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May-June 2016 – Vol. 24, No. 3

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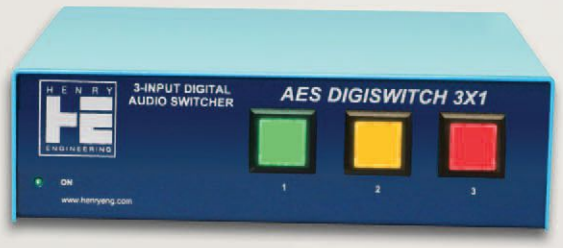

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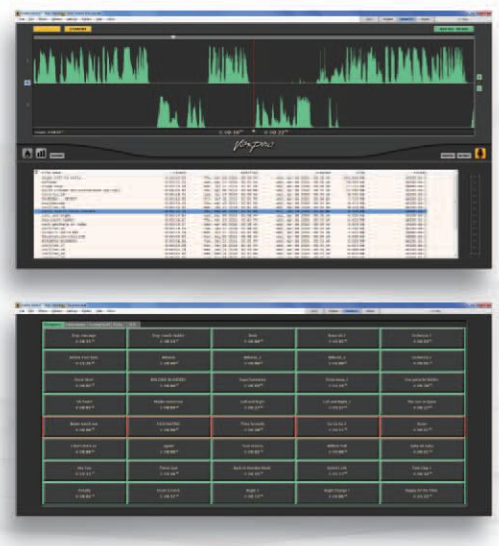

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Cover Story

Arrakis, Dante, and "Simple-IP"

All Arrakis Consoles Are Now AoIP

by Michael Palmer – President, Arrakis Systems Inc.

A Very Short History of AoIP

AoIP (Audio over Internet Protocol) has been around for almost 20 years. It breaks the audio up into small digital packets and routes the packets around your computer network. Prior to AoIP, a technology named TDM (Time Division Multiplex) could also transmit and receive multiple digital audio signals on a single cable. However, TDM lacks the flexibility and capacity of AoIP and has been replaced by AoIP as the system of choice for professional audio applications.

The first "AoIP" systems like CobraNet, EtherSound, etc. in the late 1990s, were designed to use standard IT computer networks in order to deliver a limited number of channels through a 10 or 100 Mbit network. Other solutions at the time used standards that required specific network hardware and were incompatible with standard PC network traffic. Today, we have gigabit networks and network technologies have advanced to the point where very low latency (delay) audio networks with many hundreds of channels of audio are easily assembled.

Today's AoIP Landscape

While AoIP has grown to become the dominant audio distribution technology today, with much higher reliability, ease of use, and capacity, the AoIP world has not yet coalesced around a single standard. It is close, maybe, but not quite there. The leader by far is Audinate's DANTE with more than 200+ manufacturers and 600+ products that all work together seamlessly. The uniqueness of DANTE is that it is a software-hardware AoIP module that manufacturers license to create DANTE compatible products. In this way, any number of manufacturers are AoIP compatible without the need for a standards body creating a standard.

The IEEE has been working on a standard called AVB for years, but it has not moved much beyond the standards process. As a consequence, the rest of the non-DANTE AoIP world remains isolated into proprietary single manufacturer products that do not work together.

AES67 AoIP Audio Protocol

To help the many AoIP manufacturers that have different protocols communicate (and as a reaction to AVB), an AES67 audio protocol has been recently created. The idea is for "Manufacturer A" to be able to talk to "Manufacturer B" through a connection that uses the AES67 audio protocol. Most AoIP manufacturers (including DANTE) have adopted AES67 and are in the process of rolling out updates that support this for their products that have the processing power to support it. It is important to note that AES67 only creates a "link" or "links" between two different systems. It does not make them merge into a completely interactive system.

AES70 AoIP Control Protocol

Unfortunately AES67 is less than half of the solution to making "A" speak to "B." This is because AES67 doesn't deal with device recognition or control. In other words, Manufacturer A's AoIP network can't see or control Manufacturer B's AoIP network. The device recognition and control protocol to help with this is called AES70 and is in the process of being formulated. At the moment it is necessary to use a primitive static IP assignment for two AoIP networks to talk together by an AES67 link. The much larger issue of letting two different systems configure and control each other goes way beyond setting a standard to a question of customer support. It is very unlikely that AES67/AES70 will ever go beyond creating a link between two or more different manufacturers.

Even Just an AES67 "Link" Has Value

While AoIP has not found a standard yet, there is nothing inherently wrong with buying Manufacturer A's or Manufacturer B's proprietary AoIP system. When you add to the system in a studio where you want auto-recognition and control then you simply use another of Manufacturer A's products. If you are only sending and receiving audio in that expansion studio, then you have the option of choosing any manufacturers product and linking to Manufacturer A's network using an AES67 link.

The Professional Audio Industry and AoIP

The Radio Broadcast industry is a small part of the entire Professional Audio industry which includes live sound, production, large venues (such as stadiums), residential, etc. Outside of Radio Broadcast, DANTE dominates AoIP with its more than 200+ manufacturers and 600+ compatible products. From mics to amps to mixers to speakers, they are all DANTE connected. DANTE has the power to support more than 500 bidirectional streams with automatic device recognition and powerful control software.

The Radio Broadcasting Industry and AoIP

In an interesting twist, the Radio industry has taken a different direction with AoIP than the Pro audio industry. In Radio there are analog consoles, digital consoles, and recently "IP" consoles. Analog and digital consoles are stand-alone products connected by wire. Driven by consolidations requiring large routing switchers, IP consoles came into being combining the mixing console with AoIP distribution. Due to the relatively high cost of AoIP compared to wire, most small and medium market stations were left out of the AoIP revolution. However, with the recent explosive growth of DANTE into the defacto standard for AoIP audio distribution worldwide, AoIP distribution of audio is now cost effective, reliable, and extremely easy to use.

"IP" Radio Consoles

IP consoles combine the console functions with an AoIP distribution system. To do this, IP consoles digitize the audio sources in the station and stream them onto the AoIP network. A digital mixer on the AoIP network performs the selection, level, and mixing functions of a console. A control surface then connects to the digital mixing engine. This approach is interesting and flexible. Any source or mix can appear in any studio. The control surface can reconfigure inputs and mixes for each board shift. The tradeoff for this flexibility is complexity. With complexity comes reduced ease of use, increased cost, and decreased reliability.

DANTE AoIP Audio Distribution in Radio

For the first time Radio broadcasters have the choice to distribute audio around their station with a cost effective, robust, reliable, easy to use AoIP solution. This is a proven technology because it is the solution used by more than 200+ manufacturers and implemented into more than 600+ products around the world. Also, DANTE is the choice for live venues worldwide, so it is ideal for live on air radio applications. With DANTE, you don't need to choose a single expensive IP console manufacturer. Instead, you can use your existing or new analog or digital consoles and sources and use DANTE for the AoIP distribution around your station.

More About DANTE

DANTE supports a maximum of 512 x 512 mono streams. It uses standard off the shelf ethernet switches. It can be used on the same network as your PC computers but is obviously more reliable on its own network. DANTE even supports redundant networks. The DANTE Controller software works on both Windows and MAC PCs. It is incredibly easy to use. It automatically recognizes all of the DANTE products on your network. Once the Controller software has set up your network, then the PC can be turned off – the settings are stored in the DANTE enabled devices.

To connect your PC audio software, Audinate has a ~$30 software product for Windows or MAC PCs that is named "DANTE Virtual Soundcard." It acts as a sound card and interfaces your favorite PC audio programs to the DANTE network. DANTE features 150 microsecond to 1.0 millisecond latencies depending on network size, so it is ideal for live applications. Importantly, DANTE supports both unicast and multicast modes. For ease of setup, DANTE clocking is automatic and guarantees all devices are synced to within 1 millisecond. For amazing sound quality, DANTE supports maximum bit depths of 32 bits and maximum sampling rates of 192kHz.

Simple IP Front View

Simple IP Back View

Arrakis "SIMPLE-IP" amd DANTE

Arrakis is a 35 year old, leading manufacturer of standalone analog and digital consoles for radio. We have been waiting years for a standard in AoIP to emerge. With DANTE now the clear world leader in AoIP, Arrakis has just introduced our own DANTE enabled products named "SIMPLE-IP" with analog or AES3 IO. For AoIP distribution to be truly competitive with multipair cable and punch blocks, it needs to be more than just better. Cost is critical. So the cost for SIMPLE-IP per studio is just $999 list price. This is easily cost competitive with cable, punch blocks, and labor while providing all of the benefits of AoIP audio distribution. With SIMPLE-IP, all Arrakis consoles (and everyone elses) are now AoIP. *– Radio Guide –*

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Doubling Down on Dynamics

Shure Introduces New Dynamic Design

by George Zahn

Microphone brands and models can be like cars to some engineers and managers. I know some people who will only buy and drive models under one brand umbrella. Microphones can be perhaps even more of a "locked in" choice for many stations. From consistency of sound, to using the tried and true performer, there are few reasons to try new mics.

Add to that the fact that many of the most used models have been around for decades and it's rare to see a new microphone design (other than perhaps styling or color) make headlines any more. That's why it was a "stop in my tracks" moment, when I ran across materials for a new microphone design from Shure, for their dual diaphragm dynamic microphone, the KSM8 Dualdyne.

Shure KSM8 Dualdyne

Shure Thing?

For sheer cost and durability, most stations and sound reinforcement companies are already using dynamic microphones. Given the dynamic hold on a good portion of the market, there may have been little perceived need to make a new dent in that market. As we'll detail, there has always been room for improvement in dynamic microphone performance, and Shure is making some headlines with this new effort which uses two diaphragms in a hand held/standard mic clip design.

A standard, unmodified dynamic microphone would be basically omnidirectional. There is a single diaphragm, usually attached to a pole with wound wires, suspended in a magnetic field. The diaphragm acts as a de facto eardrum, vibrating to sound frequencies and moving the attached wire assembly in the magnetic field, creating an audio signal. To create a directional pattern, sound is allowed into the microphone capsule assembly from the rear through added ports. This allows sound from the rear to be "canceled" in effect, as sound hits the diaphragm from both sides.

Because of this fairly simple, yet pretty decent fidelity, design, the dynamic family of microphones remains the most durable group and have been used in high risk or high impact situations such as PA and news gathering operations. We've chronicled some of the exploits of the Electro-Voice 635A as a field microphone for journalists on these pages in the past.

"Weight" and See

That durability comes with a tradeoff, as the heavier wire and pole moving portion of the capsule assembly has an inherent extra weight. The extra weight simply translates to limited high frequency response since the frequency with which the diaphragm vibrates is transduced into the audio signal. Heavier elements naturally cannot vibrate as efficiently at higher frequencies by sheer inertia.

The proximity effect on many higher-end broadcast microphones could be rectified by a bass roll-off switch – a high pass filter built into the microphone. Multi-channel consoles or better mic pre-amps could also allow for modification of the bass response on a microphone without the roll-off feature.

The dilemma of poor high frequency response in dynamic mics has been addressed at times through a high frequency boost on some very limited mic models. More often than not, bringing out intelligibility has been done with processing and EQ when needed.

How the KSM8 Works

According to detailed descriptions by Guy Torio and Jeff Segota of Shure, the new double diaphragm dynamic design has a front and rear diaphragm. The result is far different from a dual diaphragm condenser microphone design. Instead of operating as two distinct condenser diaphragms the can be electrically manipulated to create different pick up patterns, the dual diaphragm dynamic uses its two diaphragms to reduce proximity effect – the exaggeration of bass frequencies when working very close to a directional microphone.

The front diaphragm is active while the rear is called passive by Shure. The Shure design uses a reversed side entry airflow system. According to Shure's literature: "Sound enters the microphone via the side entry inlets and passes through the rear second diaphragm before striking the front diaphragm. By using the second diaphragm in the resistance network, low frequencies are partially blocked from entering the cartridge resulting in a natural, low-end response with controlled proximity effect and no loss in clarity."

Shure says that its diaphragm stabilization system will reduce 'plosives and proximity effect. They also claim better high frequency response by reducing the weight of the element. The built-in pop filter is made from hydrophobic material, and the capsule has tuned open chambers that also help to fight handling noise common in many unidirectional mics.

In some ways, this reminds me of utilizing some of the tenants of a condenser (capacitor) design to create flatter frequency response with a lighter transducer element, but it is very different. Unlike a condenser microphone which uses two charged "plates" to create an audio signal, there is no external or internal power supply needed to "power" this dual diaphragm dynamic. You can see even more exacting detail in Shure's technologic changes by doing a Google patent search for the US8818009 B2.

Dual Identity

Prior to this design by Shure, the only other dual diaphragm design was used in condenser microphones. In a far different application from the dynamic design, the dual diaphragm condenser microphone uses two distinct transducers. Each diaphragm, generally aligned back-to-back, acts independently and the activity and phase relationship between the two elements can be switched to allow for different pickup patterns.

These switchable pattern microphones allow for one microphone that can create omnidirectional, cardioid and bidirectional polarity patterns at the flip of a switch. The only caveat of the switchable pattern condenser is that the bidirectional pattern "looks" less like a smooth figure-8 pattern and more like an apple core – with more aggressive rejection on the sides of the microphone depending on position.

The Shure KSM8 is strictly a cardioid design. It has a similar appearance to the distinctly different Shure KSM9 condenser model that has switchable patterns that allow for cardioid/supercardioid pickup patterns. In fact the same windscreen model fits both and happens to also fit the Shure SM58 and several other Shure models.

How "Sweet" It Is

Proponents claim that the KSM8 has a larger "sweet spot," which is an announcer's optimum working distance from a microphone. This dovetails with decreased proximity effect, allowing for more consistent sound whether working close or leaning away to reach for copy. The lighter element allows for better high frequency response as well. For uses within a PA or sound reinforcement system, that also means less need for EQ and processing.

The tighter pickup pattern of the new design could also lead to the KSM8 being used in interview applications where multiple mics are needed. As with any microphone brand and model, consistency of pickup pattern across the model can increase the likelihood of a microphone being used in many applications.

Whether the KSM8 will take on some of the other top models in broadcast remains to be seen. It's a new product unveiled in 2016 and there can be slow adoption curve based on our own biases and past success at stations. Shure is also touting the design for sound reinforcement and TV hand held applications to broaden its market. Shure is also offering the KSM8 basic model as a wireless hand-held as well, and the KSM8 capsule can be purchased separately to attach to Shure QLX handle transmitters.

