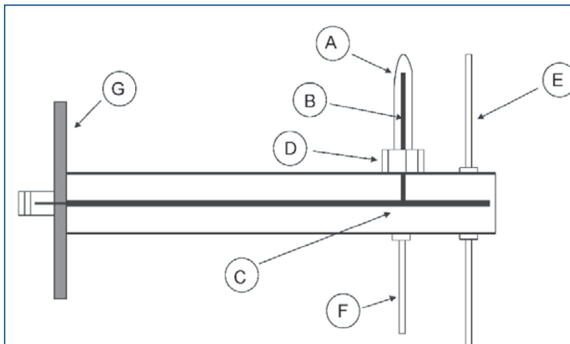
So nothing interrupted the signal during the next day, but at about 3:00 a.m. the next night it happened again – it went out at almost the same time! This time I got to the site to look at it during the outage and it had a signal – but apparently not enough to lock the receiver. Back to Internet audio, and now something had to be done to find the problem. So I went up the tower at the transmitter site the next day. Once at the receive dish, it was an easy first test – I just lightly bumped the "feed horn." Sure enough, the receive audio dropped off instantly! (I can see how the term feed horn may not be a totally accurate description for a dipole suspended by a pipe.)

My next step was to be sure I was on the backup Internet audio feed (again, a luxury). I unhooked the feed line and unbolted the feed assembly, which thankfully came right out through the dish, and out the back (on this model.) I was careful with the feed assembly, not to damage the radome. With other dish designs, it may not be that easy to remove, having to come off from the front. I made a note of polarization and checked the RF connectors for water and corrosion, when I disconnected the feedline from the feed assembly connection.

Once back on the ground, the feed assembly was taken apart and the water just poured out.

It was a good design, in that the center conductor and driven element were brass to reduce corrosion in the presence of all that moisture. There is a good reason larger antenna bays are under pressurization with nitrogen.

In this case, the N connector was able to be separated from the flange – it had an O-ring seal – and disconnected from the center conductor. It was simply a press fit into the long center conductor. Other models may require the driven element to be disconnected first, and the center conductor comes out with the N connector.



Typical STL Feed Horn Construction

The driven element "B" screws into center conductor at "C" allowing the center conductor to be removed.

The Teflon radome at "A" protects the driven element. The seal on the radome is made by compression nut "D." The radome must be removed first to unscrew the driven element. (Not all antennas come apart in exactly the same way.) Another design type has a threaded radome which screws into a fitting on the arm. It must be carefully unscrewed, and later sealed with a sealant.

Reflector "E" and passive element "F" are connected to the feed assembly arm and are thus grounded. There should be little chance of a leak at these points, as they are typically welded to the support arm.

The parts must be cleaned up and dried out, once apart. Keep up with any O-rings that may be behind the N connector and add O-ring grease. Cleaning the arm tube reminds me of cleaning a shotgun, so if you have some of those tools, you should bring them. Other wise, use a piece of cloth wrapped around a stiff wire to run up the tube.

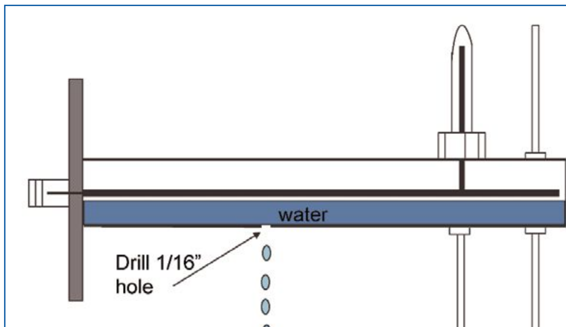


Figure 2

Figure 2 shows water in the assembly about to kill the signal. There is a *last ditch emergency* effort to resolve this problem. A 1/16 inch hole can be drilled in the bottom of the feed assembly that will allow the water to drain out, to get you back on the air quickly.

When the antenna is positioned to vertical polarity, the question is, should the radome point up or down? I have seen manufacturer photos showing it pointing both up or down – no real mention is made if there is a preference. If the radome points down, and gets water in it, will take less water before the assembly becomes shorted to ground. And if a freeze occurs, the radome could be damaged.On the other hand, I saw one recently that had the radome missing, was also pointed down, and it has had no problems, because the water drained right out of the assembly. But if that radome was pointed up, the assembly would fill right up the next time it rained. If insects do not move in you might be OK. But even those on a really tight budget can resolve this type of problem without spending a lot of money, especially if you have someone to climb.

Back to our case example – our receive signal strength came up and locked on solid. Now we know where the receive threshold is and we have a lot of headroom.

I find it useful to cut tiny triangle arrows out of station bumper stickers and place them on various meters at their normal levels. Later if you have a non-experienced person on site during a problem, it is easier to talk them through looking at meters. Or if something very slowly drifts, you will notice something is happening.

Why does this water seal issue happen in the first place? Have you ever seen how an empty water bottle crushes in when it gets cold? In this case the vacuum created pulls in on the sealed container walls. So what happens when the structure such as a feed assembly does not give? The vacuum can increase to the point where air makes it past the seals. Then, if water is present at the seal, it sucks it right in. Seals tend to leak with age. Take a hot summer day, the pressure will increase and some air may be forced out past the seals. Then a rain storm comes up and quickly cools off the sealed device, bringing in water. The more volume of air which is contained in a device, then the more expansion and contraction of the air will take place. All this expansion and contraction can put stress on seals as well.

Hopefully some of this will help you as you have to address STL problems.

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

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Chief Engineer

Hide Those Wires!

Or ... Now You See 'Em, Now You Don't

by Scott Schmeling

Happy New Year, everybody! I hope your holidays were all that you wanted them to be.

In the last edition (way last year) I told you about the flooding that occurred at one of our transmitter sites last September. All the stations involved are now back to full power. That site has flooded twice now, and that's two times too many!

We have plans to, hopefully, prevent flood damage in the future. In the AM building, we have raised the roof about 6 feet. In a few weeks we will be raising the floor well above the water levels. It should be very interesting. I *will* take pictures! It is possible the water might go above the base insulator, taking the station off the air, but transmitter damage should be prevented.

Over at the FM building we plan to bring in adequate fill to allow us to construct a new building above that high water mark. The hope is we will *never* have to go through that again. And I hope *you* never have to!

OK – on to the next project.

Early last year we bought another radio station. (Just to be clear, by "we," I mean, the people I work for.) Part of the agreement was that we had to move the studios by February 1, 2017. I really don't mind. Studio construction is one of my favorite aspects of this job. I love creating a new and efficient work space.

One early comment from ownership was they didn't want to ... "see any wires!" First, let me say that *wires* in a radio station are like *plates* in a restaurant. Plates carry the food in a restaurant like wires carry the audio in a studio. But, yes, concealing the wiring certainly would make a studio more attractive. In many of my studios, the punch blocks are mounted somewhere below the counter tops – but they're still visible. And to make any changes, I have to sit on the floor and crouch under the counter. The lighting is poor and it's rather uncomfortable.

However, in one studio remodeled in 2010, we did a "Wiring Closet" concept, with the punch blocks mounted *inside* a cabinet. It's very attractive, wires are concealed, *and*, when changes have to be made, I can stand upright and do whatever is needed! Maybe it's time for another Wiring Closet.

The cabinet from 2010 measures approximately 24" wide, 51" high, and about 12-1/2" deep, and essentially sits on the beautiful Cambria Quartz countertop of a sit-down studio. I would want something similar. However, I'm building a stand-up studio so some of the dimensions will be different. Checking with the contractor, I learned that a custom cabinet of the desired dimensions would cost about $3,000 – and I would need *two* of them!

I knew $6,000 would never fly, so I started searching elsewhere. I was thinking there should be something available in one of the home improvement stores. Build-it-yourself closet systems, for example, are available everywhere. I found systems at Lowe's and Home Depot that were close, but not exactly what I wanted.

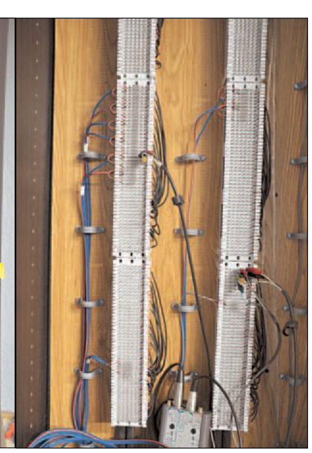
Here in the Midwest, we have a chain called Menard's (menards.com). The Menard's flyer in my Sunday paper showed a system from Dakota Closets that looked like just what I was looking for. Uprights available up to 86-1/2 inches (pretty close to floor to ceiling), and shelf packs 24-inches wide and 14-inches deep. That was just about perfect! Some of the options are 20 and 40-inch doors, 5 and 10 inch drawers, plus others for closets, like shoe racks and closet rods (but I didn't need those). The system is modular, so you can configure what you want to fit your needs. I was able to build exactly what I wanted for something around $500 – for *both!*

An Economical Wire Cabinet

I chose the Java finish. It's a dark wood that should go well with the wood trim at the new location. I also decided on the wall mounting option rather than floor standing. The hang track was positioned on the wall so the unit would be down 1-inch from the ceiling and up 6-1/2 inches from the floor. By doing this, there was no need for a toe-space on the bottom.

Assembly was much the same as any flat-pack furniture. The only tools I really needed were a Phillips screwdriver and a level. Holes were pre-drilled every inch-and-a-quarter. I had to screw the *cam dowels* in the desired locations in the uprights, put the *cam locks* into the pre-drilled holes in the shelf pieces, then simply seat the shelf onto the cam dowels, turning the *cam locks* a half-turn with a Phillips screwdriver. The drawers took a little more, but that's not really what this article is about. By the way, there are two 10-inch drawers and a shelf for binders, etc. that fill the rest of the space.

