

# Radio Guide

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Digital Issue Now On-Line

September-October 2019 – Vol. 27, No. 5

## StudioHub: An Idea Too Good to Die!



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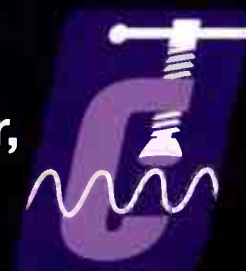
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# Radio Guide

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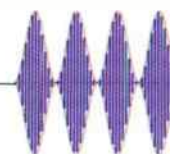
Volume 27 – Issue 5

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PO Box 20975, Sedona, AZ 86341  
Phone: 928-284-3700 • Fax: 866-728-5764  
Ray Topp (publisher & editor) – [radio@rconnect.com](mailto:radio@rconnect.com)

Radio Guide, ISSN 1061-7027, is published bi-monthly, six times a year, by Media Magazines Inc., PO Box 20975, Sedona, AZ 86341. Radio Guide is copyright 2019, Media Magazine's Inc., and may not be copied, reproduced, or stored in any format, without the written permission of the publisher.

## In This Issue



### Critical Content for Radio

#### Cover Story – by Anthony Clarke (page 4)

**StudioHub: An Idea to Good to Die:** “It wasn’t long, though, before people began asking them about StudioHub accessories. Would Angry Audio begin making these as well? After many such conversations, they realized that there was a natural synergy between the product lines — and so Angry Audio negotiated a deal with the original owners to purchase the entire line of StudioHub electronics, formerly made under the Radio Systems brand, and bring them back to market.”

#### Studio Site – by George Zahn (page 6)

**On the Right (Voice) Track:** “Now through Internet connections, cloud delivery, and even basic e-mail for smaller operations, one announcer can populate voice breaks all over the country. The same can be done with drops, promos, commercials, and voice-overs. And as consumers become more and more accustomed to mpeg audio compression, files, especially voice for AM, can be made downright small for quick and easy transfer.”

#### Chief Engineer – by Scott Schmeling (page 8)

**Saying Goodbye to an Old Friend:** “But a big part of our work time is spent working on transmitters. After you work with (or on) transmitters for a while, you get to “know” them. You know their sounds, their smells – the way they tune. You become acquainted with them and you can often identify a problem, sometimes before it happens, based on changes in sound or smell. We nurse transmitters back to health – and sometimes bring them back to life! We keep them running as long, and as well as we can. You could say a bond is created between Engineer and transmitter.”

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## StudioHub: An Idea Too Good To Die!

by Anthony Clarke

### StudioHub: An Industry Standard

Punch tools. TB strips. Spade lugs. Krone blocks. For most of radio's history, discrete audio cabling was the only way studios, even very large ones, were wired. It was backbreaking, time- and labor-intensive work.

But in 1999, Dan Braverman (of Radio Systems) brought a new idea to radio: StudioHub, a prewired cabling system that radically transformed the studio wiring process by using CAT-5 rated, shielded twisted-pair cables. People already knew CAT-5 as computer networking cable, but the precise twisted wiring pairs required for high-speed digital communication made it ideal for balanced audio as well. Besides that, the radio industry was undergoing a conversion from analog to digital, and CAT-5 was capable of transporting either.

The concept was well thought out. In addition to stereo audio, every CAT-5 cable could also carry DC power. A wide range of active accessories were engineered to pull audio and power from an RJ-45 jack, which reduced cost, infrastructure complexity and installation time dramatically.

Broadcasters, who know a great idea when they see one, embraced the idea almost immediately. The first major broadcaster to take the plunge was New York's WCBS, whose engineers wired their entire 57th Street broadcast center using StudioHub cables and adapters. And the rest, as they say, is history.

Engineers soon came to depend on StudioHub adapters. Entire facilities were either retrofitted or built from scratch using StudioHub gear, and those who used it fell in love with how easy it was to use. Engineers, consultants and integrators used it and recommended it. StudioHub quickly became the de facto wiring standard for radio studio infrastructure worldwide, and a full line of popular accessories were also introduced.