The KSM8 comes in two finishes, black and brushed nickel. The list is about $625, but many retailers have it in the $500 range (the wireless model is about $690). By comparison, one of the other Shure radio broadcast staples, the SM7B (non hand-held), lists at about $440 and can be found for about $350 retail. The old Shure SM5B remains a favorite of many broadcasters, despite being discontinued in the mid 1980s.

Some of the other models commonly used for radio studio voice work include the Sennheiser MD421 (retails at about $390) , the Neumann BCM 705 (about $700), ElectroVoice RE320 (about $380), Audio Technica BP40 (about $350) just to name a few. The KSM8 appears to be priced in the upper half of this sample.

Trying the KSM8 (or any other new microphone) is the only true test. While the Internet is a wonderful thing, it's difficult to hear on-line demos with much accuracy because of the limitations of computer speakers and streaming frequency response. As I've stated before, developing a relationship with an equipment retailer is a great way to potentially try out a new piece of gear. Sometimes engineers can facilitate a loan from another station to give a new microphone a try. Trying before buying, when possible, is a great way to learn how the new microphone will interact with, and sometimes change, your station's processing and talent wildcards.

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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Transmission Guide

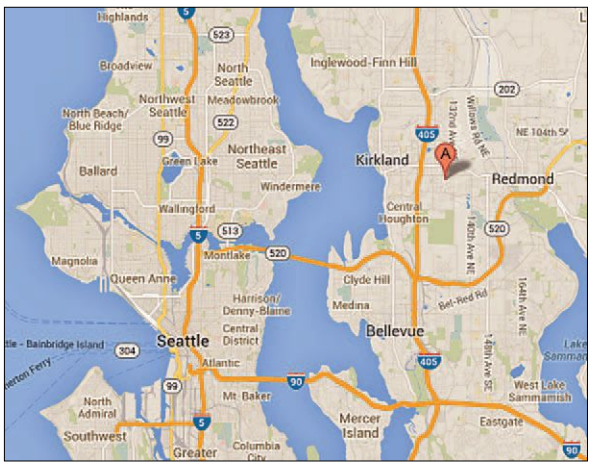
Problems When the Lease Runs Out

by Clay Freinwald

Decades ago, many AM stations were built on the edge of town, or out in the boonies. Growth has often led suburbs – even pricy ones – to be built around transmitter sites.

Combined with many station transfers which left the land in the hands of someone other than the station owner, problems can happen.

It has been some time since an AM station went dark around here in Seattle, but it looks like that time nearly came again.



"A" marks the spot of the KARR site.

This time the victim was set to be KARR, 1460 kHz, a 5 kW DA-2 station in Kirkland. WA, Northeast of Seattle.

The six-towers for KARR's directional antenna (DA) are located on Kirkland's Rose-Hill, surrounded by residential uses and a church. The site is also the shared home of the night DA operation for KKDZ, Seattle, on 1250 kHz, another station that is endangered.

Just East of Kirkland is Redmond, home of Microsoft among other tech companies.

As you can well imagine, over the years, the area around the transmitter site has built up and land has become more and more valuable.

The KARR and KKDZ site.

Hence, the problem: neither station owns the land and the actual land owner has determined that it is time for a change. Most ominously, the lease for the radio stations was not renewed.

KARR was operated by Family Stations, who had announced that as of the end of February 2014 they would simply be off the air while seeking a new site. An STA from the FCC was sought for that purpose.

KKDZ will also need to file for an STA to operate nights from their West Seattle day site, if possible, or some other site. Neither solution seems good for several reasons.

Lessons for Others

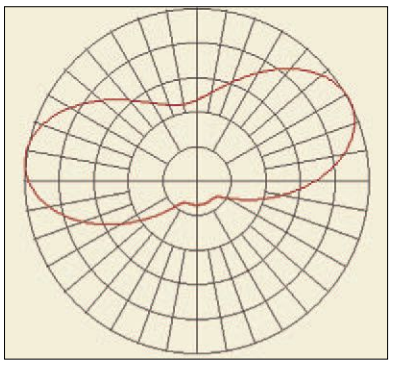
There are a number of items to consider when you think about this story. They tell a sad story about AM broadcasting in the 21st century.

The first point is, of course, not owning the dirt under your business can be risky, should the land owner decide to do something different when your lease runs out. This is especially true for directional stations because, even if sufficient new land is found, it may be in such a location as to cause nasty minima to appear across the station's main service area.

The second problem is in having a multi-tower AM in a residential area like Kirkland where demand and prices have become so high. By way of contrast, this is likely why three other AM DA's in the market are likely to be safe. Those sites, located to the South of Bellevue (near Factoria) are in a swamp area that is unlikely to see any development any time soon.

Little Choice

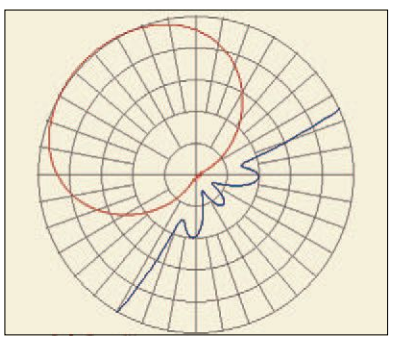
The question now is: can KARR ever find a suitable site and return to the air at full power?



KARR day pattern.

Only time will tell, but it does not look like an easy task. Their day pattern is fairly peanut-shaped, which does not allow for a lot of North-South movement to keep the signal over Kirkland.

The night pattern is even more demanding: it requires putting almost no power to the Southeast, hence that is the only viable direction to look for a new home.



KARR's night pattern.

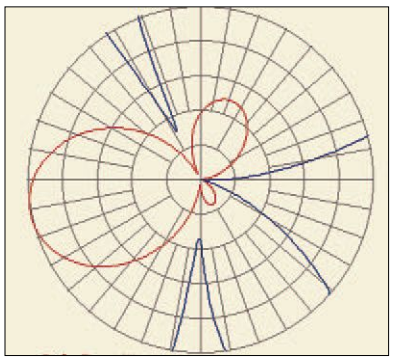
With that assigned minima, the station would have to be relocated in the Southeast area of Kirkland to have enough signal to attract an audience. Sufficient land for a multi-tower array is not going to be easy to find in that area.

Since shutting down operations at the Kirkland site, Jim Dalke, a local engineer, acquired the license and STA. As this is written, KARR is being operated about 3.1 miles away from its original site, on a 100-foot, end-fed wire, 30 feet above ground with 250 Watts power, but still no permanent home in sight.

Another Difficult Situation

As for KKDZ, I am somewhat familiar with that facility, having worked there many years ago when it was KTW.

Back in those days, KTW did not have a night site and the station signed off at sunset to pro-tect KWSU in Pullman, WA. On the other hand, today's night DA has a main lobe is to the Southwest with severe minima to the Northwest, Southwest, and South. Just take a look at how tight they are.



KKDZ's night pattern.

It would not work out as well for KKDZ to be located in the Southeast part of the area as it might for KARR, and there do not appear suitable sites to use or share in the Kirkland area.

One choice might be to operate non-directionally from their Pigeon Point transmitter day site to the Southwest of Seattle. In fact, that is what the station currently is doing under an STA for an emergency antenna, running 1.25 kW, non-directionally.

Nevertheless, given the protections required to other stations – especially to the East-Southeast, as shown in their night pattern above – it would likely have to be with a very low transmitter power. In the end, KKDZ would most likely essentially become a Daytimer once again.

The Biggest Dilemma

Looking ahead, probably the biggest problem, even if one of the stations had owned the dirt, is that the value of the property would have likely exceeded what they could reasonably make in this day and age of diminished returns from AM station operations.

Perhaps you remember all the stations that were bought in the late 1980s and early 1990s for their land value. Many became non-directional operations at very low power levels, with many of the night arrays replaced with shopping centers and/or housing.

I understand that houses in the Kirkland site's area are selling for north of $500k. The land owner certainly will be able to place enough houses on the land to push the decimal point over.

All-in-all, as I see it, this will continue to be a major problem across the country, with AM's being taken dark for these and/or similar economic reasons.

Clay Freinwald is a Seattle market veteran engineer, who continues to serve clients from standalone stations to multi-station sites. You can contact Clay at K7CR@blarg.net

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Transmitter Site

Is There An Unwanted Visitor At Your Transmitter Site?

by Steve Callahan

It's Spring time and that means it's the right time to visit the transmitter site that you've haven't visited in months. There is no better preventative care than a regular visit to transmitter sites. Too much can go wrong if you don't go there monthly, or even better, weekly. However, I know all too well that if you have a lot of sites spread over several states, a weekly inspection visit is not always possible.

One pet peeve I have is with unwanted reptiles or rodents taking up residence in transmitter sites. They're attracted by the warm and welcoming accommodations, with consistent heat and no one to bother them.

I had one AM daytimer I used to visit on a regular basis, even though the tower and ATU were in a swamp and I had to wear a pair of boots to read the base current. I slogged out to the tower one day and opened the ATU door expecting the see only a normal base current but when I looked up, just inches from my face, I saw the biggest and most threatening snake I could imagine. Admittedly, in hindsight, it was probably a small, non-poisonous snake but I wasn't going to stay around to find out. The next week, I returned to the same site ready to wrangle a snake, but he had found a warm perch on the trifilar tower lighting choke and had come in contact with the tower-side connections on the top of the choke and he was now a toasted reptile. To this day, I always approach unknown ATU's with a level of caution and respect.

Many years ago, at a multi-tower AM directional, I knew the engineer had trouble keeping the pattern within tolerance. The antenna array was in a very rural area, in a field adjacent to some woods, and the field mice used it like a Motel 6. He asked the FCC for a Special Temporary Authority to operate at parameters at variance to replace the damaged components in the ATU's – based on excessive amounts of "mouse excrement." The FCC granted him the STA for that reason – the first time I had ever seen the FCC grant an STA for *that!*

I got a call one day from a two-tower AM directional where the transmitter was showing an abnormally large amount of reflected power and wouldn't stay on the air. It required a look into each of the ATU's and I definitely didn't like what I saw. There was mouse excrement, and I mean a *lot* of mouse excrement. I estimated at least an inch of the vile stuff on the floor of the ATU box, and there were even mouse nests in the inductors. Aside from a myriad of other issues, the mouse droppings were the most dangerous. Mouse urine is very corrosive and mouse excrement harbors Hanta Virus. Don't take chances and definitely keep breathing masks and latex gloves in your bag of tricks. That particular station is now off the air and had its license to operate deleted by the FCC – bad for the station owner but good for the mice.

If you've had first-hand experience with unwanted rodents, you're probably wondering if there is an effective preventative solution, and if you tried a solution, why didn't it work? Well, the first step you should take is to fill all cracks and crevices with steel wool. Mice can squeeze through some extremely narrow openings and will chew their way into almost anything – except steel wool. I used to be a big fan of moth balls at tower sites and ATU's but they need to be replenished as they evaporate and the unwanted visitors are much more persistent than you.

I used to have both a mouse and snake problem at one of my sites. Remember my early surprise experience with a snake? Well, I found three in a small transmitter building one day and it was more than a bit unsettling. Trying to herd them out of the building was something I didn't want to do again. I did some research and I couldn't find any effective snake repellent, but I did learn that if you have mice in your transmitter building, snakes will follow. I filled all the cracks and holes that I could find, put a flexible plastic sweep on the bottom of the door, and placed a two foot wide bed of sharp gravel around the outside of the building. I haven't seen a mouse or snake since.

Snakes and mice are not the only unwanted visitors you can expect at your site. I once had the most determined squirrel in the world that kept gnawing his way into an AM transmitter building. He chewed through the wooden shingles on the side of the building, so I replaced them and he chewed through them again and again and *again*. I then covered his access hole with sheet metal and he pulled the sheet metal off with his super-squirrel strength. Then I stumbled onto this solution: a Victor Pestchaser Pro. I usually don't promote a specific product in this column, but this little device chased my persistent squirrel away and I haven't had a squirrel or mouse problem at this site since. However, don't cheap out and get some of their small units that plug into a socket, get the Pestchaser Pro. You won't be disappointed.

Victor Pestchaser Pro

If you find that your facility needs to be cleaned up after a mouse or other rodent's visit, take a look and see if the job requires a pro or you can handle it yourself. Remember your latex gloves and breathing mask. If you or anyone else has left empty pizza boxes, sandwich wrappers or used soda cups at the site, remove them and don't do such a foolish thing again! The next step is to open the door to the building or ATU and let it fully ventilate before you start scrubbing. Mix up a cleaning solution of 1 part bleach to 9 parts water. Let the cleaning solution sink in and then use a lot of paper towels to thoroughly clean the area. Do your cleaning in such a way that you are upwind and the fumes are not being blown toward you. Dispose of the paper towels safely and thoroughly wash up when you're finished cleaning.

I recently came across a transmitter building that had a spider problem. I had installed some security cameras in the transmitter building which were motion-sensing. The camera kept turning on at random times with no discernible image. We finally deduced that the sizable spider population in the building was trying to take "selfies" in the middle of the night.

The spiders wouldn't quit, so we had to do some research to find a solution. We've all seen transmitter sites that weren't often visited and looked like the spiders had taken over. Terro Spider Spray is another specialty product that seems to have worked wonders with our unwanted spider population. Look for it at your favorite home improvement superstore.

Take the time to clean up your transmitter sites. Bring some trash bags and load them up and then be sure to remove and dispose of them – don't leave them at the tower site. No one wants to work in a dirty or unsafe environment. As for your unwanted guests, they'll move on to greener pastures.

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Mar/Apr-16, Page 20 – Article Correction

In the last issue of *Radio Guide*, I interviewed Jim Gorman at Gorman Redlich Manufacturing and he told me that, "he believes TFT encoders/decoders will receive the six-zero code as they are, and that other manufacturer's units will receive the message if you tell it to accept the code for Washington, DC."

Harold Price of Sage Alerting Systems disagreed with Jim and had the following comments: "In general, the statement is incorrect in that FEMA isn't going to use the Washington DC code for the September 2016 national test (which will use the NPT event code). I have confirmed this directly with FEMA. Therefore, telling a unit to accept the Washington DC code will have no effect whatsoever. The unit will only process the message if it can receive the 000000 code.