Partial Wiring in Place



A Closer View

The doors come in 20 and 40 inch lengths. I wanted something about 50 inches for my punch blocks, so I chose the 40 inch doors and added a 10 inch drawer *front* (not the entire drawer) at the top to give me the space I wanted. (This drawer front is not in place as I submit this article.)

For a solid mounting base for the punch blocks, I used a piece of 23-1/4 inch deep bull nose shelving, cut to the length I wanted. (I chose Honey Oak because I think it's really a nice looking finish – but plain white might have been better here!) The shelving piece was screwed to the studs and punch block risers screwed to the shelving.

When I'm planning where things will mount, I use a *lot* of blue painter's tape. I think it's fabulous! I set things approximately where they will be, check spacing, make adjustments, then put down the tape and get out the square and level, and a Sharpie! After everything is marked, I drill a pilot hole before I put any screws into the wood. This way, everything is nice and square, and evenly spaced.

Nice and Square with Blue Tape

Cable access is a 2-1/2 inch hole I cut in the back left corner of the top of the cabinet. The ceiling tile has a hole directly above this hole. Since there's only an inch between the cabinet and the ceiling, those cables are not visible.

Inside the cabinet I use PVC conduit clamps for cable management. I have them in sizes from 1/2-inch to 2 inches. They work very well for keeping all those runs of audio cable together and looking as neat as possible.

Under the Console

Below each column of punch blocks I have another hole for cable entrance/exit. All of the 20-pair, and the two-pair cables, between the punch blocks and the console inputs and outputs and the various pieces of source equipment, exit below their punch blocks – then to the right and through a hole below counter level, through more conduit clamps.

I can't show you any "finished product" pictures because we're still in construction, which should explain the alligator clips and the tone generators and test meters. The owner is happy because he can't see any of the wires and I'm happy because I don't have to crouch down under a counter to punch cables. I guess that makes it a win - win!

I hope you've found this information useful 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

Practical Engineering

Never Assume Ground is Ground

by Michael Bradford

You know how the story begins ... "It was a dark and stormy night." We engineers often start our stories with that line from long-ago – all too often the stories actually begin that way. Well, it was just such a night when I got a call from a client station here in Michigan, with a complaint that there was hum in the audio everywhere! I grabbed the travel mug from under the coffee machine and headed out into the storm.

Upon getting close enough to hear this little Class A FM's signal, I heard no hum – just clean audio amidst the lightning flashes and frequent thunder booms. "This could be good news or this could be bad news," I thought. Upon arrival, I dashed into the front door and headed around the corner into the control room, to find the station on "auto pilot" and a note on the computer screen. It read, "Couldn't stay to talk, hum in headphones on all channels, I need food." Well, this was hardly a high-tech note, but I got started by plugging in the headphones lying on the counter top. Sure enough, there was hum in all the audio sources on the good old Auditronics 2500 series console.

I noticed, as I moved around with the headphones on, that the hum got better or worse depending on where I stood. This could be entertaining, I thought. I coiled up the long headphone cable and the hum almost went away. I punched the "auxiliary send" button nearby and sent the production room output to the FM transmitter so I could work on the console. I turned off the console primary power, got the extender card from the "Audi" parts box, and noticed a note printed on the circuit board: *"Remove this circuit board from the holder for certain modules."* Of course, the headphone module was one of them. I removed the circuit board as warned and installed it onto the headphone module, then plugged in the assembly and turned the power back on to the board.

The hum was just as loud as before, so I started to look around for something obvious on the module; no bulged capacitors, no burned resistors, no hanging wires to be found. I noticed when I touched the metal front-panel on the module that the hum was less. I used a jumper cord from the tool box to connect the console frame to the module front panel and the hum was even less. I noticed that the mounting holes on the module were threaded inserts and there was paint on the surface where the module met the frame. I then touched the jumper cord to the ground wire on the headphone jack and the hum was almost inaudible.

About this time, I decided on a course of action – I powered down the console and removed the module. I used a small file to remove the paint from the module mounting studs and on that portion of the frame where it mounted. I drilled a small hole on the front panel and scraped the paint off on the back-side of the panel. I installed a small 6/32 screw (see **Fig 1**) and, using a short length of wire and a soldered-on spade terminal, I soldered the other end to the ground connection on the headphone jack (see **Fig 2**)

I plugged in the modified assembly and turned on the power ... no hum! I also noticed the cue speaker audio was clean too. I put the travel mug into the microwave for a shot of heat and began to think ... "What is actually going on here?" There could be a "grounding" issue somewhere associated with the installation of the console. As long as the prod room was sending programming to the FM, I took a wooden panel off from underneath the console and began looking around for the ground strap. I found a 2-inch copper strap connected to a 1/4-inch bolt on the bottom of the console and followed it down and under the punch blocks and through the wall into the adjacent room. I tugged on the strap and it came loose in my hand! This *could* be an issue. I stuffed the strap back under the wall and went into the next room to investigate.

Figure 1 – Grounding Screw Installed

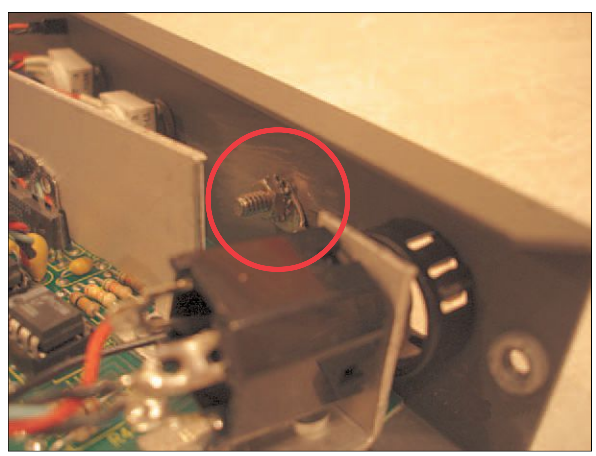


Figure 2 – Inside View of Screw with Lug

There was another 2-inch strap lying on the floor, that went through the cement outside wall and outdoors. I used my VOM to check between that strap and the nearby AC service panel ground and found only a fraction of an Ohm difference. (I also noticed the 2-inch strap soldered to a 4-inch strap outside, that headed out to the tower base). I used a steel brush to clean both ends of the 2-inch strap and bent about 1-inch of strap over on each piece – the one from the control room console and the one going outdoors. I smeared some silver soldering on each end and overlapped the bends, hammering them down for a tight fit. I used my 2% sil-phos solder and small torch to solder the ends together.

I was feeling good about finding the phantom ends, and trotted back into the control room for a final check. As I was tugging on the ground strap, I noticed that it was loose, where it connected to that 1/4-inch screw on the console bottom. I also noticed that this screw was not factory-installed. I removed the screw and cleaned the paint off both top and bottom sides of the console "tub." I put everything back together, adding a "star washer" and a flat washer, and tightened the screw with a wrench for a secure connection. With the wooden panel back in place, I plugged in the headphones and listened to all the inputs – all were clean, with no change as I moved about with the headphones on. I was satisfied that I had found and repaired several "ground" issues. I returned the main console to "send" for the FM programming, left a note for the morning man, and headed back into the storm outside.

Three days later, I got a call from Juli, the "Girl Friday" at the station, telling me that the hum was back! I was not happy.

I arrived that evening to begin yet another search, believing there was yet another "ground" that wasn't "ground." I checked all the previous areas and found nothing amiss. I popped the top on the console and checked the voltages on the internal power supply; the DC values were exactly +/- 15 VDC as expected. I switched the scale on the VOM to AC mode and checked the voltages again. This time I found substantial AC on the "minus" buss. I used my old "butt" set and listened to each DC output and heard that hum loud and clear! Luckily, I had a spare power supply (see **Fig 3**) and exchanged it for the original in about half an hour. Now the audio was clean everywhere.

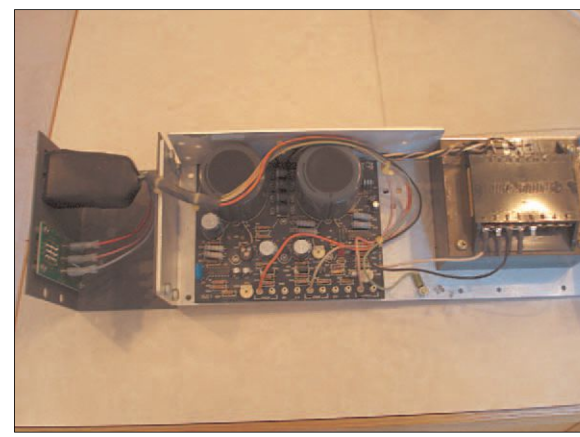


Figure 3 – Spare Power Supply

I began to suspect that the power supply was the main source of the hum along, and turning the power on and off several times during my previous adventure caused the filter caps to "reset" for a short time. I called Lightner Electronics the next morning and got a capacitor rebuild kit on the way (see **Fig 4**).

Figure 4 – Capacitor Rebuild Kit

Well, there you have it: Don't assume ground is actually ground where hum (or RF bleed-through for that matter) is the problem.

Keeps your soldering iron dry and never pass up coffee with a fellow engineer. Till next time.

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

Small Market Guide

Testing Switchmod Cards in AM Transmitters

by Roger Paskvan

This article is about servicing and testing the modulator cards in PDM transmitters. Most of the AM broadcast world has migrated to class D modulation that utilizes a width modulated square wave to control the modulation percentage in AM transmitters. This article is a solution to servicing troublesome switchmod cards found in the Collins 828 and Continental 315 AM transmitters. Fortunately, Continental still stands behind this series of transmitter and does an excellent job of fixing these cards, but you're off the air until it gets returned.