### The Return of StudioHub

In July 2019, Radio Systems decided to return to their roots as distributors and system integrators, and discontinue manufacturing. Unfortunately, this meant the end of StudioHub. You probably saw the discussions in broadcast publications and on social media, where people wondered, "How will I wire my studios now?" With thousands of engineers and facilities depending on these products, their sudden unavailability caused quite a bit of angst.

Enter Angry Audio, the new company owned by Michael "Catfish" Dosch. Longtime broadcasters know him from his time designing mixing consoles and other products for PR&E, and from Telos Systems, where he launched Axia Audio in 2003.

**ANGRYAUDIO**   
www.angryaudio.com

The idea for Angry Audio came when Catfish saw a need for high-end problem-solvers and specialty devices for radio studios. Their line of gadgets and gizmos has quickly become a hit with broadcasters, making Angry Audio the fastest-growing audio accessory company in the industry.

When Angry Audio saw broadcasters lamenting the loss of StudioHub, they began manufacturing the most common cables and adapters that engineers needed most. They even searched out the factory that made original StudioHub cables, to ensure the new ones would be of the same high quality.

It wasn't long, though, before people began asking them about StudioHub accessories. Would Angry Audio begin making these as well? After many such conversations, they realized that there was a natural synergy between the product lines – and so Angry Audio negotiated a deal with the original owners to purchase the entire line of StudioHub electronics formerly made under the Radio Systems brand, and bring them back to market.

There's more good news. Not only will they be selling the StudioHub brand, but (in what is sure to be a great relief to existing customers) Angry Audio will also provide support for all electronics products previously manufactured by Radio Systems, including the Millennium console line. They have purchased the entire spare parts inventory, and will provide technical assistance and repair services too.

### More Than Just Cables

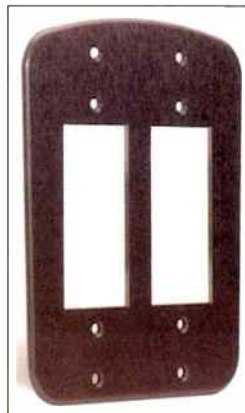
StudioHub cables and adapters are everywhere! But that's only the beginning of the story, and engineers have come to rely on other essentials such as balancing amplifiers, headphone amps, power supplies and patch panels, all using RJ-45 connections for fast and easy hookup. There are an amazing number of devices in the StudioHub ecosystem, all designed to work together seamlessly. Here is a brief overview of what's available:

- **Adapters.** The RJ45-to-XLRM/XLRF/TRS/RCA adapter cables that broadcasters have come to know and love. Would you believe there's more than a dozen different styles? Not to mention specialty adapters for different brands of studio equipment and consoles.



- **Control and connection panels.** Headphone amplifiers. GPIO control switches. Monitor level controls. Input panels. Mic preamps. The list goes on, with over 30 different kinds of utility panels to meet nearly every studio need.

- **Mounting plates and brackets.** Sometimes, you need to mount a control panel in the wall, under the counter or in a desktop. An array of single, dual and multi-position mounting plates and brackets make it easy to do so.



- **Cables.** Many of you probably already know that StudioHub has a very wide range of shielded CAT-5 patch cables in standard lengths, but they also make specialty cables to order.



- **MatchJacks and distribution amplifiers.** Believe it or not, there are still some broadcast audio devices without RJ-45 audio connections! MatchJack balancers, converters and distribution amps are lifesavers when you just need to convert a single line-level or AES/EBU source to the StudioHub format.



- **Dongles, splitters and couplers.** DB connectors are almost everywhere in broadcasting. It also seems that every company has decided to use a different pinout, for everything from audio to logic. Dongles tame that beast by converting nearly everything there is into the logical, sensible StudioHub standard format.

- **Hubs and patch panels.** Because sometimes, you've just got to get something into your audio chain fast. Audio breakout panels, hubs and RJ45 patch panels make it simple.

- **Power supplies.** One of StudioHub's most unique features is that it can also carry +/- 15 Volt DC power right alongside audio, to supply MatchJacks, control panels and other studio devices. A complete selection of power supplies and injectors does the job without fuss.