"The entire point of the 000000 code is that the kludge of using the Washington DC code (as was done in the 2011 live code EAN test) is no longer required. I suspect that FEMA will not use the Washington DC code for a live EAN after the 6th R&O deadline at the end of July.

"Therefore, a unit *must* be able to process the 000000 code, and a unit must be able to accept the 000000 code in whatever mechanism is used to tell the unit to select an alert for processing. In particular, for example, a unit in Pennsylvania must respond to the 000000 code as well as the Pennsylvania state code, and must *not* respond to the Florida state code.

"As one of the 'other manufacturers' mentioned above, the old, non-CAP grey box model 1822 Sage unit will not follow the new rules set forth in the 6th R&O. Sage's current product, the 3644, will follow the new rules when the user installs the free, firmware update that will be released this month."

Jim Gorman responded: "In my conversation with Al Kenyon at FEMA, I discovered that as of July 31 FEMA will no longer attach the location code for the entire DC area to their various tests using the NPT event code. I think not sending the *entire* DC area is a mistake. I thought the purpose of the test using the NPT event code was to confirm that the national network for the distribution of the 3 national event codes (EAN-NPT & NIC) was in place and functioning, and the addition of the *entire* DC area would not do any harm.

"All of our CAP-DEC decoders could be programmed to add the ENTIRE STATE OF XX to any message addressed to the entire country (6 zero code), and all of these older units that we did not make could be continued in operation until they die a natural death. If the station using the older units is not an LP1 or LP2, adding the entire state will not do any harm.

All of these older Certified EAS units could be run until they no longer function rather than replace them and lose track of these older units which could fall into the hands of people with malicious intent. Any location using our EAS-1 Encoder Decoder just has to have the V9.8 E-prom in the radio model or the V20.9 E-prom in the TV model to recognize and process the 6 zero code. *– RG –*

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FCC Focus

AM Translator Action and The ENDS of Advertising

by Peter Gutmann

AM Translator Action Underway

Now that the first AM translator window is well underway, FM stations face a challenge – how to deal with their new neighbors, and specifically how to guard against interference.

By way of background, recall that late last year, as part of its AM revitalization, the FCC announced four filing windows for AM translators. The first two enable an FM translator (whether licensed or a mere CP) to move up to 250 miles and change channel to serve an AM primary station. They extend from January 29 through July 28 for Class C and D AMs and from July 29 through October 31 for all others. The remaining two windows will open next year for new translators to serve any AM station that had not been specified as the primary station in the first two windows.

Hundreds of window applications have been granted so far, with many more to come. While AM broadcasters generally welcome the opportunity to strengthen reception (and to extend daytimers' hours of operation) there is a countervailing concern – some FM stations are troubled over the incursion of the new signals and wonder how to protect their audiences from feared interference.

First, let's get one tempting approach out of the way. Attacking a new translator on financial grounds is a non-starter. Veteran broadcasters recall with decidedly mixed feelings the influx of new FM stations in Docket 80-90, which dropped in nearly 700 new FM allotments throughout the U.S. and radically altered the competitive landscape in many small and medium markets. Back then (was it really nearly 30 years ago?) the FCC rejected all economic arguments that the new outlets would impair the viability of existing stations.

No different result is apt today. While Docket 80-90 was based upon a largely abstract policy to encourage diversity, the translator windows are designed to address a far more specific and pressing need – to provide relief to alleviate, at least temporarily, the severe challenges of the AM band. So contentions of competitive damage are even less likely to be persuasive.

Rather, the only feasible ground on which to oppose an AM translator is technical interference. As a basic matter, window applicants are required to protect existing authorizations and earlier-filed applications. In addition, they can only serve as "fill-ins" (that is, providing coverage only within the protected contour of their AM primary station). So any application failing those threshold standards should not be granted.

Yet there are two other approaches for FM stations to consider, both involving interference to FM reception. These are the same rules that apply to all new or modified FM translators.

A pending application can be challenged on the ground of mere potential interference. An FM translator's 1 mV/m contour cannot overlap a populated area already receiving a regularly-used, off-air signal of any authorized co-channel or first-, second- or third-adjacent channel FM station and interfere with reception of that station.

Unfortunately, there is a procedural problem. Prior to the current crop of "250-mile waiver" window translator applications, existing stations were afforded a meaningful opportunity of at least several weeks between public notice and grant, to evaluate potential interference. But, to its credit, FCC staff is now processing AM window applications far more quickly – one was granted the very next day after we filed it!

Confronted with an already-granted application that threatens reception under the FCC's standard, an FM station has two choices. First, it can apply for reconsideration of the grant if it can show that it lacked sufficient notice and therefore was unable to participate prior to the grant.

Second, once the translator is built and begins to operate, a station can demonstrate actual interference to reception by its regular listeners. Unlike the standard for pending applications, this one is far broader, as it applies without regard to geographic proximity or signal strength. All it takes is documentation of actual interference (although the listener must be independent of the station and the situation can't be contrived).

At that point, the translator licensee is obligated to eliminate the interference or cease operation. Interference to only a relative few listeners on adjacent channels can be remedied using filters or traps or by upgrading the receive equipment. But wide-spread, co-channel or mobile situations can resist adequate technical solutions.

It must also be noted that once such a complaint is filed and presumably opposed by the translator licensee, FCC staff has been taking a long time to act. When they do, they often afford the translator opportunities to investigate and correct actual interference. In light of the priority being given to the window applications, complaint resolution may be accelerated, but the situation still can endure for far longer than many FM stations would hope to tolerate.

So FM stations concerned over competition from new translators have some remedies to pursue, although they might prove impractical.

In the meantime, AM stations (other than those Class Cs and Ds that are already specified in a window application) can continue to plan to add their own translator. Each window is "first come-first served," so the first day attracts the bulk of the filings. After July 29, prices of remaining translators may fall well below current levels, but waiting in the hope of a bargain entails risk, since in areas of spectrum congestion eligible channels and sites might already be foreclosed by earlier filers. As with so many choices in life, it's a gamble.

The ENDS of Advertising

Although broadcast advertising of cigarettes, little cigars and smokeless tobacco has been banned for decades, a new and potentially highly lucrative source of ad revenue has arisen lately. Recent studies found that one in six high school students already "vape."

But don't spend your new-found $$$ just yet. After years of deliberation, the Food and Drug Administration concluded that even though e-cigarettes do not contain tobacco, they are infused with nicotine and thus are a tobacco product subject to its regulation.

The new rules cover "ENDS" – Electronic Nicotine Delivery Systems – and include not only electronic cigarettes but such products as personal vaporizers, vape pens, electronic hookahs, electronic pipes, atomizers and vials containing nicotine – essentially, any means by which nicotine can be inhaled.

Opponents of the new FDA rules claimed that the cost and complexity of compliance (including a requirement that all ENDS be submitted to the FDA and approved before they can be marketed) will force entrepreneurs and small companies out of business, leaving the field to the major tobacco companies to extend their dominance. Challengers also touted the health benefits of weaning smokers away from cigarettes and cigars in favor of less harmful nicotine delivery methods. But proponents prevailed by citing the addictive health hazards of nicotine, the appeal of e-cigarettes to youth, and the fear that e-cigarettes will become a gateway to smoking.

While most of the FDA rules concern the manufacture, packaging and labelling of ENDS, they also extend to advertising and promise to impact broadcasters' ability to rely on this burgeoning source of revenue.

Packaging and TV ads will have to display a graphic warning *("WARNING: This product contains nicotine. Nicotine is an addictive chemical")*, but so far it is unclear how that language will have to be included in radio spots. Indeed, several commenters requested clarification of this mandate. One had recommended that advertisers be required to include a voiceover "stating the warning out loud, in a clear, conspicuous, and neutral manner," but the FDA declined, at least for now. While confirming that "the requirements to include a warning ... apply to all forms of advertising, regardless of the medium in which it appears," so far the FDA has applied specific formatting requirements only to advertisements with a visual component and added that it "intends to provide guidance on how to comply with the health warning requirements on unique types of media" at some point in the future.

Even so, it is clear that the warning will need to be prominently displayed in program guides, mailers, digital ads, Internet web pages, social media, messaging, billboards and other visuals associated with radio stations. To satisfy that requirement the warning must occupy at least 20% of the area of the ad.

A crucial consideration is the new rules' prohibition of sales of ENDS to people under 18 (and a requirement of photo identification by buyers under 26). Presumably this entails avoiding scheduling ENDS spots altogether in programming oriented to kids and teens. But it also will require that ENDS ads in general programming – and, indeed, any ENDS references in the program content itself – not target or unnecessarily appeal to the young. In that regard, keep in mind that the FDA defines an "advertisement" broadly to include any statement regarding the availability of a product, which could include incidental mentions.

How best to implement these practices is hard to define, but some guidance may be gleaned from advertisers' and broadcasters' experience with alcohol ads. Another source of guidance may come from Colorado and other states that have legalized marijuana but ban it from ads or event sponsorships that attract youth.

A bit of good news – given the complexity of these considerations, the ENDS warning tags will not be required until May 2018. In the meantime, though, some states may impose tighter restrictions that would affect ENDS advertising within their jurisdictions, including raising the prohibited target age from 18 to 21.

In a way, the uncertainty over ENDS advertising contrasts with the outright ban on cigarette ads. While depriving broadcasters of a lucrative source of revenue, at least that line was clearly drawn. The extent and manner in which ENDS ads will develop remains to be seen.

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INOVONICS BROADCAST

Chief Engineer

Installing a Coaxial Switch

by Scott Schmeling

I'm writing this article as I wait at the Denver airport. My wife and I are flying to Caldwell, Idaho, for our daughter's graduation from the College of Idaho. She's graduating with degrees in math, physics, education, and physical sciences (If I may brag for a minute...). It's been 20 years since her high school graduation, and her third time back in school. But she's determined, driven, and passionate about math, and we are very proud of her. Next she works on her Master's degree in Education toward her goal of being a high school math teacher.

Originally, we were to have a short layover in Denver, but the plane from Atlanta to Minneapolis was delayed because of weather. We missed our connecting flight and were re-routed to Sacramento, then to Boise. But enough about our travel woes.

Recently, I was "given" a new transmitter to install. The old transmitter (a 1977 vintage Collins 831G-2C) was still working well and would be kept as a backup.

As far as I know, there are two different methods of switching an RF antenna feed from one transmitter to another – an RF patch panel or a motorized transfer switch (three methods if you count unbolting connectors and manually changing cables). The patch panel is less expensive, but it also requires someone to be on site to physically move the big jumpers from one position to the other. There is also the advantage of someone actually being there to observe the transmitters during the change-over.

But that "advantage" is also a disadvantage – somebody *must* be there, and there are times when that can be nearly impossible! For that reason, I chose the motorized RF transfer switch. We also ordered a dummy load which would allow us to work on either transmitter while the other one is "on line."

My friend and frequent assistant, Marv Olson, would assist with the installation. But for the "extra hard" stuff (fitting sections of rigid transmission line between the four pieces) I also called Mike Troje. Mike had recently relocated back to Minnesota from Dallas. In years past, Mike had served as Chief Engineer for some of the stations in the Minneapolis/St. Paul market. Mike has retired, but still wants to "keep his fingers in the business." Two people makes this job much more "do-able" ... three is that much better. But wait, there's more – John Sims of RF Specialties was also there!

You might think that with four people working on the same project we'd be tripping over each other. But, actually, it was *perfect!* There was a wonderful sharing of experiences, techniques, "what-if's" and "how-a-bout's."

The first night the only thing on the schedule was connecting the transfer switch between the existing transmitter (the Collins) and the line to the antenna. Let me mention something here; most of our stations are using 3-1/8 inch line, and some are using 1-5/8. This station uses *5-inch line!* In addition, there's something less than five feet of that line coming inside the building. Knowing that five-inch line is much less flexible than 3-1/8 (especially with as little as we had to work with), we knew we would not be able to "square" things up. We literally bolted the transfer switch to the output connector of the Collins, then we bolted the 5-inch line to the switch. With the switch in circuit we would be able to get everything else connected during the day without the need to go off the air.

Connecting the 5-inch Coax to the Myat Switch

The next day all four of us went to work on the rigid line. The last time I installed one of these I bought a combination mitre saw and a cutting disc so I could make very nice square cuts in the copper tubing. The cutting disc left us with quite a bit of de-burring to do. Mike brought along his "big" tubing cutter (I don't remember *how* big, but it handled the 3-1/8 rigid outer conductor with ease). Using the tubing cutter instead of the cutting disc was really nice. It made a good square cut and there was very little de-burring to do. That alone saved us a whole bunch of time. (Thanks, Mike.)

We firmly adhered to the principle, "measure twice, cut once." But in one case, we cut twice. At that point, John got on line with MYAT to verify how to determine how much shorter the center conductor had to be, based on the overall length of the piece of line. You can find the cutting chart at myat.com – select the Technical button at the top, then "Technical Drawings" part-way down the screen.

After the "plumbing" between the transfer switch, both transmitters, and the dummy load was finished, Marv and I continued with wiring the audio, control, and metering circuits. The basic control functions and metering were wired to the remote control unit. That was pretty straight-forward.

The interlocks, however, were a bit more of a challenge. The transfer switch provides three sets of form C (SPDT) contacts for position A and for position B. Initially, that seemed like way more than we would need. MYAT (the transfer switch manufacturer) calls them "limit" switches – indicating the switch has reached the end limit of its travel (and is fully in position). It's important that the transmitter control be wired through the interlock switches to ensure the transmitter can not be turned on when it's not connected to a load. The manual includes a diagram of the switches – but no suggestions for wiring them. We'll get to the rest of this in a bit.

The dummy load (manufactured by Altronic) has an interlock relay. Our initial reaction was, *"fantastic!"* One thing we had discussed was the need for a dummy load interlock so the announcer back at the studio couldn't mistakenly turn on a transmitter connected to the dummy load – there by burning up said dummy load! (I've heard it has happened.)