The power supply is straight forward – a diode bridge, electrolytic filters and bleeder resistors on the end for safety. (**Refer to schematic, Figure 2**) Adjust the Variac or series resistor for 125 Volts DC under load with the card in-place. The test card draws about one Amp off the power line and the 1.5 A fuse should be adequate. The edge connector was difficult to find. If you purchase the one in the parts list, you will need four (4) segments to make all 12 pins that the card requires. They just snap together.

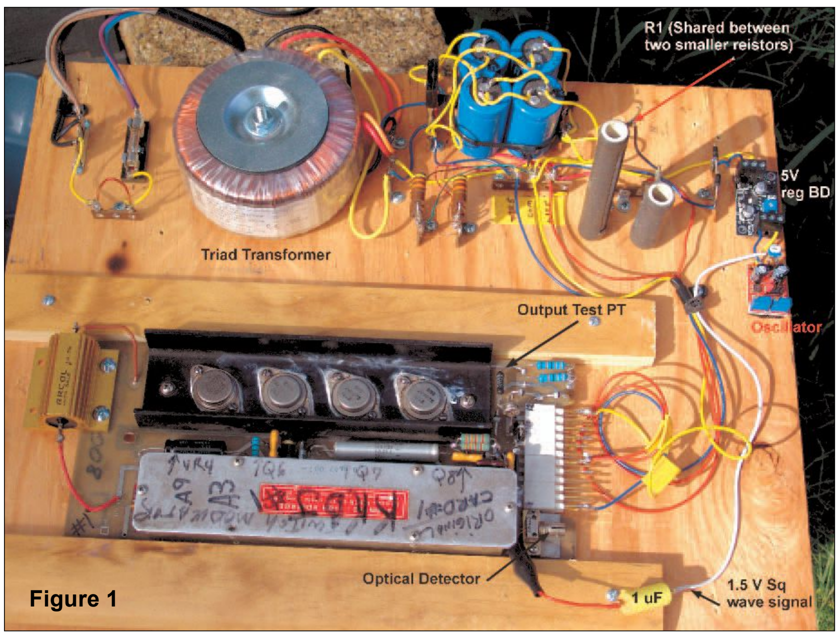


Figure 1

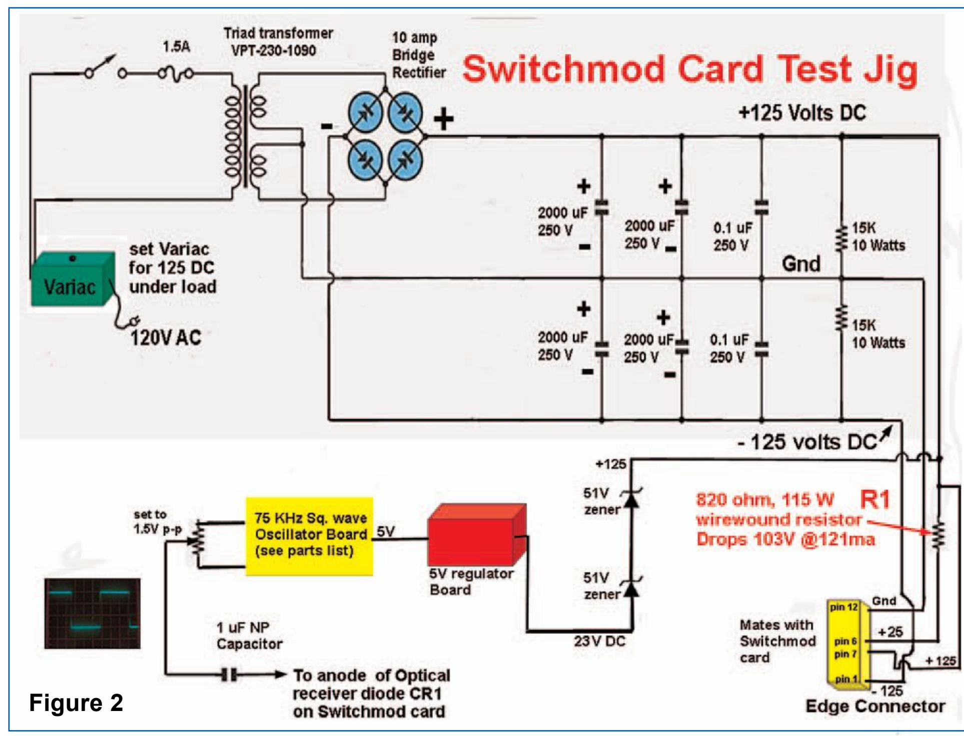


Figure 2

The problem with troubleshooting and repairing these switchmod cards comes from the fact that, in the transmitter, the 13,500 VDC supply is present on the card components. This makes it dangerous to use a voltmeter or scope for troubleshooting. Late one night, in my haste to get us back on the air during a football game, I received a 13,000 Volt shock through my voltmeter probe, that formed a whole new line of respect for this card. I decided that there must be a better way to troubleshoot the card without getting yourself killed.

This switchmod board operates by basically turning on/off a 225 Volt pulse at the output, when all is working well. The card circuitry uses +/- 125 Volts to switch the output transistors. The card is fed through an opto- isolator utilizing a fiber optic cable, to get the 1.5 Volt modulated square wave into the board, therefore keeping the 13,000 Volts out of the pre-audio stages – since plastic fiber optic cable is a non-conductor. These switchmod cards are a linear square wave regenerator/amplifier designed to control the post modulator tube or transistor output stages.

My test fixture is built on a stock of plywood with two boards to hold the test card firmly in place. All connections to the test card are made through the edge connector but the input signal is clipped to the opto- isolator receiver diode. Build the power supply on the top part of the board and the low voltage regulator/oscillator to the right side, since this will keep the leads to the card short. The +/-125 volts is set and regulated by an AC Variac which I found on Ebay for $25. If you choose not to use the Variac, a series 25 Ohm, 100W wire wound resistor in place of the Variac will work but it does get quite hot. (**See Figure 1**)

To simulate the PCM input signal that drives this card, I used a variable 555 oscillator board that had the capabilities of emitting a 75 kHz square wave. This is what the card fiber optic receiver wants to see.

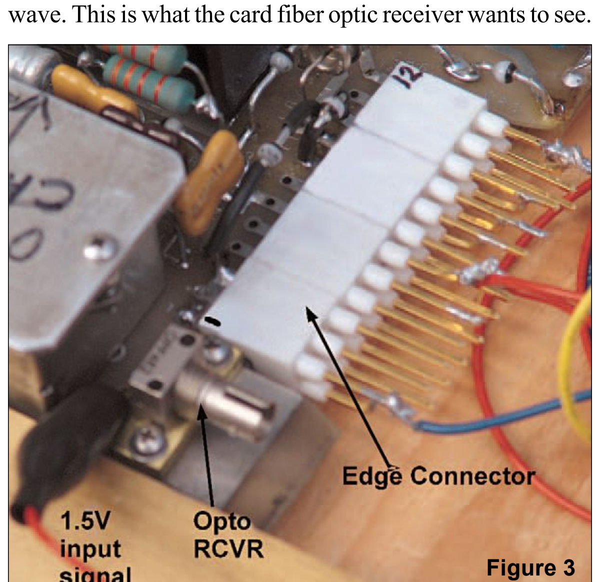


Figure 3

Since we are not utilizing light, clip to the anode of the optic diode. The 1 uF non-polar capacitor isolates the oscillator from the card DC. The small pot at the output adjusts the signal to 1.5 V P-P. This oscillator board is powered from the +125 volts, stepped down through two 51 V zener diodes in series, and then regulated through a LM317 board to 5 Volts to run the oscillator. Current draw is less than 50 ma. (**See Figure 3**)

To use the test fixture, place your switchmod card in the holder. Connect the edge connector to the card and clip the 1.5 Volt oscillator signal to the anode of the optic diode. Using an oscilloscope with an 10X probe, touch the probe to the collector of transistor Q8 or the resistor R16.

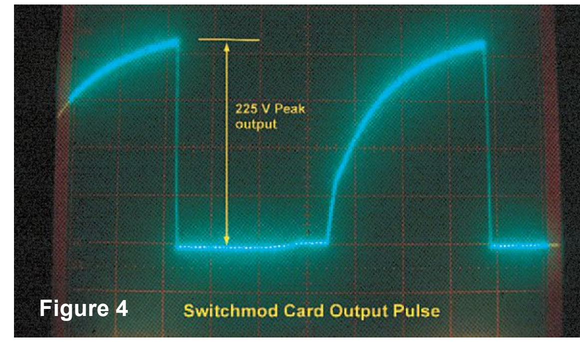


Figure 4 Switchmod Card Output Pulse

A "shark's tail" waveform should be present if all is working well. (**See Figure 4**) This waveform is 225 V P-P and drives the grid of the clamp modulator tube or stage. You can now safely probe around with a scope or VOM and locate bad parts or problems. When done, allow a minute for the voltages to discharge through the bleeder resistor before you pull off the edge connector.

There is no reason why this idea cannot be adapted to other models, since the jig is just a collection of power supply and input signals to make the card work. With minor power supply changes and different edge connector connections, this jig can be utilized to test other switchmod cards such as the Harris MW series transmitters.