- **Adapter/Cable packages.** You've got an entire studio – or five – to build? No problem. A variety of pre-packaged adapter kits make it easy to plan and execute your project.

### StudioHub Is Back

By the time this article sees print, a new website will have launched at [www.studiohub.com](http://www.studiohub.com), featuring all of the essential products broadcasters have come to depend for their studio wiring infrastructure needs. You can also purchase StudioHub cables, adapters and studio products from all major broadcast equipment suppliers.



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## On the Right (Voice) Track

### Tips for Better Voice Work in Studio (or Office)

by George Zahn

The motto for most business in the last decade is doing more with less. How can we squeeze the maximum human effort out of an already hard-working staff? While that equation may have diminishing returns, there are some things that even small stations can do to spread station presence, even at a time you're heavily automated. It's relatively simple, by making an office a potential voice tracking station.

The larger conglomerate stations have taken voice tracking to an art form, often with one announcer tracking for dozens of stations and sharing, sometimes even scheduling, their track for multiple stations within an owned group. Now through Internet connections, cloud delivery, and even basic e-mail for smaller operations, one announcer can populate voice breaks all over the country. The same can be done with drops, promos, commercials, and voice-overs. And as consumers become more and more accustomed to mpeg audio compression, files, especially voice for AM, can be made downright small for quick and easy transfer.

Lest you think I like that we've "dumbed down" audio quality or that listeners appear to be less picky (depending on format and medium), I don't like that, but I do realize that more stations are trying to maximize everything from storage to transfer time. I hope that most of us are using MP2 at the very least, with some material perhaps at a 128 kHz or 256 kHz 44100 sampling rate MP3 at worst.

Our station has a small staff of three full-time on-air people and a part-timer. Our drive times are live, but certain day parts are, by necessity, voice tracked if we don't just want to be a jukebox or wallpaper. We'll talk the tech in a moment, but if you have any automation capability, basic short voice tracking makes a difference of virtually replicating a Pandora stream to having an engaged presence with basic back announcements and forward promotion.

#### Don't Sweat the Temp

The days of people listening just for time and temp as primary targets are over. I can see time and temp on my watch, my phone, or any other device. Don't let the lack of specificity keep you from creating a basic track schedule. Our station doesn't track overnight automation, but we do use it for some afternoon programming Monday-Sunday with decent response. As a music station, our old automation model of music and a few scheduled promos left listeners frustrated. Even though we have our last thirty songs on our website, they wanted to hear an announcer tell them what they heard.

Forward promotion is another basic benefit of tracking. We can briefly talk up station events and promotions, and it sounds as if someone's there through the weekend hours (we never say we're "live" in the studio or give exact time or mention temperature). You may have access to recording these from local weather sources and inserting them on the weekend or at off times. The bottom line is that for about 15-20 minutes of studio time on a Thursday or Friday afternoon, we have weekend presence that we never had before.

Some are saying, what happens if the tracking file accidentally plays two weeks in a row? We "kill date"

every track that we do, so it can only run the day it's intended to be played. It's a routine part of the voice tracking process for us. If studio space or scheduling of the room is an issue, I have some ideas.

Never has it been so easy to turn an office space, or even a closet, into a voice booth. Sound deadening materials, or even carpet remnants, can be used. USB microphones are advancing, although my ear still prefers a decent broadcast microphone going through a USB interface with a nice pre-amp. The same computer you record to will allow you to edit with software that can cost hundreds of dollars – to basic software that's free. Audacity is a good software to learn on, if you're new and considering whether to do much recording/editing or not.

#### Good Mic and Monitor

If you want to try turning an office space into a voice tracking studio, here are some things you can try. Avoid garbage in-garbage out. Don't just use any microphone. If you use a standard microphone model in your station, borrow one from the studio and run it through a USB converter with XLR inputs (don't just try to adapt it to a mini plug to go into a basic computer sound card) to record into your work station. Using the same microphone model will give you the best chance to match sound.

If the office or closet space is a bit reverberant or "boxy" sounding, you can try a curved acoustic baffling kit that is a semi-circle of absorbing foam that sits a foot or two behind the microphone, helping to reduce sound bouncing in from the sides and rear of the mic. A good windscreen will help you to avoid 'plosives. If you'd rather spend a bit more, you can get a pop filter that can be moved to keep your talent from getting too close to the mic.