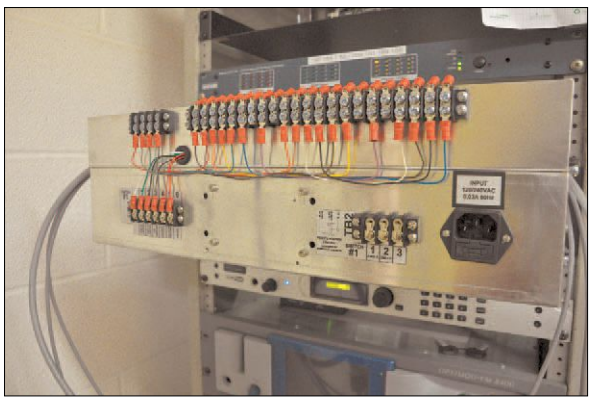
In reading through the manual and talking with tech support, we learned some cool things about this dummy load. Apparently, you don't have to turn the blower on before applying RF to the load. As the sensors detect the temperature rise above a threshold, the blower motor starts automatically. Regarding the factory-installed interlock relay, the manual simply says it exists. We checked continuity through the interlock connection points and discovered the interlock relay energizes (closing the contacts) when AC power is applied to the load. The relay de-energizes if the temp rises above another threshold indicating the load is overheating.

This is not the way I want (or expect) the dummy load interlock to work. I don't want the announcer back at the studio to mistakenly turn either transmitter on if it's not connected to the antenna. It would be far too easy for the non-technical to turn the wrong transmitter on and think he's on the air (I've heard *that* has happened, too!)

Our solution was to add an additional relay wired to the contactor that applies power to the blower motor. This additional relay will serve as *our* interlock relay and will be energized only when power has been applied to the blower. I chose a 4PDT 24V AC relay. Two sets of contacts are wired through the limit switches of the transfer switch to each of the transmitter's interlock connections, thereby allowing the transmitter connected to the dummy load to be turned on *only* if the blower is running.

Speaking of those limit switches, the controller panel for the transfer switch has two terminal strips on the back. One is for remote control connections, the other is for voltage to the motor of the transfer switch. There is no place to connect the wiring from those 18 terminals for the A and B limit switches. Unfortunately, there's no room for a terminal strip long enough, either.

We cut a piece of 2" by 2" aluminum angle to size and mounted it to the back top of the controller chassis. Then we mounted two terminal strips to the angle. One strip was a 4-terminal for connection of each transmitter's remote interlock. The other was a 22-terminal (18 for the limit switch connections and 4 for the dummy load interlock relay connections.).



Two Terminal Strips Were Added on Top

After completing the installation, our new transmitter was on line with full remote control and metering. If that transmitter were to go down, we can command the transfer switch to change to the "B" position (status indicators on remote control show the switch position) and turn on the backup. The transmitter connected to the dummy load can *only* be run up if the *blower* on the dummy has been manually turned on – exactly the way we wanted. I love it when a plan comes together like that!

By the way, we're now in Idaho getting ready for our daughter's graduation. I'm shutting the computer (and maybe my phone) off.

Until next time – keep it between 90 and 105!

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

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Antenna Topics

Multi-Bay ERI Antennas

by Mike Hendrickson

In the Mar/Apr-16 edition of *Radio Guide* I gave a detailed description of the ERI single-bay antenna. This article will go into more depth on the multi-bay ERI antennas. It is intended as a generalized description of the ERI antennas.

There are two general groupings of ERI multi-bay antennas, the end fed antenna and the center fed antenna. Both of these antenna types are based on the single-bay antenna.

Since the center-fed antenna is composed of two end-fed antennas I'm going to start with the description of the end-fed antenna. The multi-bay, end-fed antenna is composed of multiple single-bay radiators. The radiators are separated from each other by the inner bay transmission lines. As an example, a two-bay antenna is composed of two bays, or radiators, with an inner bay transmission line between the two bays. This inner bay line is a standard 3-1/8" transmission line, one wavelength or one half wavelength long, with square flanges on each end. The top bay has the shorting stub placed on the top of the 'T' block. The bottom bay has the matching section connected to the bottom of its 'T' block. ***(Figure 1)***

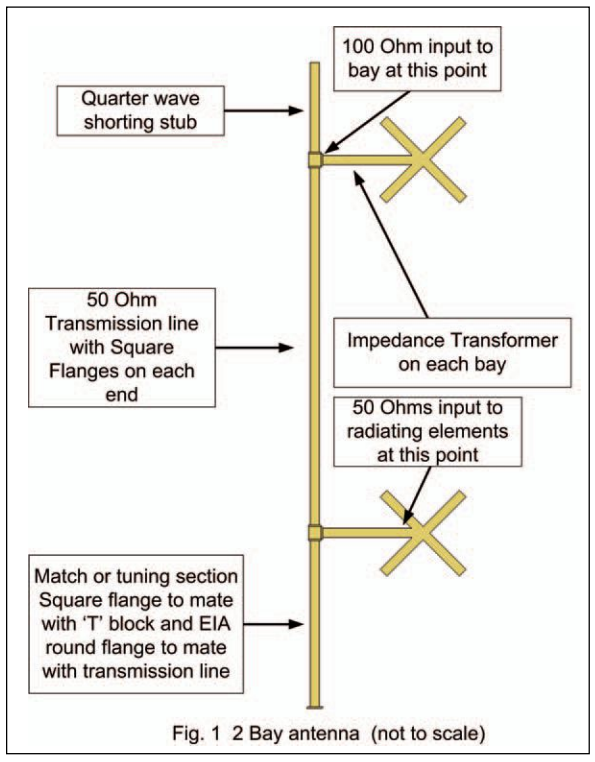

Fig. 1 2 Bay antenna (not to scale)

If 50 Ohm, single bay radiating elements are just simply installed in a multi-bay antenna end-fed antenna, the input impedance of the antenna will be 50 Ohms divided by the number of bays in the antenna. In the example, a two-bay antenna would have an input impedance of 25 Ohms. In ERI antennas, the impedance of the radiating sections is changed from 50 Ohms to a value based on the number of bays in the antenna. The impedance change is accomplished in the impedance transformer in the antenna bay. This is the length of transmission line between the "T" block and the "Tee" located between the radiating arms of the bay. The standard center conductor of a 50 Ohm transmission line is replaced with a center conductor designed to transform the input impedance of the bay to 100 Ohms for a two bay antenna. ***(Figure 2)***

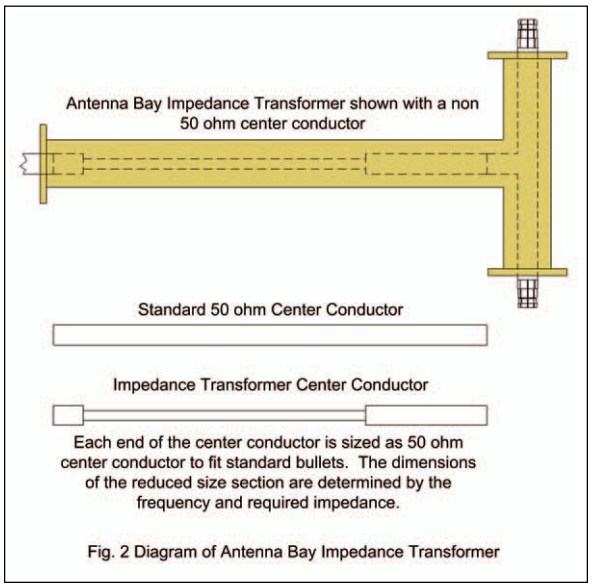

Fig. 2 Diagram of Antenna Bay Impedance Transformer

This same description is accurate for the two-bay and larger end-fed antennas. There are simply more bays and inner bay lines inserted to make up the multi-bay antenna. The input impedance of each bay is set at the value of 50 Ohms, multiplied by the number of bays in the antenna.

At the bottom of the "T" block of the bottom bay, the antenna matching or tuning section is installed. This section of standard 50 Ohm transmission line is approximately six feet long. One end of the section has a square flange to mate with the "T" block. The other end of the section has a standard EIA round flange to mate with the transmission line. The tuning section is designed to trim the antenna's input impedance by small amounts, since the impedance is already a nominal 50 Ohms.

The simplest description of the center-fed antenna is that it is two end-fed antennas in parallel. The top half of the center-fed antenna is a standard end-fed antenna without the matching section. The bottom half of the center-fed antenna is also a standard end-fed antenna, but the feed point has been moved to the top of the end-fed antenna and the DC shorting stub has been removed. The bottom bay of the antenna has a "L" block in place of the standard "T" block.

Since the two end-fed antennas are in parallel, the input impedance to each end-fed antenna must be changed to 100 Ohms to maintain a 50 Ohm input to the complete antenna. The center section of inner bay line is replaced with two shorter lengths of transmission line. These two shorter lengths are connected to a transmission line "Tee." This "Tee" is the input to the antenna. The two shorter lengths of transmission line are the impedance transformers for the two end-fed antennas. They also are the transition sections between the square flanges of the "T" blocks on each bay and the round flanges of the transmission line "Tee." ***(Figure 3)***

This design of the center fed antenna can prove useful. A few years ago Minnesota Public Radio desired to install an auxiliary antenna for the radio stations at Bemidji, Minnesota. The transmitter site is located about 22 miles away from Bemidji, Minnesota. We gave consideration to installing just a single bay antenna, but quickly realized that, even at the maximum power output of the transmitters, we would not cover Bemidji with an adequate signal while using the auxiliary antenna.

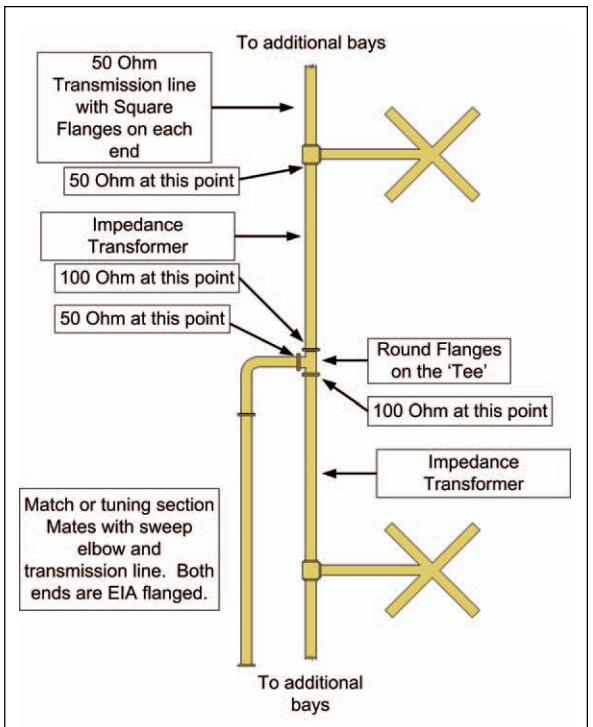

Fig 3 Multi-Bay Center Fed Antenna

We did have on hand a 10-bay center-fed antenna that had been storm damaged and retired from use. We rebuilt five of the best bays from this antenna and constructed a 5-bay, end-fed antenna that was installed on the tower. We did not need to change any of the impedance transformers in the individual bays. We did replace the impedance transformer that was between the center feed point "Tee" and the input to the bays. That simply involved installing a tuning section in place of the impedance transformer.

The ERI half-wave spaced antenna utilizes the same bay design as the full-wave spaced antenna. Since the inner bay transmission lines are now a half wave length long, there is a phase shift of the signal of 180 degrees between each bay of the antenna. Since there is this phase shift, the bay is rotated 180 degrees. Thus, on an ERI half wave length spaced antenna, every other bay is rotated 180 degrees.

Up until a few years ago I had always thought that center-fed antennas had to be an even number of bays, but then, I encountered an eleven-bay, center-fed, antenna in Dodge City, Kansas. I am also aware of a nine-bay antenna center fed antenna in another city. This makes sense if you consider that the lower portion of the center-fed antenna and the upper portion of the antenna are both end-feed antennas in parallel.

I have one final observation about ERI antennas. All ERI antenna bays have a red band on one of the radiating elements of the bay. The installation instructions state that the bays are to be installed with the bands pointing in the same orientation. Another indication of proper installation orientation on full wavelength antennas is that the insulators on each bay are installed in the same orientation. Recently, when I was reviewing high resolution pictures of one antenna that had been installed 20 years ago, I discovered one bay had been installed upside down. This antenna appeared to be operating properly. But, when you think about it, this bay was 180 degrees out of phase of the rest of the antenna. This means that this bay was effectively canceling part of the signal transmitted from the balance of the antenna. This was a nine-bay antenna, but because of the upside down bay, the gain was reduced to that of a 7-bay antenna. The ERP of the station was reduced from the licensed 100 kW to about 77 kW. (The antenna bay has since been reinstalled correctly.)

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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In The Field

I Just Can't Toss That

It's my story and I'm sticking to it.

by Jim Turvaville

It is not just us "old guys" that tend to collect things; I recently ran across a fellow Engineer who is 20 years my junior that has more collection of radio gear than I do. As is usually the case, I look at his rooms full of salvaged gear and ask, "and just why did you think you wanted to keep *that?*" – an expression that I'm 100% certain is what people say when they see mine as well.

For a little bit of group therapy, let's look at the habit of keeping things and perhaps some really practical ways to clean up and help someone in the process. Or, at least let's agree to not criticize each other very much and get a good laugh – either one is just fine.

Watching those Reality TV shows about hoarding, I've come to the conclusion that there is a distinct difference between the very real psychological condition surrounding a hoarder, and me and my kind. While it is true that both personality types tend to surround themselves with an abundance of "stuff" that seems to have little or no value to anyone else, a hoarder cannot bring themselves to let go of anything – when an intervention takes place, they are carried away kicking and screaming about the demise of their things. Me, on the other hand, will surround myself with all kinds of old and discarded radio gear which has little or no value to anyone else (hence, why it is now in my possession, you understand). But given the opportunity to swap it for a different variety of stuff (of equally useless value to most of humanity), I will gladly help you load it up in your truck as long as you are bringing me some more to take its place. Hence, that is not "hoarding" – it's my story and I'm sticking to it.

Reason to Keep Things #1

The first reason I keep things, and the most important to me personally, is that it still works. Growing up in a poor rural area, it was just ingrained in me to never throw away something that was not broken. Even if I no longer needed it, as long as it was workable, then the possibility always existed that someone else, somewhere else, could extract more usable life from it. When I got into this crazy business, that part of my DNA did not just magically switch off, though some close to me may argue that I've not done anything to assist that process either. Still, my first evaluation of some item is whether it is still functional; and even if it is only "somewhat" broken it may get some serious consideration if it could be quickly and affordably be repaired. It also counts to me if the item contains valuable spare parts for similar (or sometimes not so similar) devices.