Parts List:

1. Transformer – Triad VPT-230-1090 (Any transformer, 120V primary to 240 CT secondary will do, at about 2 Amps.)
2. Edge connector – Mouser Electronics Part 587-243-006-542-203 (You will need 4, to fit together as one connector of 12 pins)
3. Adjustable 555 pulse generator board (MPJ 31070MI) Part number – 400857249192
Available from CQ Supply, EL Dorado Hills, Calif.
Ph 916-798-5696 Also listed on Ebay.
4. Five Volt Regulator board – many available on Ebay (LM317 regulator bd) <200 ma

All other parts are junk box substitutable capacitors, resistors etc.

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Engineering Perspective

The Power of Networking

by Jim Turvaville

Though my times of hands-on work, day in and day out, are past me, I still have the opportunity to get my hands into a problem every now and then. Usually I enjoy it very much, unless it becomes a gremlin chase, and that's when I realize why I do not do those things on a daily basis any longer.

On a first bitterly cold day of the fall season, I had a call from a very long-standing client about 90 miles away, who was at his tower site and trying to see why the station would just randomly go off and then back on, after a few seconds or minutes of static. We quickly surmised that his relatively new Nautel 10 kW transmitter was happy, but the STL seemed to be dropping carrier and the squelch was open enough to allow the static to be broadcast over the air, giving the illusion that the station was off. At the tower, he was able to see the STL receiver drop signal and the audio meter peg with static.

After a bit of visual troubleshooting over the phone, it was determined that the STL receiver was going out of frequency lock when the signal would go away – a perfectly normal reaction to the receiver no longer receiving the transmitted carrier from the studio. The station owner made a comment about having to get out in the bitter cold, and I quaintly asked about the temperature in the building. He responded, "Well, it's about 5 or 6 degrees outside, with 35 to 40 mile per hour winds, and it's probably about 20 in this building." Even though that nice Nautel transmitter put off so little heat, compared to the old tube rig it replaced, the lack of auxiliary heat in the original installation had left the interior cold. And then we were both blinded by the light going off in our heads – that STL receiver was not made to keep locked on frequency at sub-freezing temperatures. It was amazing it had worked so well for so long. A portable electric heater was set in front of the rack, bringing the temperature of the air being pulled through the equipment above the freezing mark, and suddenly everything was happy again. No more problems from the STL. We both laughed about overlooking a simple solution to a complex problem, and both agreed that in most all situations, two heads are better than one. A little bit of networking – even long distance – can sometime save the day.

Wide Band FM

As an interesting twist, later that same day I got another call from another client about 125 miles away, but in the same direction as the previous call, who wanted to know what he could do if he was getting his station at more than one place on the dial. When asked to explain what he meant by that question, I was informed that his Class C2 FM on 105.1 could also be heard on 105.3, 105.5, 105.7 and 105.9, as well as the companion channels below him on 104.9, 104.7, 104.5 and 104.3. Knowing the location of this station and the weather at that moment, I asked him if he had any heat on at the tower, and was informed that he did not. Still riding high from the previous solution, a portable electric heater was suggested to be placed in the transmitter room and see if getting the STL receiver and Exciter up to a temperature closer to its normal operating range would be of help. I was told he would try that and let me know; and I promptly went back to my own area of warmth and took not another thought to his problem.

Fast forward another 4 or 5 days, and the wide-band broadcasting guy calls me back, and reports that the heater did not fix his issue; it may have helped some, but he was still getting his station over most of the top of his radio dial in town. As an old friend of mine is fond of saying in situations like these, "Well *that* didn't work!" – so a follow up visit in person to the tower became a necessity. Fortunately, the weather had broken and temperatures were back hovering near the freezing mark, making any cold nature in equipment less likely to be an issue.

Coming into town, I found that he was clearly broadcasting on the main channel, as well as the each first adjacent quite clearly; and on the second and third

(Continued on Page 22)

Engineering Perspective

The Power of Networking

– Continued from Page 20 –

adjacent channels much more than would be considered acceptable when closer to the tower. I called a friend, who was retired from the manufacturer of the transmitter, and asked if the exciter would be a culprit in this case. After being told it was likely the issue, the exciter from the backup transmitter was plumbed quickly into the main transmitter and I was certain that my immediate fix would be golden. Again I hear ringing in my head those words, “Well *that* didn’t work!” as I got in my truck and turned on the radio to find no change in how the station was broadcasting. OK, so some networking on this one led me down a rabbit hole, or so it would seem at first glance.

Then I remembered another Engineer with whom I had worked many years before, who now was now a regional engineer for a large company. I knew he had several of these same kinds of transmitters with which he dealt every day. A quick call and I asked if a transmitter could do such as this, apart from an exciter problem – and he said, “Yes – and give me 5 minutes to finish pumping gas and I’ll call you back and tell you what I found.”

I headed for the tower and was walking in as he called me. No more than 5 minutes later, we had walked through a checkup and tuning procedure and found that the fairly ancient solid state IPA unit had lost one of the two parallel transistors and was making only about 60% power. And it seems that in a situation where that has occurred, the imbalance in the IPA module will cause it to create spurs on either side of the main carrier. With some careful tuning and adjustment of the drive to the IPA module, the spurs were greatly diminished and the station was back operating mostly on its assigned channel only, with minimal splatter onto only the first adjacent channels. A replacement IPA module was placed on order and swapped out, to completely remedy the situation, and bring the station up from 80% to 100% operating power, once the IPA module was able to drive the final to full power again. So that networking connection brought my solution – and the previous one, while not giving me the exact answer, put me in the right direction so the solution was then much easier to find.

Not everyone has 38 years of radio engineering to fall back on when an issue arises. But that’s no problem, I did not either when I got into this biz back in the 70s’. But I did very quickly make some network connections to those who had more experience than me, and always approached every problem as an opportunity to learn something that I could share with another when the need arose. I have many times in the past, and even now in the present, been the recipient of those words of wisdom and accounts of experience from others. I find myself more often being the provider of those stories of troubles in the trenches these days, but I will never get to the point where I am above the need to glean something from another engineer, no matter how young or old they may be.

It has been said that we must learn from the mistakes of others, as we will never live long enough to make them all ourselves. I would argue that the opposite is also true, we must learn from the successes of others, as we will never live long enough to learn them any other way. My network connection to a myriad of engineers – some of which are reading this article right now – is a vital part of what makes me the Engineer that I am today, and will be in the future.

May all of you find your own way of creating that network, and help each other as we travel this road of life in Radio Engineering. As the sign says in my office now – “I got bit by the radio bug at the age of 9. I believe its terminal.”

Jim “Turbo” Turvaville is semi- retired from 38 years in full-time Radio Engineering and lives in Rural Wheeler County Texas in a “tiny house” where he maintains a small clientele of stations under his Turbo Technical Services (www.jimturbo.net) operation providing FCC application preparation and field work.

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In the Field

The Best From Belar

by Steve Callahan

Remember back in the good old days, when you had to have both modulation and frequency monitors in your station's rack, and you actually had to log the frequency monitor's readings? Smart engineers deliberately deviated the frequency reading slightly, so that a normal reading of straight up at mid scale wouldn't also be the place where a dead monitor's meter would come to rest.

I've seen the name BELAR on modulation monitors at almost every station I have ever worked at. It's been a constant in this ever-changing broadcast industry.

I had the privilege of installing some at a couple of AM stations recently, and I was impressed. The AMMA-2 can be used by AM stations utilizing MDCL or AM stations using standard modulation. It has a long list of very useful metering parameters such as, positive and negative modulation in percent, positive and negative peaks per minute, positive and negative average peak modulation ratios, AM noise detected in dB, carrier level and reference, and carrier high/low/ratio in sliding one minute monitoring windows.

Fortunately, Belar has also been changing and innovating with two new products that I have had the opportunity to recently install.

One innovation, in the AM world, that has proven its value, is MDCL or modulation dependent carrier level. MDCL really does save a lot of money on your power bill but does play havoc with monitoring and measuring equipment. Belar has come up with a solution that is very impressive – which is their feature-rich AMMA-2 Precision Digital Modulation Monitor.

The AMMA-2 has the expected wide array of programmable alarm relays such as, loss of modulation, normal condition, carrier fail, carrier shift or loss of carrier. Of course there is an RS-232 serial interface and a wide variety of settable parameters and alarms, all in one rack height unit and just 10 pounds.

I'm as guilty as the next guy in that I want to rip open the box and slap a new piece of equipment in the rack as soon as I get it. With the AMMA-2, take a deep breath, sit down and read the manual. The technical writers at Belar have always done a great job with their manuals and this is no exception. Because there are just so many features, you will want to at least read the first ten pages of the manual. There are a lot of menu loops that you can get lost in quickly, but if you know where in the menus you are, setting up the AMMA-2 can be a very rewarding experience.

First, you turn the RF level on the rear panel fully counterclockwise because the last thing you want to do is toast your brand new mod monitor! The AMMA-2 can be powered from 100 to 240 VAC with no user adjustment, and since it has no power switch, it will immediately turn on and won't be unintentionally turned off. After it goes through its initialization, you'll enter the CAR SETTINGS programming loop, find MOD MODE and set it to NORM. After a couple more calibration adjustments you can apply no more than 10 Volts RMS of RF to the unit, watching the HIGH RF LEVEL message in the display to avoid any damage.

With the manual firmly in one hand, explore the various programming loops, which will open up the full features of the AMMA-2. The manual goes step-by-step through the settings but beware, to save your settings you must select SAVE CONFIG and press the UP PARAMETERS button when you finish. This preserves all the settings when and if power is removed. I admit that I had to learn this lesson the hard way, by going back and reprogramming all my settings more than once. I really like the AMMA-2 and all its many features. Take the time to see how the settings interact and you too will be impressed.

(Continued on Page 28)


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The Best From Belar

– Continued from Page 26 –

Over on the FM side, the folks at Belar haven't forgotten about you. They have the FMHD-1 Precision Digital FM HD monitor/analyzer.

This mod monitor is so much more than a mod monitor. It delivers a tsunami of data about your main signal and HD carriers and in a very well thought out way.

The main tuning screen is just one of the data-packed pages that this monitor provides. You can see which of eight – yes eight – HD carriers you have, and can select which one you want to monitor. The next page is the total, pilot, left, right L+R and L-R screen. As you would imagine, it gives you all the information you want on horizontal bar graph displays. For a really impressive display, use the jog wheel to access the RF spectrum screen which gives you a color display around the tuning frequency with green being the analog carriers, yellow being the HD carriers and red the extended mode HD carriers.

There is a very useful time alignment screen which graphically displays the time alignment and also the polarity and amplitude of your analog and HD carriers.

Plug in the power cord and after it boots up on the display, you'll see the MAIN TUNING SCREEN where you input, via the jog wheel, your station's frequency. RF setup from your transmitter's high level sample port couldn't be simpler with you adjusting the RF input level on the back panel into the green region with yellow being too low and red too high. You can use either the high level input or an antenna input. I chose to use the antenna input because the unit I installed was at a transmitter site that had a main and backup transmitter and I didn't want to have to build an RF sample port relay.

One tip is to keep your eyes on the little up and down arrows in the upper right corner of the display. To change pages you have to navigate to the arrows via the jog wheel. It can be a bit frustrating if you are trying to move quickly from page to page. After you're aware of the arrows, navigation from page to page gets much easier and much more efficient.

The FMHD-1 also has what Belar calls their Automatic Delay Correction Software Module which is very cool. This software allows the mod monitor to directly talk to the device that sets your diversity delay. Belar advises that both the analog and HD main audio be processed as identically as possible, preferably with just one processor performing both functions. Using the multi-scan mode, the FMHD-1 can measure and correct the diversity delay on up to 6 stations. To get started, you have to initially activate the delay correction software which is already in the unit via a pop-up menu. Presently the FMHD-2 will talk to the GatesAir HDE-200 exporter, the Nautel Exporter Plus, the Omnia .7 and.9 processors, Orban 5500, 5700, 8500, 8600, 8600S processors, the Wheatstone AirAuraX3, FM-531HD, VP-81P and FM55 processors. You should contact Nautel and Omnia for specific set-up requirements for their individual units.

It used to be an FCC requirement that every station had to have a modulation monitor. Unfortunately, some engineers have had to cut that one piece of equipment out of the budget and depend on a borrowed modulation monitor for "spot checks." However, these two new innovative products from Belar make it possible for you to thoroughly know what your signal is doing, or not doing, on a real-time basis.

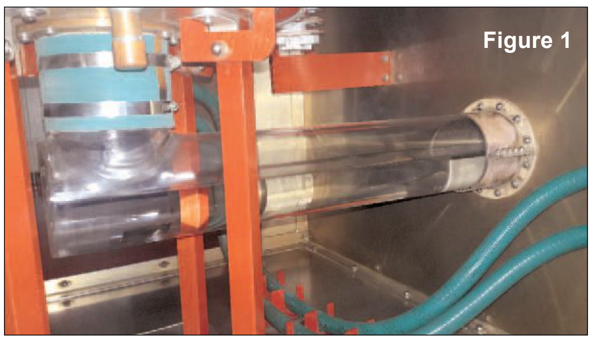
Steve Callahan, CBRE, AMD, is the owner of WVBF, Middleboro, Mass. Email at: wvbf1530@yahoo.com

Maintenance Guide

The Case of the Mysterious Metal Shards

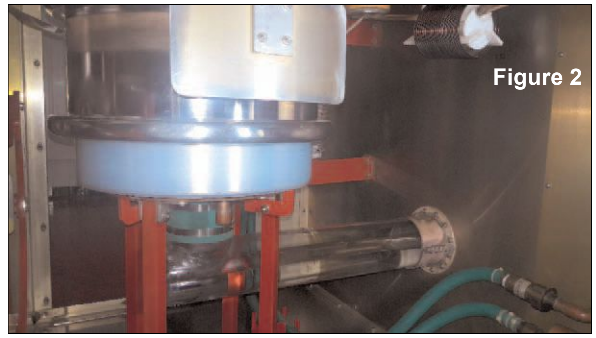
by Rolin Lintag

A while back, on a small island in the Pacific, I worked at a Shortwave transmitter facility. There were four 100 kW HF transmitters that utilized the Eimac 4CV100000C vapor-phase cooled tetrodes for both the PA and modulators. The PA used a boiler that was coupled to a Pyrex glass by a Teflon tube. The Pyrex glass is an indicator of the ionized water coolant as shown in Figure 1.



The boiler for the PA tube sits on top of this Pyrex glass. (Figure 2) We inspected this glass every regular maintenance and recorded our observations.

It puzzled us to find some dark metal shards settling inside this glass.



Where did these shards come from, and was the tube anode chipping off?

This large tetrode, with a plate dissipation of 100 kW, is a very expensive tube. We could not afford to take chances with its operational life, so an investigation was a must-do task.

The questions we must be able to answer were:

1) Where did these metal shards come from?

2) How do we prevent this situation from adversely affecting the operational life of the tube, and the PA system as a whole?

It is intuitive to go ahead and dismantle the system and inspect the coolant lines one by one. That may be what most action oriented technical guys would do. However, it is not only a lot of plumbing work but we could not afford to have this transmitter out of service for a long time. Besides, there was no clear place in the cooling system where we could start the inspection to find the culprit.

It was not a very good idea to lift the big tube out of its socket when it had been operating for many years, with no clear issues so far. It was better to take a step back and analyze what could have been going on, using the maintenance logs. It was good that this facility had records of tasks that were implemented under a preventive maintenance program. We were able to look at what was done on a regular basis, including parts that were replaced and when.

We found a clue as to which part may be chipping off.

After operating the transmitter for a few years, it was decided, in the preventive maintenance program, to replace the flow regulator valves quarterly. Inspections of these valves on the coolant line had shown that they become faulty after a few months. These valves regulate the flow of coolant on PA parts to prevent leaks that may be caused by excessive fluid pressure. These metal valves are rated for different gpm (gallons per minute) depending on where they control the flow after the manifold that distributes the coolant after the pump. Combine the vibrations from the pump and the high temperatures from the vapor-cooled tube, and these metal valves became brittle over time and started to chip off. The shards recovered from the Pyrex glass were of the same color and material from the worn out

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Mysterious Metal Shards

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valves taken out of the system. We even kept some of the faulty valves that were replaced from the last maintenance work.

It helps to understand the cause of failure.

One prevailing theory of what produced the shards, is that these valves become brittle over time due to high temperatures and the vibrating action of the coolant being pumped. Both conditions of high temperature and high vibration are easy to observe on the system while in operation. It was also possible that some chemical reaction with the coolant was happening, causing the discoloration of the valves – but that was unlikely, considering that we kept the coolant up to 10 Mega-Ohms in resistivity after the de-ionizers that are in the system. The triple distilled water being used as a coolant, further refined by the de-ionizers, is almost free, if not clear, of minerals and other impurities. Ten Mega-Ohms of resistance across one-inch is a real good insulating property that prevents electrolysis from happening. Besides, the water targets, specifically designed to be the fall guy during electrolysis, were intact and had never been observed to deteriorate over the years.

It was apparent that the root cause of producing the metal shards was the combined heat, vibration and quality of the metal valves being used.

What now?

After coordinating with the transmitter manufacturer, a few things came up:

1. Not much could be done on the temperature issue. The valve regulators simply needed to withstand the operation. A replacement model was being researched in order to rectify the chipping off problem.

2. The coolant vibration problem could possibly be mitigated. A provision of an air column, to absorb the hammering energy along the coolant line, could further minimize the coolant vibration. This air column was implemented by adding a vertical copper tube after the pump, where inert air is trapped at the top end, and serves as a recoil absorber to dampen the vibration on the cooling line. It was debatable as to how much benefit this air column really provided towards mitigation of the vibration problem, but we did observe a slight reduction on the vibration after putting in the column. We just went with the empirical result and judged that it was indeed helping. It was not a perfect solution but it provided progress. The benefit to cost ratio of this solution made it a good way to go.

Progress is a better aim than perfection.

After a month or so, we visited another station, since they were installing a new transmitter. To our surprise, we found the new transmitter to have a built-in air column tube on the coolant system. That was progress on the design and we were happy for them. The manufacturer acted upon the feedback from the users and made it better. That is the way it should be. We just wished we had ours with the improvements already.

Then, after another month or so, we learned that the metal valves had been replaced with the plastic ones. That was another step towards progress. Unfortunately, I was no longer working at that site to find out if the plastic valves performed better, or if all the metal ones were replaced with plastic.

I already learned a practical lesson: that manufacturers do not produce perfect machines when sold to you. It is better to find a manufacturer that you can work with, to make the product better, than to find a perfect product. There is only so much you can do to vet how good a piece of equipment is. The rest of the equation depends a lot on how good the manufacturer will work with you after the sale. Of greater importance to consider is if the manufacturer will still be around after the sale. This last one is getting a bit harder to deal with for our industry nowadays.

Rolin Lintag is Asst. Chief Engineer for KRON 4 in San Francisco, CA. Reactions welcome when sent to: rlintag@kron4.com.