For years I had a warehouse full of gear – a lot of square footage of which was taken up by vintage 70's era radio automation systems. I'm talking the SMC and Schafer gear in those cool 6-foot equipment racks. I think I had over 20 racks full of them at one time. I freely admitted that the time would never come back around when would use reel-to-reel tapes and carousels for programming again, but there were some amazingly cool parts in those old beasts, not to mention those SMC green racks – almost all had great casters and locking back doors on them.

I had a pair of vintage Schafer Spotter units (a reel player using tape with clear windows to trigger a stepper relay for "random" access to the material) which no longer worked, a dozen or more reel players and a huge library of the automation tapes. I needed to keep some of the reel machines around, I had the space available, so it all got kept. That is, until it became time to move and sell the warehouse.

Faced with the inevitable, I spent a few days of reconnaissance and dismantled the 25 or so Carousel units of various ages, and came away with a couple five-gallon buckets of parts – power cords, fuse holders, power supply regulator boards, micro switches and all those wonderful 24V ice cube relays and their sockets. As I recall each Carousel had like 12 relays on it, so my 24V relay count was in the hundreds – some of which I still have and use for projects today.

The Schafer Spotter yielded a couple hundred rotary switches and knobs and some relays. I kept a couple of the better reel machines and scavenged the rest for a box of spare parts, which I did use over the next decade to keep the units running. That gave me time to buy a nice USB audio interface and set up a little system on the workbench to transfer that entire library of reel tapes to my computer.

(Continued on Page 22)

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I Just Can't Toss That

– Continued from Page 20 –

Those old reel libraries were recorded from vinyl, and there's just not much in the world as good as the sound of vinyl to my old ears. I kept a few of the nicer SMC racks with sides and doors, took the industrial casters off the rest, and they joined all of the items above in a metal recycling run. In the end, I got to keep what I really wanted and needed from all of that stuff, and it took less than 10% of the space as before.

Reason to Keep Things #2

The secondary reason I keep things, and it is just barely a slim second to Reason #1, is for "fodder." That old agrarian word is actually referencing feed for cattle, and the Urban slang version means "one who exists to absorb projectiles." But my definition is somewhere between those extremes, from the traditional dictionary meaning of, "a consumable, often inferior item or resource, that is in demand" – i.e., barter materials. My use of the term does not always fall completely on the narcissistic "junk collecting" side – often my desire to keep something for fodder material is completely altruistic in nature.

I tend to keep most all working laptops and computer systems, long after their hardware and software systems have become unsupported by the manufacturer. I still have a working 486DX-266 unit, for the simple reason that I have boxes of 5-1/4 inch floppy discs that still are waiting transcription, and a pile of old IDE hard discs that can be read by that unit. One day it will go the way of the Schafer Spotter Unit and Ampex 770's, but only after I no longer need it for format conversions. But I also have a lot of computers which still work, and are usable for a variety of utilitarian reasons. Stash a couple at your tower sites for that occasion when you need to actually have a computer with a real monitor for browsing the Internet, or load a nice Freeware Audio player and some files to keep a station running in an emergency. This is a really good use for spare used laptops, as they can be stored in a plastic bag and kept clean for use. Back when the first LPFM filing window came along, I was able to repurpose an old Arrakis Digilink-2 system to a startup LPFM operation. It had been replaced by a much more (then) modern system, but was perfectly usable and functional – and that community broadcasting group was extremely grateful. I've donated dozens of computers to little non-com stations, startup LPFM's, and even Internet broadcasters who just needed something workable to get started. Those old XP machines will still work great, just disable Update and make sure it has good Anti-virus and firewall installed. It's not meant for permanent use, but can sure help someone get off the ground with a project. If all fails, check your local Goodwill or other charities who recycle computers, or those who upcycle them and donate to the less privileged to use.

Save Those Laptops

And it's not just computers. Most all of that old analog audio gear, that has long been replaced by the new digital models, can have some kind of a life in a less demanding or less professional environment. Analog telephone hybrids, CD players, analog mixers and consoles, switching gear or old studio processors are usually welcomed by the smaller or startup broadcasting facility. That Sine Systems RFC1-B remote control can be a hobbyist's new way for kicking on the morning coffee maker, in the right hands. Just be creative and think out of the box of the day-job demands.

"Hello, my name is Jim and I keep things." But sometimes that is okay.

Jim "Turbo" Turvaville is semi- retired from 38 years in full-time Radio Engineering and 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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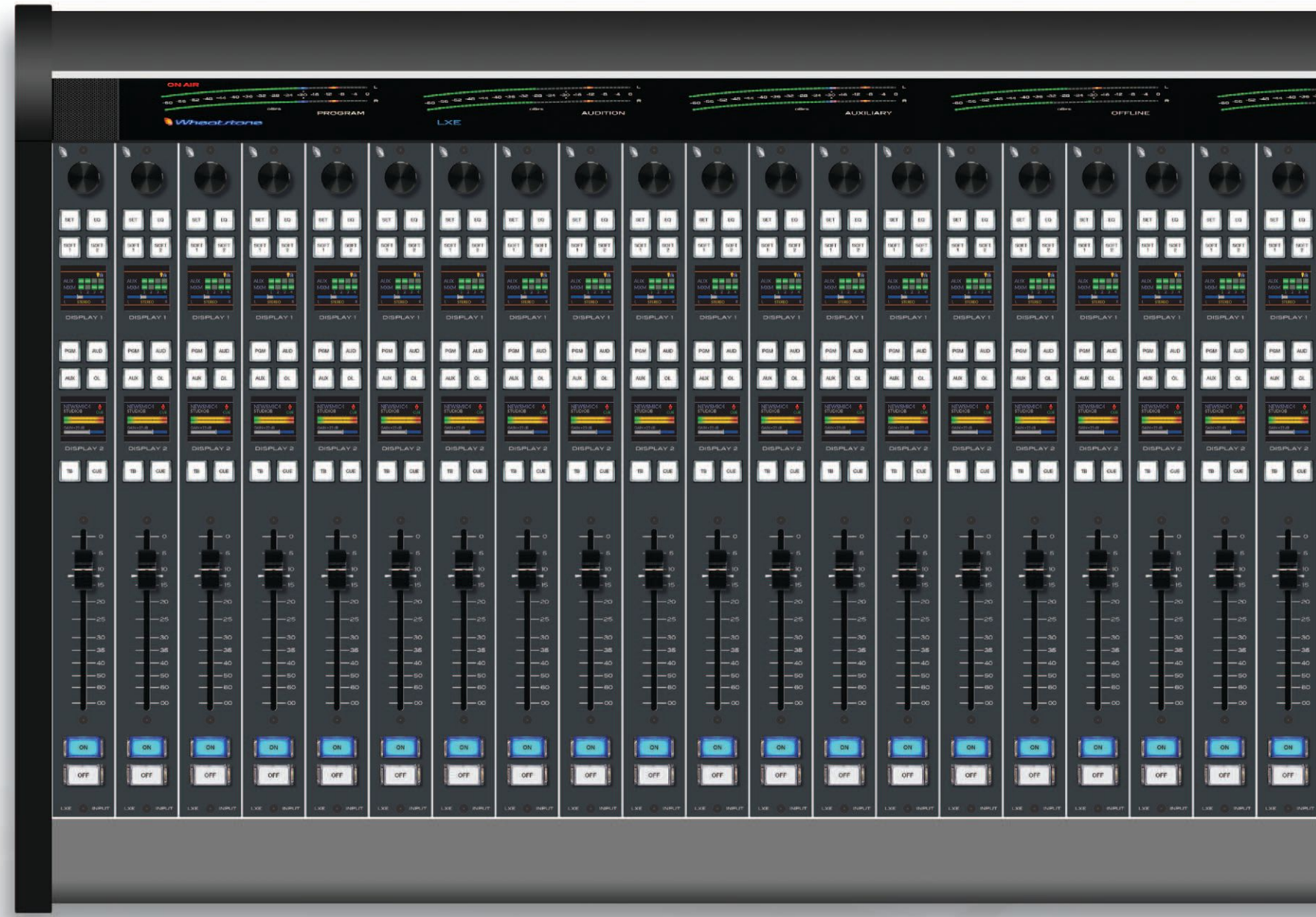

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Any Way You Want It

ConsoleBuilder software allows every switch on the surface to be programmed for function, mode, and even color (switches are RGB led illuminated). In fact, built-in software allows every button to be scriptable, letting you create powerful macros for as many controls as you want. Multiple full color OLED displays on each panel keep pace with ongoing operations, and event recall allows painless one touch console reconfiguration at the press of a button. With its inherent control flexibility and ability to access thousands of signals (sources and destinations are limited only by the size of the network) the LXE takes facility work flows and audio control to a new level.

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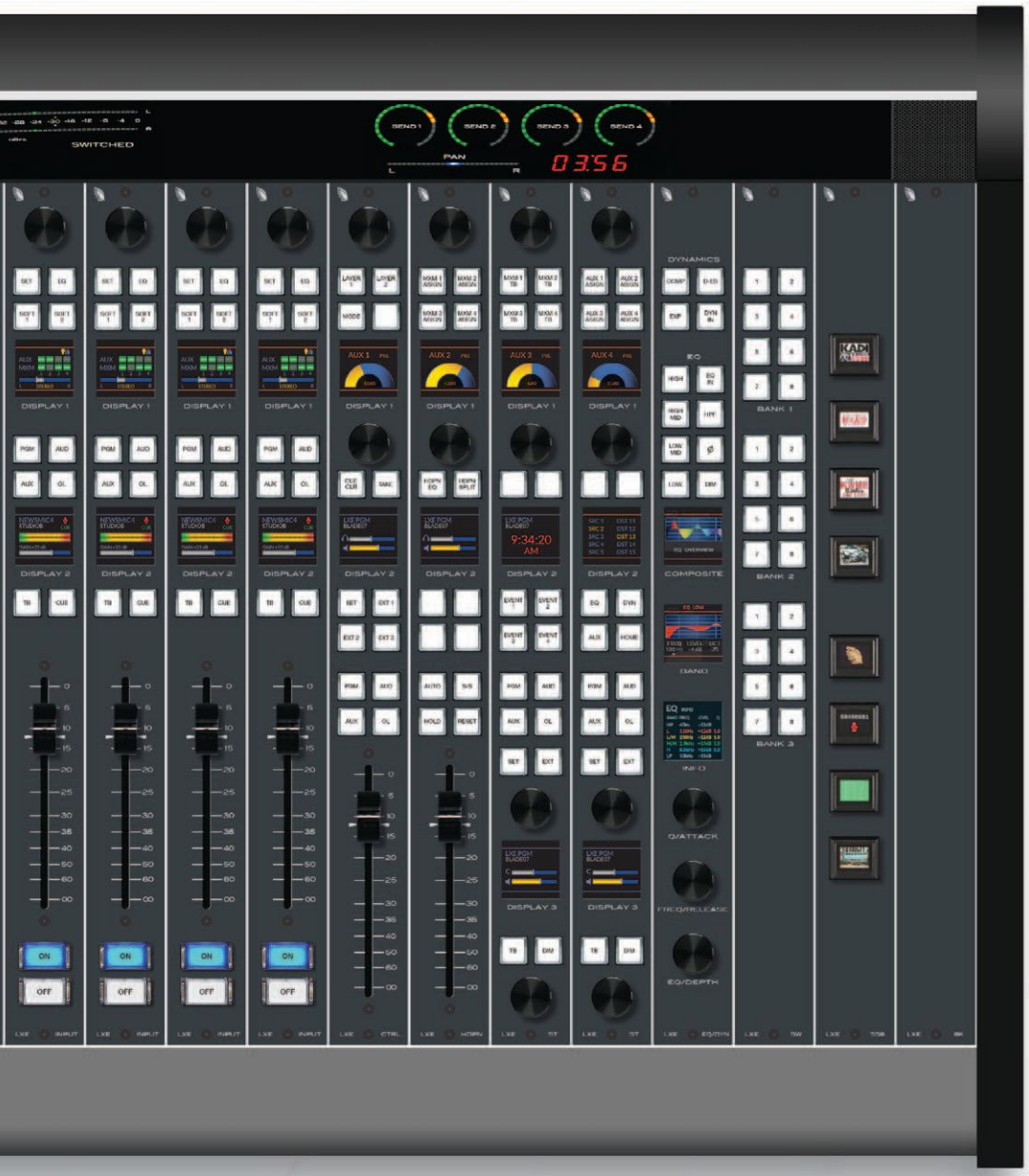

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Tower Topics

"Tuning" Fixed Capacitors

by Phil Alexander

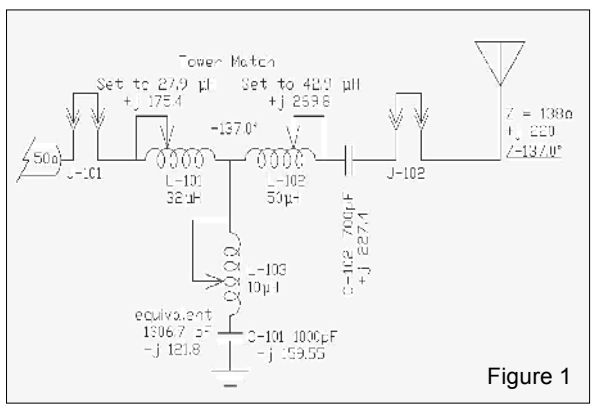
Previously we mentioned that there was a way to make fixed capacitors appear variable. Because the networks of most stations depend on this simple principle, that will be our focus this time.

However, first, a bit of a disclaimer: The following applies generally to circuits handling 5000 Watts or less – which does include the majority of stations. It is true that these circuits are often handled differently and more expensively in higher powered installations. However, those specialized high power variations are beyond the scope of this article, because helping those with very little, or no, AM transmission experience understand transmission basics is our goal.