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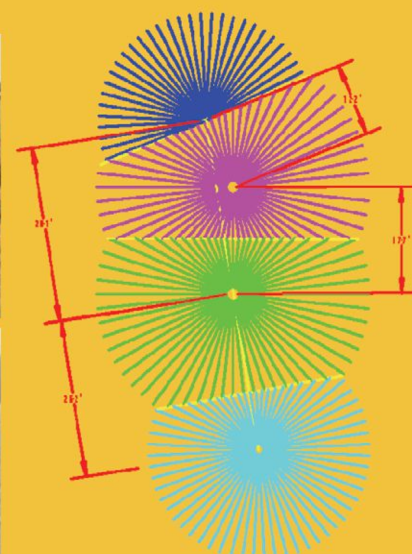

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Monitors and Meters

Old Ain't Bad *(Part 2)*

Rebuilding a Simpson 260 Meter

by Tommy Gray – CPBE CBNE

In our last issue (Nov/Dec-2016) we started refurbishing an old Simpson 260 meter. This time we will continue the project. If you obtained a Simpson meter since last issue, or resurrected one out of the storage bin, you should have cleaned it up and removed any left over corrosion from old batteries, which is so common to these meters when left unattended for years.

Getting Started

Last time, I showed pictures of a bluish residue and a white looking substance that was left behind on the silver plated contacts from different types of cells, when they deteriorated over time. The electrolyte (usually in the form of a paste, ammonium chloride, etc., that can be corrosive over time) is what leaks out and causes damage. Some of the deposits can be very hard and must be scraped or brushed away with something like a Dremel™ tool to remove them. Others can be removed with simply an old toothbrush or something similar.

Once you have removed all the left over deposits, and your contacts are clean, install a new set of good quality cells into your meter. I recommend good quality Alkaline cells for your meters. These will last longer than the standard carbon-zinc cells, and some of them will last years without turning into a pile of corrosion like the Carbon-Zinc cells will. If you are fortunate enough to have had only terminal corrosion, you can clean everything up and then check your calibration, and you are good to go. If your meter has the residue from years of rotting Carbon-Zinc cells, you will not only have terminal corrosion, but will probably have a liquid like substance left behind that can eat up everything good inside the meter. If your meter has the gooey substance, you need to get something like a good contact cleaner, and attempt to remove it from the internals of the box. If it has done too much damage, then the only reasonable alternative is to scrap the meter and try another one.

Cleaning "Stuff"

I put my contacts in a bowl of Tarn-X™ brand silver cleaner, and immediately the corrosion dissolved and left the contacts. It is a great cleaner for just about anything silver in your transmitters as well. I use it to clean tube socket finger stock, and tuning sliders. Just remember to wash it off with water to remove any residual cleaner that may be left behind, in order to stop the cleaning process. Once the contacts were clean, I had to polish them a little with the Dremel™ tool and a piece of fine Scotch-Brite™ pad to bring them to a shiny, clean state, so that the Cool-Amp™ silver plating compound would stick to the parts. Note: Complete instructions on how to use the powder can be found on the manufacturer's website at http://www.cool-amp.com. I also purchased my powder there.

Once I had them cleaned and all the surfaces of the contacts silver plated, I re-installed the contacts into the meter. Simply follow the instructions that come with the various products to get best results. One thing I would recommend, is that you use very warm or hot water instead of room temperature water with the plating powder to get the best results. It will save a lot of time too, as the powder will transfer better when the water and metal are warm. On larger pieces, I use a cotton ball dampened in the warm water. A soft rag should work well also. I pat the moistened ball (or rag) into the powder, then rub it onto the metal surface until I have enough silver deposited on it to satisfy.

It may take numerous applications to get a sufficient amount of silver deposited on the surface. Also, don't expect it to look like a piece of fine jewelry. It will have a satin like finish but will be plated well once you are done. If you desire, and have left enough silver on the part, you can shine it up pretty well, but it takes a little elbow grease and a lot of patience along with a soft rag. Rub until it is as shiny as you like.

You can make a lot of new parts to replace hard to find stuff in older transmitters, with a little bit of copper and some Cool-Amp™. I have used it to make IPA plate straps in some older FM transmitters to replace worn out ones, among other things. I cut the new parts out of some good copper strap, plate them with Cool-Amp™, and they worked as well as a factory piece!

Moving Right Along

I gave my meter a good cleaning inside with a non-corrosive contact cleaner and used a soft paint brush to get rid of any remaining dust, etc. One word of caution – you should probably not spray contact cleaner into the carbon potentiometers as they may be damaged and render your meter dead or plagued with intermittent connections, until you replacement them.

(Continued on Page 36)


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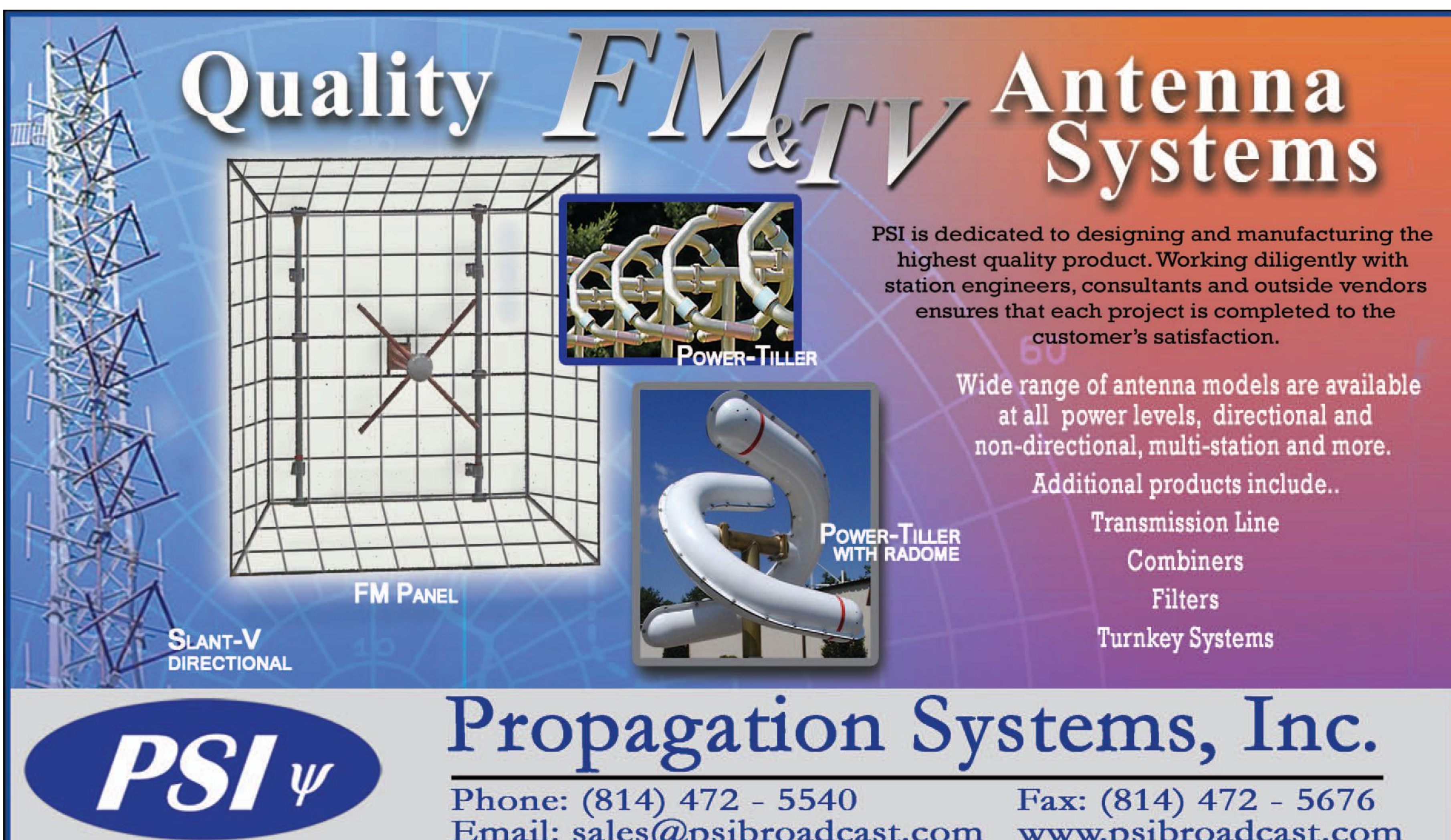
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Monitors and Meters

– Continued from Page 34 –

Once you have everything reassembled and ready to use, it is time to verify the calibration. This will require you to use a good set of calibration instructions to help you figure out which controls do what. To do my basic calibration, I simply take a meter of known accuracy and adjust the meter to read the same thing. Usually this is sufficient.

One note here is that, regardless of what version your meter may say on the meter face, its construction may vary slightly from what the pictorials and schematics say yours is. *(The version number is printed on the front of the meter face itself.)* Apparently, when Simpson made these meters, they did not control versions very well, or their documentation is a little mixed. My version 5 meter has the battery layout that is shown in the pictorial diagrams for a an older version, and it also has the circuit board that is shown for a newer version – go figure? Regardless of which one you have, it is easy to figure out which one to use when calibrating the meter, as the pictorials and schematics will help you know which controls do what.

I would suggest doing some AC and DC voltage comparisons with a good meter of known accuracy, along with some resistance measurements, etc., with your good meter, and adjust as necessary for a starting point. A quick search on the Internet will help you find a myriad of schematics, operators manuals, and some service manuals. There are a few sites devoted solely to the Simpson, that are a goldmine of valuable information. The one I have found that has a very comprehensive array of documentation for just about all of the Simpson meters is: http://www.simpson260.com

If you look at the backside of the circuit board, using my meter as an example, you will see the controls used to perform calibration on the meter. I will share a bit of wisdom with you here. Don't just start cranking on the controls. I have found that, for the most part, nearly every one of these meters that I have refurbished was so close in calibration already, that all it took was a very minor tweak on only a couple of controls to bring it within serviceable specs and have it ready for use. If it takes a lot of adjustment you might have damaged components that need to be replaced.