Adding "j" Values

The matching network under discussion is an ATU (Antenna Tuning Unit) network to connect and match a 50 Ohm transmission line from a transmitter with a carrier frequency of 1000 kHz, to a tower with a base impedance of 130 Ohms of resistance and 220 Ohms of inductive reactance. In making the match, our calculations showed a requirement for a shunt capacity (X3) value of -j121.8 Ohms. The circuit looks like **Figure 1**.

The question is, how do we get a capacitor sized for -j121.8 Ohms at our operating frequency? According to the values shown on the ATU schematic, all we need is a 1306.7 pF capacitor to use as C-101, but no manufacturer makes that value.



A "T" Network with 50 j0 Ohm Input, 138 +j220 Ohm Output, and 137° Phase Delay.

However, a simple way to change the effective value of a fixed capacitor is connecting a coil in series with it. In its basic form, this means mathematically adding "j" values together.

A 1000 pF capacitor has a value of -j159.55 Ohms at our carrier frequency. Connecting a +j37.75 Ohm inductor in series with that standard capacitor value will give us a net value of -j159.55 +j37.75 or -j121.8 Ohms – exactly the X3 value required to make this network match the 50 Ohm transmission line to the 138 +j220 Ohm tower, with a phase delay of 137 degrees between network input and output.

Selecting the Right Parts

Could we use a 500 or 800 pF capacitor and more coil? Yes, that would appear to work at the carrier frequency.

But the solution that works for that frequency may not work as well for the sideband frequencies, as there is a greater risk of poor transfer of sideband frequency energy – especially at higher modulating frequencies that produce sidebands further away from the carrier frequency. There is always greater risk of poor performance when using larger reactances than needed and offsetting them with excessive reactances of the opposite sign.

Thus, for the best results, the inductor should be minimized by selecting a capacitor having a -j value above and as near the value needed by the circuit design. However, there is an even more important reason for sticking to this rule in directional systems.

In DA arrays we would like to have all frequencies passing through a network delayed or advanced by the same amount. Obviously this is not practical, but keeping as close as possible to this ideal will give better pattern bandwidth and less modulation distortion in those areas in deep nulls where pattern bandwidth issues are the worst.

These pitfalls were not always recognized in some of the older "universal" one-size-fits-all ATU's still in service today, although they were built 40 to 60 years ago. For this reason, it is always a good idea to run the design calculations before doing repair work on an older ATU, especially in a DA.

Using the Existing Parts

At first, it looks like a similar situation exists in the output branch of this network. Certainly, the schematic (**Figure 2**) makes it look that way, but there is a better way. If you consider the problems we have described

(Continued on Page 28)

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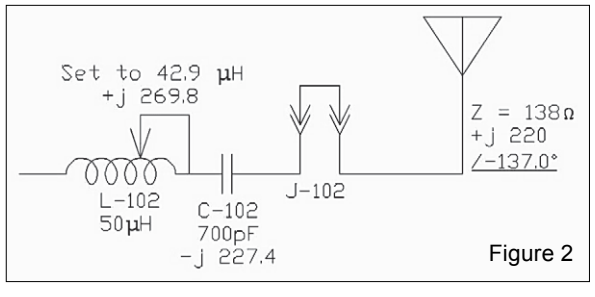
"Tuning" Fixed Capacitors

– Continued from Page 26 –

about the pitfalls of using too much -j and cancelling a large part of it with more than the minimum +j (inductance), it is clear we need a better way.



An enlarged view of the Output Branch.

Looking at the output (X2) branch of the schematic above, we have:

• Part of L-102, the X2 (+j) required by the Tee design formula = +j269.8 Ohms

• Part of L-102, the adjustment to make a circuit with C-102 to offset tower reactance = +j7.4 Ohms

• C-102 the capacitive part of the tower reactance offset = -j227.4 Ohms

• The tower reactance = +j220 Ohms

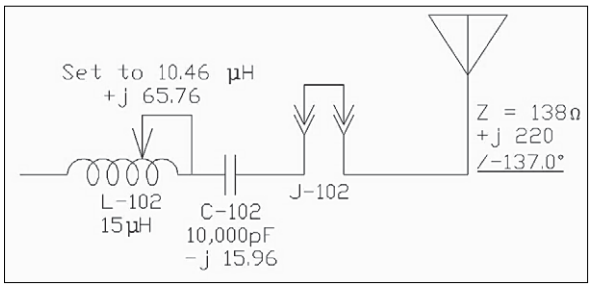
If these are summed the result is +j269.8 +j7.4 +j220 -j227.4 for a net inductance of +j269.8 Ohms. Simple inspection shows we have far more inductance than necessary.

A Different Solution

What will happen if we eliminate the excess?

First, the "Q" of the output branch will be reduced. Second, impedance bandwidth of the network will improve. Third, the group delay of the network will become somewhat more uniform thus having less impact on pattern bandwidth. Most importantly, the size and cost of the output branch coil are very significantly reduced. What, a better result from cheaper components? Strange as it sounds, that is exactly the case.

Some of us may remember something called the Communicative Law of Addition which taught us the order in which we summed a group of numbers did not affect the result. This law also applies to the j values in a branch of a network. Thus, we can, and should include the tower's reactance in our calculation of the output, or X2, branch of the network.



The Output Branch recalculated for inclusion of the tower's inductance.

Including the tower reactance in the output (X2) branch of the ATU network rather than simply inserting an opposite reactance to cancel it, makes interesting things happen. Our formula calculations show the correct X2 value is +j269.8 Ohms, but the tower supplies +j220 Ohms of that amount. Thus, only +j49.8 additional will make the network functional.

Other Considerations

However, other additions may be desirable and useful.

For example, some consider a capacitor between the physical transmission system and the tower is essential as a "DC blocker." The idea is this capacitor presents an impedance to static charges, increasing the possibility they will discharge across the ball gap at the base of the tower rather than in components of the transmission system. The interest level in this practice seems to parallel the lightning activity in the region of station and the experiences of the engineer responsible for it.

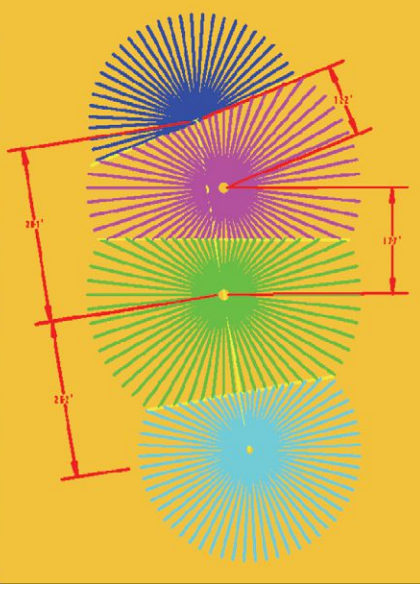
Some consider the blocker optional, but one engineer who spends his days designing ATU's for a major equipment manufacturer told me, "I put one in everything I do, unless there is some reason it would be a bad idea." In this ATU, a 10,000 pF capacitor will have a reactance of -j15.96 Ohms, and represents an effective cost/performance compromise. Do not forget that the voltage rating of this capacitor must include an ample safety factor above the maximum expected arc voltage at the tower's ball gap.

Including a 10,000 pF blocker increases the additional +j needed to just under +j66 Ohms. Even with the blocker's addition, including the tower reactance in this case reduces the size of the coil needed for the X2 branch by about 75 percent. Practically speaking, for this ATU, it means L-102 drops in size from a 50 uH coil to a 15 uH coil which will fit much more easily in the enclosure.

In the future, we will address adjusting or "tuning" of this network in a way that assures it matches the input and output impedances while delaying the phase of the signal by 137 degrees. We will also take a look at sizing components of the shunt (X3) branch for harmonic suppression. *– Radio Guide –*







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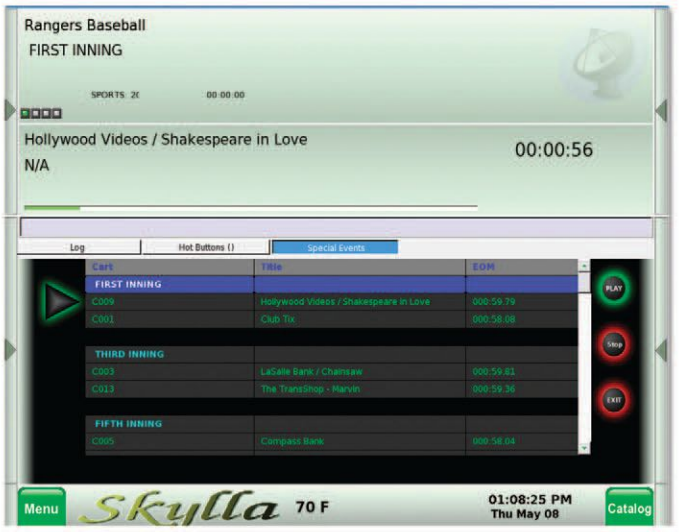

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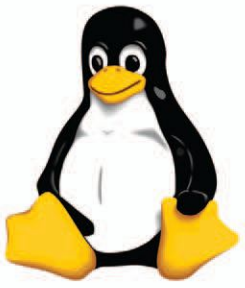

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Engineering Perspective

The Coming Crisis in Broadcasting

by Sherrod Munday

At this year's NAB show, it was really exciting to see the new technology that broadcasters can use to deliver their content to the public. Likewise, there certainly was no shortage of keynote speakers, like NAB's President and CEO Gordon Smith, who proudly proclaimed the importance of conventional over-the-air broadcasting – and Ben Sherwood, president of Disney-ABC Television Group, who reminded attendees of the $1.4 Trillion economic benefit and 2.65 million U.S. broadcasting jobs in 2015.

In spite of the many benefits of broadcasting, however, there are some serious threats that could significantly impact the sustainability of broadcasting as a public service and as a business in the not-so-distant future.

Threats to Broadcasting

It's a familiar list to most radio and TV broadcasters:

- Pandora-type services.
- Digital downloads.
- Streaming video-on-demand OTT providers like Netflix.
- Governmental regulations.
- Generational shifts to social sources of news and entertainment.
- Etc.

But while pundits, panelists, prognosticators, and broadcasting professionals debate what to do about these problems, they're missing one of the biggest threats to their existence. Oftentimes, they're so focused on external threats to their existence and sustainability that they completely miss the primary weakness from *within* their organization.

If broadcasters would employ the classic **"SWOT"** chart commonly used in business management courses, it would remind them to look at their business with an eye toward two opposed pairs of interrelated issues – things that can *help* their company versus things that can *hurt* their company, and things that are *external* versus *internal*. Broadcasters have plenty of **S**trengths (internal & helpful) and **O**pportunities (external & helpful). And, yes, there are some pretty well known **T**hreats (external & harmful) like the ones listed above that really could hurt their business. It seems, however, that the broadcasting community isn't really willing to talk about their **W**eaknesses (internal & harmful) that could hurt them.

Weakness Within

On the other hand, maybe it's even worse than that; maybe they don't even *recognize* that they have weaknesses. To paraphrase the sage Yoda movie character: *"Hurt them badly, this unknown Weakness could."*

Consider the following single *internal* weakness for a moment, and ponder its significance compared and contrasted against *external* threats like those listed above:

• Lack of qualified engineering staff to keep the facility on the air.

It's a short list, indeed, but think about its ramifications for just a few moments.

Without someone who knows the *current* broadcast technology, can your broadcast operation compete successfully and stay up-to-date and on the air into the future? Can you make any money if your transmitter is down and you don't have someone to fix it? Can your station warn the public of a public emergency when the new-fangled IP-based STL (that some consultant said would save the company a bunch of money) starts dropping IP packets and your engineer doesn't know how to fix it – or even where to start looking?

Coming Crisis

The coming crisis in broadcasting is a daunting trifecta of three interrelated issues:

1. Current engineers lacking skills to work with modern IP-centric broadcasting infrastructure.

2. Older generation of engineers approaching retirement.

3. Lack of qualified younger people interested in entering broadcast engineering.

Skill Sets: For all the benefits that the Internet Protocol ("IP") offers to broadcasters, it requires a completely new set of knowledge and troubleshooting skills that many legacy broadcast engineers don't hold. These aren't skills that are easily related to conventional broadcast engineering skills, so the current generation of legacy engineers probably won't pick them up very quickly unless they're intentional about learning.

Those skills can make employees much more valuable – *if* they master those skills. But some really great broadcast engineers just can't grasp the new technologies or learn them fast enough (or find enough time) to keep up. Worse yet, some engineers simply don't *want* to learn anything new and would rather instead just relive their analog glory days (while loudly proclaiming analog's virtues). You can probably guess what's going to happen to those engineers and where they'll end up in the next few years.

(Continued on Page 32)

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Engineering Perspective

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Don't expect your IT department to provide the solution to this problem, though. How many of you have heard IT personnel emphatically state that they aren't going to support anything (especially computers) that pertains to on-air broadcast equipment? Does your IT department try to handle the always-on, 24x7 broadcast department's on-air IT needs just like a normal office worker's complaint about a flaky mouse ("Put in a work order, and we'll get back with you when we get to it!")? While there are some stellar IT sysadmins and engineers out there, very few of them have any experience around broadcasting. Just as it's hard to just "pick up" modern IT skills, it's equally as hard for an IT person to get very proficient in broadcast engineering. Too many stations, networks, and broadcasters have unfortunately found out the hard way that hiring a great IT person to work in the broadcast engineering side of the business doesn't usually work out very well.

It's time everyone realizes that *all* broadcast engineering positions should – *and already do* – require hybridized skill sets encompassing both conventional engineering and IT practices, and that those two departments must overlap broadly and seamlessly. It's simply not possible or practical anymore to have completely distinct and separate IT and broadcast engineering departments and expect them to each stay out of the other's "turf" or territory. It's impossible to treat either one as more important than the other; they are equals and inextricably linked and interdependent in the modern broadcast facility. Each department needs to have an excellent working knowledge of the other's equipment, needs, and areas of responsibilities. There's simply no place for animosity or ignorance between the two departments anymore.

Retiring Resources: Another aspect is that we're losing valuable engineers to retirement. It's likely that most of the current engineers who attended this year's NAB show probably know more than one engineer who soon plans to retire. One engineer told of a recent SBE meeting where nearly every single member present was planning to retire within the next decade. Another national radio network engineer mentioned that their senior engineers would likely retire within the next few years. And the stories like this go on and on ...

But the real problem with retirements is that nobody is stepping up to replace the outgoing engineers.