The Backside of My Version 5 Meter Populated with New Cells

The wet looking (shiny) spots you may notice on the board near component leads, is from the lacquer-like coating that was sprayed on the front side of the board at the factory. It soaked through the holes as you can see. These boards are single-sided PC boards that are good quality. The inner (solder side) of the board is much nicer looking than the back, and contains some very good solder joints. FWIW: I have never had to redo a factory solder joint on one of these meters as they are usually first rate to start with.

Using the Meter

Once you have the calibration to your liking, then you can use the meter. Operation is straightforward and details can be found in the operators manuals on the website mentioned above. For voltage and current, etc., just set the meter switch on the center left to AC, DC+ or DC-, as needed. To make resistance measurements, set the meter to DC+, then short the leads. Adjust the "Zero Ohms" knob to make the pointer read full scale and exactly on the "0" line. When you change ranges, you will need to re-zero each time, but it is an easy process. To test a rectifier, connect to it and switch between DC+ and DC- to see front to back ratio.

Remember, when using these meters that they are *NOT* auto-ranging like some of the digitals you may be used to. To prevent damage to the meter, always start with the highest scale for your particular purpose (Volts, resistance, etc.) and then work your way down, to put the reading within a usable range. Also, they are not very high impedance meters and should not be used in digital circuits, etc., due to the loading. Have fun with your "New" Old Meter!

Tommy Gray is President/CEO of "Broadcast Engineering & Technology LLC", a Consulting and Contract Engineering Firm serving the US. www.BEandT.com

Transmission Guide

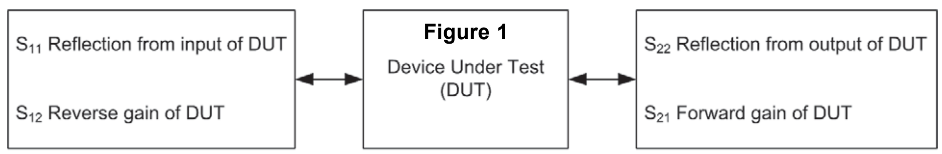
"Distance to Fault" Measurements in Transmission Lines *(Part 2)*

by Mike Hendrickson

In the last issue *(Radio Guide Nov/Dec-2016)*, I talked about using a TDR to test for transmission line faults. One of the big problems with using a TDR is that, while it is very good at finding large faults, it is not very good at finding small faults or faults that are frequency sensitive. If you are trying to track down the cause of a relatively small change in the system impedance, the TDR may not be the tool to use.

You may want to consider using a Vector Network Analyzer or VNA. The VNA uses a signal generator, at least two receivers, a directional coupler, and a CPU. The VNA compares the transmitted signal with the reflected signal to obtain amplitude and phase or vector information. This information permits the CPU and display to show return loss, VSWR, phase, amplitude, resistance and reactance of the load port, and other types of information. The CPU can use this information to compute a distance to fault display.

If you are going to use a VNA to conduct testing on the transmission line or antenna system you need to be familiar with the term "S-Parameters" or "Scattering Parameters". I'm not going to go into the mathematical definitions of S-Parameters, but you should know how the terms are used in a VNA. A port or test that uses S11 is a port that transmits a signal to a Device Under Test (DUT) and receives the reflection. The VNA will use this reflection to calculate the impedance of the DUT's input. The port or test that is labeled S21 receives a signal that is transmitted by port S11 through the DUT. This permits the gain and phase of the DUT to be determined. S22 transmits a signal to the output of the DUT and receives the reflection. This permits the impedance of the output port of the DUT to be determined. S12 is the reverse gain and phase of the DUT. S22 and S12 may also be obtained by reversing the cables and connections of the VNA or they may be obtained by changing the settings of the VNA. (Fig. 1 is a S-Parameter cheat sheet.)



One of the big advantages of the VNA for distance to fault measurements is the ability to adjust the test frequencies and distances involved. For example, if the transmission line is being used for an FM broadcast system we can select a band of frequencies that will tell us if there are problems in the line. On the other hand, if the line is being used for the 950 MHz band, we will want to change the band of frequencies to check for problems in that frequency range. The advantage to this is that a problem may be frequency sensitive. I've also found that you can use a VNA to check for potential future problems. You may have a rigid transmission line using 20 foot sections. You can use the VNA to check the overall performance of the line in the FM band – with the proper adjustment of the VNA you will see each and every bullet's performance shown on the display. This will enable you to quickly find a potential bullet failure.

My personal method of testing FM broadcast lines is to do an overall sweep of the line using two sets of frequencies. The first sweep uses the range of 50 MHz to 150 MHz. This will generally show the overall condition of the line for FM transmission. The second sweep uses the range of frequencies of 150 MHz to 500 MHz. This sweep enables me to better see the condition of the various connections in the line. With the higher range of frequencies I have been able to see a transmission line hanger that has been over tightened.

I have not talked about the necessary extra items you need to have in order to do the testing. One absolutely necessary accessory you need is the calibration kit for the VNA. This kit consists of a calibrated open connection, a calibrated shorted connection, and a precision 50 Ohm load. You will need a set of *good* test cables to make the connection between the VNA and the transmission line. I have found from experience that if you do not have good cables you will not get accurate results, even with accurate field calibration of the VNA. Expect to pay at least a few hundred dollars for the test cables and calibration kit.

You will also need a set of adapters to match the Type "N" connector on the test cable to the input of the transmission line. These adapters should be of high quality and should not be used for anything other than testing of transmission lines so the integrity of the adapter is preserved.

(Continued on Page 40)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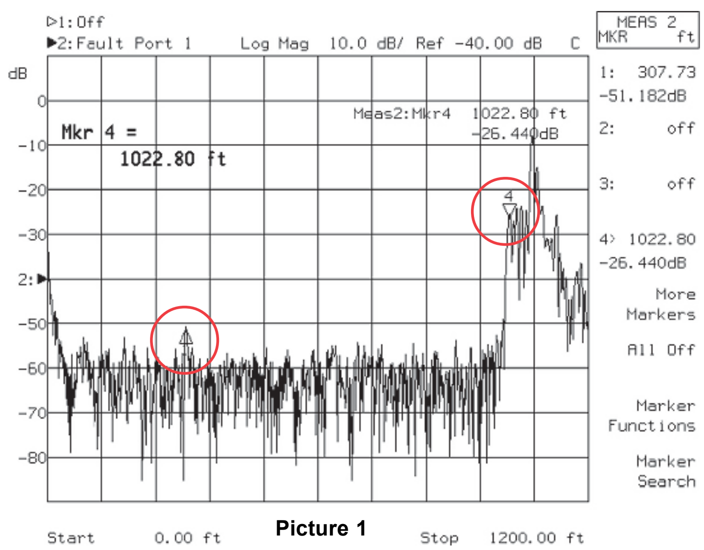
Transmission Guide

– Continued from Page 38 –

Unlike most other types of test equipment, the VNA needs to be calibrated each time you use it. The calibration stores the characteristics of the test cables and adapters in the VNA's memory. Essentially you are moving the test port from the connector on the VNA to the end of the test cable. This calibration cancels out the effects of the test cables.



Picture 1

Remember that the accuracy of the testing is dependent upon the quality of the test cables, adapters, and calibration. If you take shortcuts you will end up wasting a lot of time and doing the testing over.

A VNA is a major investment. One alternative to owning the equipment is to rent it for the period of time you need it. There are several companies that rent the equipment for periods of time ranging from a few days to a month or more. If you are going to rent a VNA be sure to include the calibration kit and test cables in the rental.

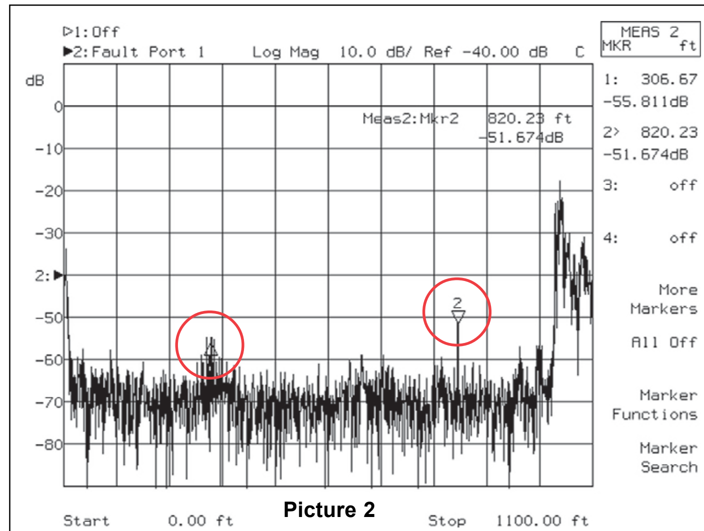
Picture 1 is of a transmission line that is about 1000 feet long. The marker is positioned at the input to the antenna. This shows the line to be 1,023 feet long. There is another marker positioned at about 308 feet. This is showing a slight bump in the return loss of the line. The frequency range used for this testing was 50 MHz to 150 MHz.

Picture 2 is another sweep of the transmission line using the frequency range of 200 MHz to 700 MHz. This sweep still shows the slight bump in return loss at about 308 feet, but now there is a very noticeable bump in the return loss at 820 feet. This bump in return loss did not show up on the first picture.

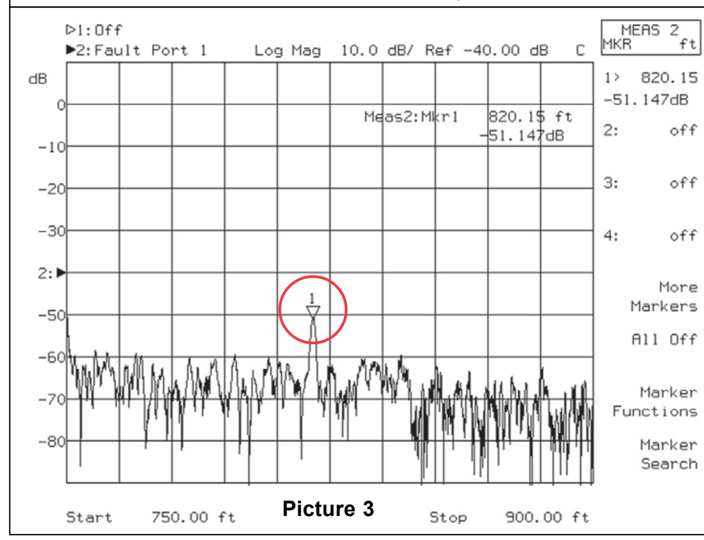
Picture 3 is a close up view of the bump discovered in picture 2. The start and stop distances of the sweep have been changed to permit zooming in on the bump. When the transmission line was physically inspected, the tower rigger found a dent in the line at the location of the bump in the return loss. Since the problem was not present at FM frequencies, we decided the bump was not a problem.

Until next time happy engineering!

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



Picture 2



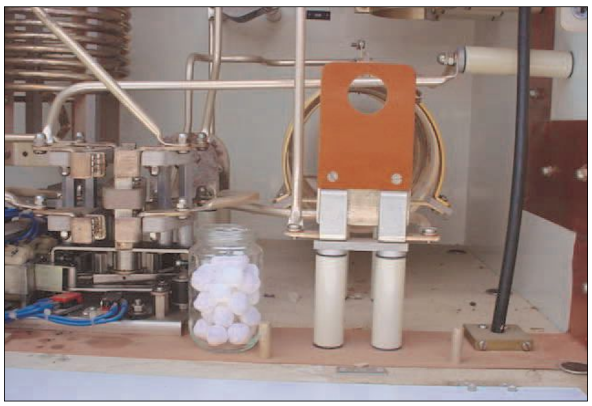
Picture 3

Tips From the Field

Moth Balls Eliminate Pests

by Gary Peterson

Have you ever opened a door at the transmitter shack, or tower base and had something unexpected fly or run out? How about finding Black Widow spiders in an equipment rack at a transmitter site? These are the sorts of surprises I have never enjoyed. A convenient solution was as close as the hall closet – moth balls. I have long used moth repellants in and around broadcast electronics. I use them in ATU cabinets and any other place I do not want something jumping out at me when I open the door.



Moth balls are usually naphthalene or para (p or 1,4) - dichlorobenzene. Both tend to sublime (turn directly from a solid to a gas) without going through the liquid phase. The rate of sublimation is a function of temperature and air circulation. Para-dichlorobenzene melts and boils at a lower temperature than naphthalene and, therefore, normally sublimes more quickly. Either will last longer in a closed area or at a lower temperature.

Neither product is directly corrosive to copper, aluminum, steel, silver-plating, insulation, electronics, etc. However, para-dichlorobenzene contains two chlorine atoms per molecule. If an ATU cabinet was filled with p-dichlorobenzene vapor and an RF arc occurred, a small amount of free chlorine gas (very corrosive) could be produced.

The amount of chlorine would be very small. However, with repeated arcs over a period of time, the corrosive effects of the chlorine could be noticeable.

On the other hand, Naphthalene contains no chlorine (just hydrogen and carbon) and, therefore, has no possibility of producing a corrosive byproduct. Plus, because it sublimes more slowly under similar conditions, naphthalene will last longer. Moth balls and snake repellant, containing naphthalene, are available at most hardware (such as Ace) and home improvement (such as Home Depot) stores. It is very reasonably priced.

To prevent naphthalene from subliming too quickly (as in an ATU cabinet where the temperature may reach well over 100 degrees F on a regular basis), place it in a glass jar and punch a small hole in the metal lid. The size and number of holes in the lid will affect the rate of vapor release.

If some critter is burrowing under your doghouse, pour some moth balls into the hole. Whatever is doing the digging will pack up and move.

It works everywhere. I maintain a translator, in a small building (outhouse size) on top of a rock outcropping. Somehow rattlesnakes were getting into the shack, likely because field mice could get in there. A couple of open boxes of moth balls every year keeps everything but me out. I love the stuff! (My heart rate still goes way up when I prepare to open the door, though.) *– Radio Guide –*

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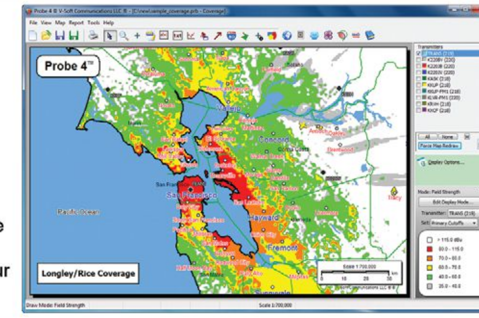

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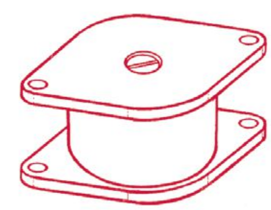

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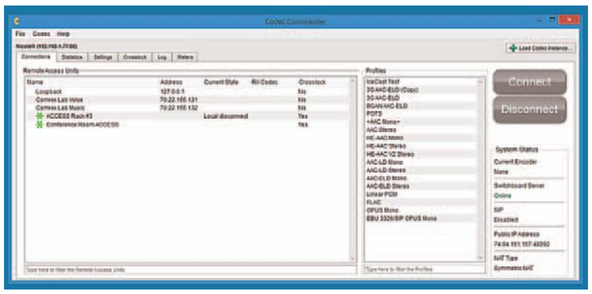
Comrex – Codec Commander

Comrex has released the Codec Commander, a management and monitoring application for its line of IP audio codecs. Codec Commander provides the same control capability as the company's existing browser-based tools for individual codec management, but doesn't use Adobe Flash, making it a good alternative for users who are concerned about frequent updates and security risks.



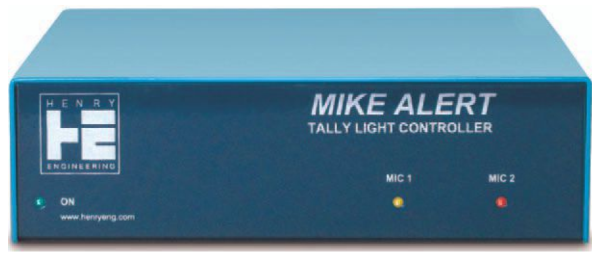
A Microsoft Windows application, Codec Commander enables users to interface with a single Comrex codec. With Codec Commander, users can manage connections, check statistics, view audio metering, adjust audio profiles, and make changes to the system settings. Codec Commander is compatible with ACCESS, BRIC-Link, and BRIC-Link II units with firmware version 3.0p13 or later installed. Codec Commander is a free application, and is now available for download through the Comrex website. For more information, contact info@comrex.com.

For more information: www.comrex.com

Henry Engineering – Mike Alert

Henry Engineering is pleased to announce a new product: the MIKE ALERT.

MIKE ALERT is a control interface for use with mic arms that utilize a two-color, integrated tally light system, including "Mika" mic arms made by Yellowtec.



MIKE ALERT provides the power and control circuitry necessary to interface the mic arm to the Tally outputs of a console, router, or other equipment. Each unit can control two mic arms. Both the microphone audio and tally circuits are interfaced with automatic polarity control, to correctly operate the White and Red tally indicators. MIKE ALERT is universally compatible with any console or equipment that provides a GPI contact closure, open collector, logic, or DC voltage for Tally light control.

For more information, please visit www.henryeng.com or call Hank Landsberg at 562-493-3589.

MIKE ALERT is now in stock at all Henry Engineering dealers. List price: $250

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Inovonics – SIMON 614 Multi-Stream Monitor

Inovonics has announced the new SIMON 614 Multi-Stream Monitor. The SIMON 614 Multi-Stream Monitor simultaneous monitors up to four Internet Radio streams and is compatible with all network formats.

SIMON 614 Multi-Stream Monitor

Following in the footsteps of Inovonics' groundbreaking 610 Internet Radio Monitor, the SIMON 614 offers simultaneous monitoring of up to four separate Internet Radio streams. In addition to multiple stream monitoring, the SIMON 614 has an intuitive Web interface that supports e-mail/SMS alarm messaging and SNMP. It is compatible with virtually all audio networking protocols, encapsulation formats, and both lossy and lossless audio encoding standards.

"Over the past year we have been working hard to fine-tune the SIMON 614 so it meets our high standards for quality and functionality. Today, the SIMON 614 is the product that we envision will fill the growing need in the Internet Radio Market," says Ben Barber, President and CEO of Inovonics.

For more information: www.inovonicsbroadcast.com

RADIO ROUNDUP

The Radio Guide Event Register

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Nashville, Tennessee
www.nrbconvention.org

Great Lakes Broadcasting Conference
March 7-8, 2017
Lansing, Michigan
http://michmab.com/ProgramsEvents

NAB 2017 Spring Convention
Convention Center – Las Vegas, Nevada
April 22-27, 2017
www.nabshow.com

NATE Unite 2017
February 27 - March 2, 2017
Fort Worth, Texas
http://natehome.com/annual-conference

Texas Association of Broadcsters (TAB)
August 9-10, 2017
Renaissance Austin Hotel
www.tab.org/convention-and-trade-show

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

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