Facing Facts: Let's be honest: broadcast engineering just doesn't hold the glamour it used to before the recent explosion of technology over the past two decades. Computers, programming, IT jobs, etc., are now "all the rage" among college graduates. Oh, sure, there are some young people interested in broadcasting – but when they find out how much it pays versus the starting salary for other technical jobs like computer programming, broadcasting doesn't stand a chance.

We shouldn't be hearing stories of station groups wanting to hire an experienced engineer to maintain three full-time stations for a paltry $30,000 to $40,000 salary, yet most broadcast engineers probably have a first- or second-hand horror story just like that to share. Aren't the stations' annual revenues worth more than that? How much is your downtime worth per hour – or per minute? Can you really afford to *not* have a highly trained engineering team on staff to keep your stations on the air?

Foundational Financials: The Bottom Line

For those managers who skip the bulk of most reports and proposals, and simply look down to the end to find out how much it's going to cost and ask, "What does this mean for our bottom line, and what's the benefit from this expense?" this part is for you.

As with any job in any business, hiring for increased skill sets, training, and retaining highly qualified employees will obviously cost the business more money. But the coming crisis of the high numbers of retiring broadcast engineers and the low interest among qualified potential candidates to replace those engineers who are leaving leaves little alternative but to take a long, serious look at compensations that will be good enough to attract new talent into the business and retain key employees who may already possess the requisite skills.

Additionally, it's critical that management recognize that it will also cost them some money to ensure their engineering staff continues to learn throughout their career. Yes, engineers should personally be *motivated* to acquire new skills to stay relevant, but management shouldn't be at all hesitant to *pay* for training that will directly benefit their operations and help keep the facility technically modern.

Realize that training isn't just an expense: it's an *investment* – both into the employee (who will surely be grateful for the training) and for the *company* (which gets the tangible benefit of keeping the facility on the air). If your station doesn't have a regular recurring budget line-item for training (or "continuing education"), it should. It will prove to be worth its weight many times over in the long run.

Conclusion

We all have to do something to ensure that broadcasting can overcome this personnel crisis, and the time for that action is now. There isn't a "quick fix" available, and this isn't a one-time thing, either. It will require a change of mindset and paradigm all the way from the junior engineering staff up through the most senior management and the C-level.

It may sound like a cliché, but it can't be denied: The future of broadcasting depends on *you* making these changes, whether you're an engineer or in station management. It's time to make changes – together.

Sherrod Munday currently serves as VP Engineering for Sky Angel, a 3-channel TV network found on Dish Network. His experience includes full-time and consulting engineering in both TV and Radio, delivering live and preproduced content over the air, via satellite syndication, and directly to consumers across the Internet. You may reach him at smunday@ieee.org

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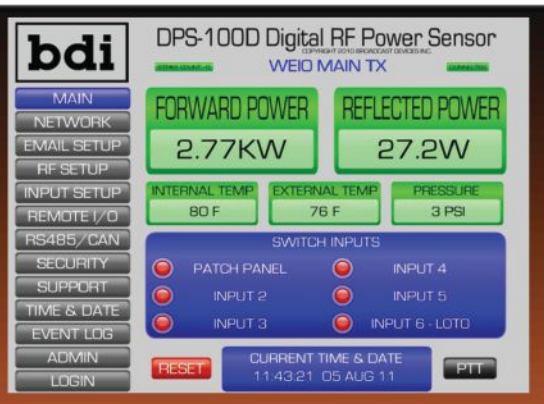

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IT Guide

How Secure is Your Network, and That Guest WiFi?

by Tommy Gray, CPBE CBNE

We All Want WiFi, Right?

These days it is becoming a common practice to provide a guest WiFi for clients and visitors to our stations. It seems like a simple thing to do right? Well it may be simple, but securing it is anything but simple. Unless you provide an additional network to your plant, that is totally isolated from your house network, you can be inadvertently opening yourself up to the world. There are ways to make it work, but they are expensive and require good management.

Now before some of you network gurus start jumping up and down with your own opinions, allow me a little time to share a few things I have uncovered the last few months with regard to network security.

How Many Things Do You Manage Through the Internet?

The list can include Websites, Cloud services, Off-site backup facilities, Drop Boxes, and the list goes on and on. You may say the providers have login security on the services. But even if they do have login security, what about the space between your computer and the website you are accessing? There can be a lot of servers and transfer points before your username and password finally gets to the destination. Don't believe it? Try running a traceroute on your connection. You will see multiple servers and intermediate points the data will travel through before it gets to that final website. Each of these points is a place where there could be a possible security vulnerability.

If all these points prove to be secure, then there is another point you may never think about. Is *your* computer sending your data encrypted, or is it being sent in the clear? Let me give you an example we discovered in our own system. Now mind you, we have a very secure network using active firewalls, etc. so I can assure you we try to know what is on our network.

A Real Eye-Opener!

This particular instance I am going to mention was a real shocker. How many of you use or maintain "Wordpress™" websites? Everyone loves them for blogs and easy websites, right? Now Wordpress is simple and easy to use, to build a decent looking site with not a lot of work. I have a few Wordpress sites and like them. However, Wordpress is about one of the least secure environments out there unless it is managed properly.

We were beefing up a piece of our network security the other day and, as we were looking at the data being transferred through the network, we noticed that Wordpress was sending the username and password in the clear and not encrypted! This means that anyone who has access to even a simple and free packet sniffer (Wireshark, etc.) would have been able to immediately see the username and password and login to the site and do what they wanted at will. Fixing this problem took a little work and I won't get into it at this time.

One word of caution here is that if you are using Wordpress site for your station, or your personal sites, *please* install a firewall program on it to protect yourself. Others I have seen hacked are Drupal, and Joomla, just to mention a couple – though they are all decent. I personally use a firewall I like called Wordfence™. It has proven to be a great firewall and does a great job scanning your files and preventing hacking. Like anything, you will need to do some decent management to get the full benefit of its capabilities. You'll be amazed at the number of login attempts your site will receive in a single day, that are blocked.

Hacked on the Free WiFi

Ever use free WiFi? If you do, then you are putting yourself out there to hackers unless you are very careful. These days there is malware that when you click on it, will install itself on your computer and allow someone to remotely take it over – all through WiFi.

Have you ever seen an unusual email from a co-worker containing a strange email address in the "reply-to," or was sent at an hour that you know the person should not have been sending email? It was probably a hacking attempt. I see them all the time. Sometimes folks will get their contact list hacked, and hackers will use the names to try to hook others, who may think the email is legitimate, by sending out message to everyone in the list.

The email may say something like, "I am sending you a file for tomorrow's presentation" or "I wanted to share this with you," and you click on the link to see what it is. Bingo! You just got hacked! You may not see anything at all, but you probably just allowed malware to be installed on your computer. The person on the other end now has access to all your secure information and can do what they want with it.

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How Secure is Your Network

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There are red flags that will help you to identify them. First, do you know the person who sent it to you? If not, you should not open it. Do you know them but it was sent at a strange time, or from a strange email address? Hover your mouse over the link and see what the URL actually is they are wanting you to click on. If it is not, what is in the text could be an attempt to reroute you or install malware.

Also *NEVER, NEVER, NEVER* click on a link in an email that you are not absolutely 100% sure is legitimate and that you were expecting. Recently several major companies were hit for millions when a message was sent to a senior accounting person, instructing them to wire thousands, even millions to someone to complete a major company transaction. The unwitting employee saw the CEO's name on the message and never paid attention to where it came from or the fact that it was sent from a strange email address and at a strange time of day – and sent the money! Check out this post from *Fortune Magazine:* http://fortune.com/2015/08/10/ubiquiti-networks-email-scam-40-million/

Ever Go Phishing?

No, I did not misspell the word and, no, I am not talking about Fishing. The word Phishing is a term that is used for attempts hackers use to try to get you to divulge your private information. It is all a part of what is called "Social Engineering." Once they get you to click on a link or open a website, they have you hooked and you are in for trouble. It could be a Cryptowall virus or some variant (there are a lot out there) or it could be to install a key tracker on your computer, that will show them every character you type on your keyboard.

You Need to Update!

One of the most common ones, especially when you are on WiFi, is the "Flash Update" message. It will tell you that you are running an outdated version of Flash and need to update immediately. Or maybe it is the Java Update. These can be bogus copies of a legitimate company's message and software, but when you click on the link you are hacked. Again hover over the link with your mouse and see where it is actually going. If in doubt, contact an IT professional who knows his or her business about security.

Bogus URLs

Ever received a message from what looks like Microsoft™ but had a strange email address? Hackers are using variants of known company websites to phish for your data. For instance, I recently received an email that was on a Microsoft letterhead with all the makings of a legitimate Microsoft support message we see all the time. However, when I looked at the email address it came from, it was "support@micorsoft.com." See the problem? The name Microsoft was intentionally misspelled. The message also contained improper grammar as if it had been translated from a foreign language. It also contained misspelled words, that would never have gone out in a real message from Microsoft. Others I have seen are "Microsift.com," or "OnMicrosoft.com," just to mention a few. They are obviously bogus even though their screen is an exact duplicate of a genuine Microsoft email message!

Internet Ready Broadcast Equipment

Recently the Internet has been buzzing about all the hacking of Internet codecs being used to feed audio to broadcast transmitters, etc. One that has been mentioned a lot (probably because there are tons of them out there), and through no fault of the equipment, is the Barix box. Hackers have accessed the units, cracked the passwords and redirected the units to receive audio from less than quality sites – many containing obscene content. Imagine that you tune in one of your translators, or worse, your station in the morning, and discover that it is still transmitting but not your programming.

One helpful site that was mentioned recently in one of the broadcast forums is https://www.shodan.io/ – going there, you can enter a name such as Barix™, Nautel™, Comrex™, etc., and see every box it has discovered to be open to the world (though these are not all)! You might be surprised what is out there.

How to avoid getting hacked? The best way I know is to keep everything behind a good firewall and open *only* those ports required to feed your equipment. Secondly, and just as or even more importantly, *use strong passwords!* I suggest using a password with at least 11 or more characters. It should contain a mix of uppercase, lowercase, numbers, and special characters ($, #, %, !, etc.). Next, go in frequently and change the password, so if someone has come close to cracking it, you will cause them to have to start over again before they get in. Remember there is no such thing as a "hack proof" password regardless how complicated and thought out it may be.

Coming Up!

In the next issue I will discuss more ways to protect your operation from hackers. If you are one of those who believes that all this talk about hacking is just blown all out of proportion, go back and stick your head in the sand and eventually someone will change your mind!

Tommy is the Senior Director of Broadcast Engineering and Technology at KSBJ Educational Foundation, Humble (Houston), Texas.

Station Stories

Broadcast Blunders

by Mike Callaghan

In the early days of FM, getting a carrier to change frequency was a real exercise ...

Imagine an "exciter" where the crystal runs at 100 kHz, and what it puts out gets multiplied up by stage after stage, and when it gets too high to multiply any more, it gets heterodyned back down to about 100 kHz again, and multiplied up again and again even more times.

Eventually it reaches 100 MHz., and from there goes out to the amplifier stages and finally the PA. This was called a Serrasoid exciter. Needless to say, it died a quick death when stereo came along.

One famous manufacturer built exciters for RCA. Their oscillator ran at carrier frequency, and it was divided down low enough to compare with a low frequency crystal.

While in production, two capacitors got mixed up. One of them was supposed to stay at the same value all the time, and the other was supposed to change value when the temperature changed.

Everything was fine – the exciters ran off the assembly line and got installed all over the U.S.A. That is, until the first summer came, and all those transmitter rooms started warming up a few degrees. Then the wrong capacitor would shift, the AFC would come unlocked, and stations were going off all over the country.

Unfortunately, the maker tried hiding the problem, and In the days before the Internet, it almost worked. Their little dark secret was safe. Until a group of engineers got together and compared notes, and the firm ended up with a black eye lasting for a very long while.

Interestingly, this firm had already developed a reputation for being less than candid with users about equipment problems. You could know for a fact that a certain piece of their gear had a tendency to fail in a certain way, and when you fell victim and called to ask about it, you heard, "Gosh, we've never heard of that problem before; this is the *first time* anyone's reported it."

The classic was their crystal ovens. The thermostats would get stuck in the "on" position, the crystal would get baked or fail, and you'd be way off frequency or off the air. Finally, tired of being the butt of all the jokes, in some of their later STL's, they put in a second thermostat to back up the first one. And like an Egyptian curse, both the thermostats would fail and the crystal would *still* get baked. Finally, the company started from scratch and now makes solid and reliable STL equipment.

Siliconetic Relays

With tube transmitters, the plates wouldn't come on until all the tubes had plenty of time to warm up. This delay was built in to the transmitter. Some transmitters used mechanical timers, and some used thermal relays. The most unique solution I ever saw were called "Siliconetic Relays." These were coils of wire wound around brass tubes filled with a sticky silicone gel. Inside the gel were iron granules. When the coil was energized, the magnetic field it produced would slowly start reorienting the granules in the same direction. When enough of them were lined up, the magnetic field around them would build up to where it would pull in a little iron flapper at the end of the tube. This, in turn, would complete the circuit to the massive plate contactor.

In a stroke of design genius, this contactor was mounted on the back side of the panel that held the Siliconetic Relays.

So, the filaments would come on, and the iron granules would dutifully start lining up. The weak magnetic field would gradually get stronger and stronger until finally, "dink, the little iron flapper would pull in.

"Ka-Wham," the plate contactor would fire like a shotgun on the back side of the panel with the little iron flapper– and it would get jarred loose. So, the contactor would drop out, and the granules would line up again.

"Ka-Wham!" (pause) "Ka-Wham!"... You get the idea.

Finally, enough of the granules would line up so that the contactor stayed in, and the station, with what was left of the transmitter, would finally be on the air.

Meanwhile, the incessant surges wreaked havoc on every component in the power supply. Surprisingly, the maker kept using the silicone-based relays for years, although they did get moved to a different panel in the transmitter.

Shocking Situation

Wiring mistakes have been with us forever, and will undoubtedly continue being a plague.

One day we had just finished wiring a new room, only to be faced with a horrendous *hum* when we turned it all on. Ground loops are nothing new; and there are any number of ways to treat them.

One common trick is to reverse the AC power polarity. This used to be easy when all you needed do was turn the AC plug over. Now, you need to use a 3 to 2 AC adapter.

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Station Stories

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In our new studio, we had three new cart decks stacked on the left side of the console, and another three on the right.

When we turned the console power over, smoke started pouring out all of six of them. As we watched the smoke drift up and start hanging in a white cloud just below the ceiling, my assistant Jerry said, to no one in particular, "You know how sometimes you hear a little voice in your head telling you something's just not quite right?"

I looked directly at him and said, "Guess what? I don't *need* that little voice right now.

After unplugging the cart decks, we soon found that if you touched the face of the console, you got knocked on your butt! An Ohmmeter quickly revealed that one side of the AC line was connected *directly* to the console frame.

Opening the power supply, we could see why. The white wire of the power cord went directly to the chassis, while the green wire went to the power transformer. We hastily checked the second power supply that had shipped with our other new console. Same story, same miswiring.

We called the factory and explained what we found. We were told to wait for a call back. An hour went by ... then two hours. The phone rang. "You won't believe this," we were told, "but we have a warehouse *full* of the damned things." It turned out the assembler had been screwing down a phenolic terminal strip so it faced the wrong way. That moved the ground to lug #2 instead of #3. It was a 6 lug terminal strip, and every single lug had a lot of wires going to it. I bet we really made someone's day. It wasa full two weeks before we got any corrected supplies.

• **Hewlett-Packard made history** when they introduced the HP-35 Scientific Calculator in 1973. If you did any kind of complex math before then, you used a slide rule.

The HP-35 cost $395 (in 1970 currency, no less), but it meant engineering students were free of the huge books of logarithms, free of having to figure out where the decimal point belonged, and free of the drudgery of doing math. The calculator was an instant hit. And every engineer, real or imagined, wanted to have one.

The wait to get one stretched into months. The anxiety was beyond imagination. H-P took to sending out little cardboard mock-ups of the device, so you could carry it in your shirt pocket, and whip it out when you wanted to pretend yours had arrived and you needed to do a problem.

I received mine about six months into the craziness – even calling the UPS depot every night to see if I could come pick it up instead of waiting for the next day's delivery.

After I had it, I did pretend problems beyond imagination. And one day shortly after it had arrived, I was playing with it in my office. Today, I was playing with logs.

I put in 2.02. Why? I dunno. Why not? Then I took the log of it – 3.43563. Then I took the antilog of that. The answer came back 2. Just 2 – not 2.02 – just 2. I tried it again. Same result. This didn't make sense. That's an error of 1 %. I picked up the phone, called Cupertino 411, and got the number for Hewlett-Packard.

The phone rang, and a man answered. I was expecting a receptionist. No, I had one of the actual field engineers. I told him who I was and asked if he had an HP-35 handy. He responded,"Of course I do."

I asked him to go through a calculation with me, and I took him through the keystrokes. As the 2 popped up in front of both of us, there was a long pause on the phone ... then, "Oh, S**T, this just can't be happening!"

He didn't write down my name or number, but shortly thereafter, H-P offered to repair any HP-35 that was returned for a bug fix. Many were returned, but many more were not.

Today, an original HP-35 sells for a premium on E-Bay if it has the original ROM with the bug. There are many explanations for what happened, but the upshot is that there were very few computers powerful enough to check the algorithms H-P used in the 35, and the bug got through. Even more interesting are some of the comments about how H-P was going to fess up to the error and ultimately correct it.

• **In the early days of stereo**, many stations just bought a stereo conversion package from their equipment vendor and put it on the air. KPPC was no different. We got a stereo generator, a stereo modulation monitor, and a frequency monitor to read the carrier and the frequency of the new 19 kHz. Stereo pilot.

I got it all plugged in and installed, and found the frequency monitor read "0" when I tried reading the Pilot frequency. Perusing the manuals, I found that our new Collins 54N-1 frequency monitor wanted at least 2 volts of 19 kHz. put into it, and the new 900C-3 modulation monitor supplied only 1.5 volts of 19 kHz.

I called Collins and asked if they ever hooked up their new equipment in a real radio station and got it to work before they started selling it. Grumble, grumble, grumble ... they opened their copy of the manuals and verified the problem. They finally told me to expect the solution to come in the mail.

About six weeks later, in comes a package with a new modulation monitor board inside. They'd added one more stage of gain to the circuit! I installed it, and now I had 4 Volts for the frequency monitor to use.

The pilot frequency read just fine, and I was happy ... until the next time I tried doing a proof with the newly enhanced mod monitor. Now, the left channel measured as right on the meters, and the right measured the left!

Wrong! By simply adding one more stage to the 19 kHz. amplifier, Collins had turned the phase upside down, which flips left and right!

One more phone call to Collins, a *lot* more grumbling, and another six weeks. Then I get another new card; and this one has *two* more stages – to turn the phase right side up again!

Mike Callaghan was formerly the Chief Engineer at KIIS-FM in Los Angeles, CA. His email is: rg@mike.fm

Small Market Guide

Keeping the Ship Afloat in Small Market Radio

by Roger Paskvan

In the past issues of this column, we have discussed employment and human relations in small market radio. Now it's time to layout ways of keeping employees or should I say keeping them productive.

In the beginning of any new job, your employee comes in full of energy, vinegar, wanting to impress the boss. It's not too difficult, since these are the very qualities and characteristics that all employers look for in a new hire. Depending on the management structure at the small market station, this "glow period" can last for quite a long time until acted upon from outside forces. So let's look at these forces that can tear down your radio station from within, or build it up as we all would want.

A new employee doesn't know anyone when first coming into your company, therefore they stick to themselves and get the job done. This attitude lasts for a short time but slowly gives way to peer pressure. At some point the staff employees will befriend this new individual and make a positive or negative reaction to their work ethic. Depending on the new hire values and work performance, this social association molds this individual in a different direction.

Eventually, the new hire will adjust to the work load and performance standards required for their position. Some not so ambitious employees will try to slow down the new hire in order to take care of their own private agenda. This same new hire may choose to ignore that example and continue, but usually at the expense of a new friend. These associations can go on, but eventually all new hires usually become one of the team and that vibrant energy and drive mellow into daily responsibilities.

So what can a GM do to keep new employees productive over a longer period of time? The answer is what small market is all about – team spirit and cooperation.

As an employer, GM, or operations manager, empower individuals to strive and accomplish good solid company goals. As a supervisor, show a special interest in every person on your staff. Provide each employee with a solid well explained structure of what is required of their job. Each employee on your station staff must be made to feel that they are an integral part of your management structure and the team goals are an important part of completing each day's tasks. I cannot overstress the need for this team spirit since it is the major key to success in small market radio.

As a small market radio employer, you must stay close enough to each employee so that you can detect a change in the person's attitude or work performance long before it takes toll on the rest of the staff, or begins to tear down the company. In radio, especially in small market radio, this is relatively easy since most employees are extroverts and on/off air performance can easily be monitored.

Management by being fair, firm, and laying out positive goals and objectives, can go along way to avoid employee morale problems. Being part of this team concept is an uplifting experience, providing the human energy that drives your station through any storm.

As management, a positive role model can and will go a long way in keeping employees productively working, helping your station grow. Most successful managers in small markets have come up through the ranks, and getting yourself involved on the bottom floor will go a long way toward keeping new employees productive and happy. The golden rule is to lead by example. There is no better motivation to a new hire than seeing the GM working next to them, "in the trenches."

Of course not everything goes as planned in any small market radio station. Bad people choices are an unfortunate evil of the business. Sometime it may be just a bad fit into an existing staff, but cuts sometimes need to be made. Firing is the necessary evil of the broadcast business. For the good of the many, sometimes people are let go so that the company can continue marching in the right direction. If done professionally and discretely, the rest of the staff will respect the decision for the good of the overall station goal. Remember, management's job is to keep the entire ship afloat especially when the sea gets rough.

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

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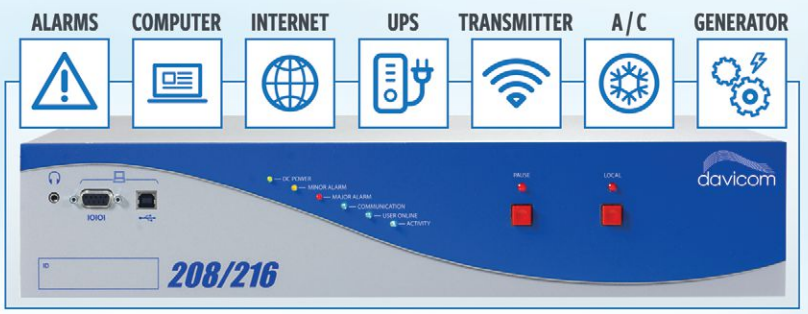

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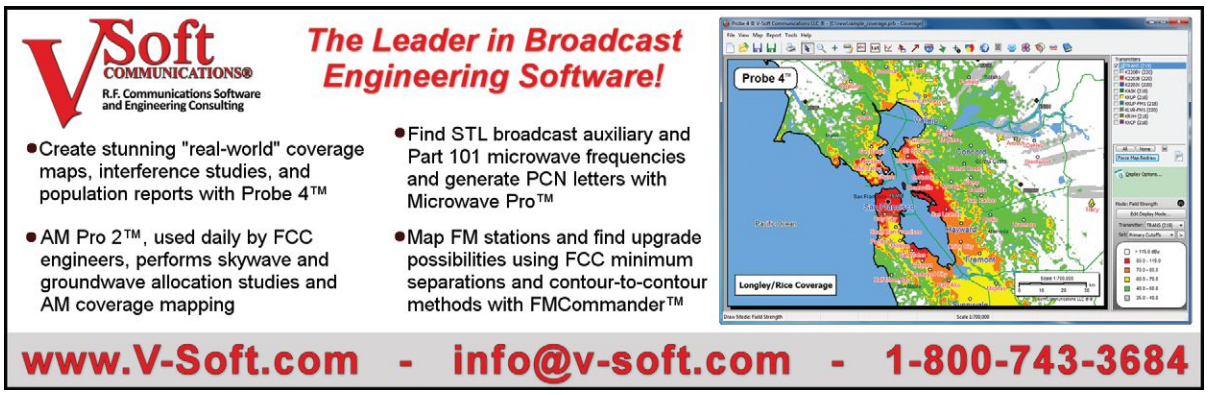

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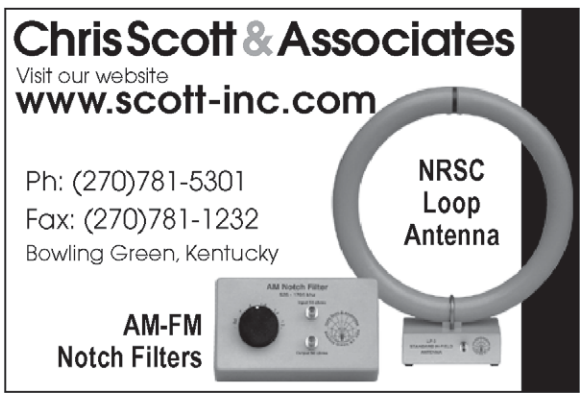

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For more information: www.audioscience.com

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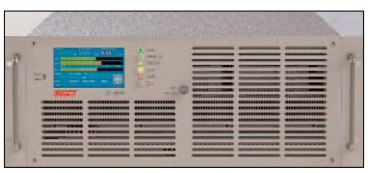
Reliability is ensured by use of the latest generation, nearly indestructible MOSFETS. The XL Series offers unbeatable energy efficiency, with very little heat generated by the unit.



The transmitter's menu can be easily navigated through the touch screen on the front panel or remotely through a LAN/WEB - IP connection. Standard contact closures for older style remote control systems are also provided.

In addition to standard analog audio inputs and AES-EBU digital audio inputs, streaming audio can also be fed to the unit. The firmware can switch to a secondary, alternate audio source if the primary incoming audio feed were to fail. The transmitter can be powered by either single phase or three phase AC.

The user manual is stored in digital format, and can be accessed using a laptop connected to the transmitter through a USB port. This function is always active even when the transmitter is off and/or completely disconnected from AC.

Available options include digital, direct-to-channel FM carrier generation, built-in stereo generator and RDS generator. Like all new Bext exciters, the XL 6000 is frequency agile.

For more information: www.bext.com

Deva DB3011 FM/HD Radio and IP Audio Confidence Monitoring Receiver

Meeting the increasing demand that comes with the spread of HD Radio broadcasting, the high-selective DSP-based tuner of the device allows the HD Radio Broadcast, FM and Internet stream of the station to be selected, monitored and listened to.

Its features include brilliant acoustic characteristics. The unmatched in performance audio system of DB3011 is equipped with two speakers to reproduce mid- and high-range audio frequencies, and a high-efficiency bass reflex speaker for high-quality sound. The device supports MP3 and PCM IP audio codecs, in addition to real-time RTP, and boasts compatibility with the most popular streaming media platforms like Icecast and Shoutcast.

The DB3011 provides users with two work mode options: FM and Internet radio stream monitoring mode and HD Radio and Internet radio stream monitoring mode. The Web Interface gives you easy access to, and control of the device through the standard browser on your PC, tablet or smart phone. The dedicated hardware will also measure and store, for future analysis, the RF level and Left and Right Audio Levels.

The DB3011 meets all HD Radio performance criteria set forth by iBiquity Digital and has been issued with the HD Radio Certificate of Compliance, proving this latest DEVA device as the cream of the crop.

For more information: www.devabroadcast.com

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www.tab.org/convention-and-trade-show

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August 16-17, 2016
Embassy Suites, 140 P St., Lincoln, NE
http://ne-ba.org/news_and_events-convention.asp

NAB Radio Show
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www.radioshowweb.com

WBA Broadcasters Clinic
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www.wi-broadcasters.org/2016-broadcasters-clinic/

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http://bts.ieee.org/broadcastsymposium/

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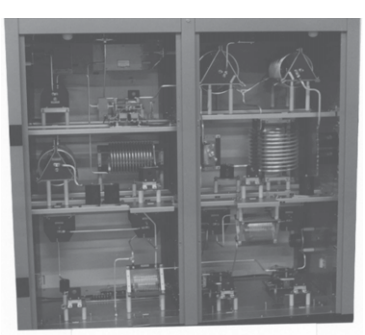

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