Note: Keep in mind that if you're using a cardioid (unidirectional) pattern microphone, you can get the benefit (for most of us) of proximity effect by working closer to the microphone. James Earl Jones-type voices don't need this extra bass boost that is natural to a cardioid mic, but if you want the extra bass of proximity effect, a windscreen will battle popped P's and other 'plosive sounds, whereas the pop filter, keeping you several inches from the mic, will take away that extra bass.



Shure SM58-X2U Cardioid Dynamic Vocal Microphone with X2U XLR-to-USB Signal Adapter.

A USB interface will help get your microphone into the computer where you're recording, but outboard microphone processors can do so much more before the voice is committed to the digital file. Many like a basic USB converter, so they can get a good, flat signal, then adjust voice quality (compression, equalization, etc.) in the computer's audio editor. In either case, you need decent and trustworthy headphones or speakers when doing that "sound shaping" of the voice, so you know that what you're hearing is accurate.

A dedicated voice processor has a built-in microphone pre-amp and can allow for immediate processing, including De-Essing, which is an equalization that helps to minimize over enunciations of "S" sounds that can cause splatter on the air. Usually a talent either needs a De-Esser or not – it rarely changes for an individual.

The voice processor can also be used to limit the dynamic range of those speaking, pulling in louder vocal parts to make a more volume-neutral signal. Keep in mind, though, that some of your broadcast processing is likely already doing that.

While we're on dynamic range, many also have a Gate setting, meaning that when the sound entering the mic drops below a certain threshold, the processor will "turn down" the level even more, in effect almost turning off the microphone. When the talent speaks again, the Gate "opens" and audio passes through.

A voice processor can also do some basic equalization of the voice. For instance, if you want to use a pop filter and eschew the proximity effect, you can still add some bottom to the voice through the processor. You can also increase intelligibility in the sibilance range (usually around 4 kHz) for those who's S's and T's don't stand out enough (in effect, the opposite of the De-Esser).

Some processors have Reverb (close reflections) or Delay (actual repetition like an echo) settings to create effects. Another nice feature on some are Exciters. These work well on some voices and on some instruments to brighten sounds. It sounds a little like black magic, but Exciters use their effect to make things stand out a bit more by appealing to the portion of the frequency spectrum the human ear is most sensitive to – the 8th octave of the frequency spectrum. This is subtle but can be very effective, depending on the source.

#### Give It a Try

Some stations can also use this setup in an office or closet to create other content such as extra podcasts (perhaps a pilot show you want to try on-line before on-air), or to record a client if the studios are jammed with activity. It's a great way to recycle an old, still well-working Windows 7 computer, as the Microsoft support dissolves for Windows 7 in January, 2020. Just use the computer only for audio recording and keep it from an Internet connection, and you can use that functioning computer 'til the proverbial cows come home.

And keep in mind that many of the features of the voice pre-amp and processor can be attained through some of the editing software effects after you get the voice into the computer. If cost is a major factor, get an inexpensive USB microphone interface and work your way up to a voice processor or outboard devices as you grow.

Let me know if you're voice tracking at your station, and how it works for you. Have you already used any of the ideas here, or come up with better ones? We can all learn together how to do more with the same or less!

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](mailto:gzahn@mkcommunities.org)

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## Saying Goodbye to an Old Friend

by Scott Schmeling

As engineers, we get to work with equipment and people (you can pick your favorite). But much of our time is spent with various pieces of equipment. One day we might be working on a computer that keeps dropping off the network, or can't find its mapped drives. Another day we might be working on a console, making it work exactly the way you want within your system.

But a big part of our work time is spent working on transmitters. After you work with (or on) transmitters for a while, you get to "know" them. You know their sounds, their smells – the way they tune. You become acquainted with them and you can often identify a problem, sometimes *before* it happens, based on changes in sound or smell. We nurse transmitters back to health – and sometimes bring them back to *life!* We keep them running as long, and as well as we can. You could say a bond is created between Engineer and transmitter.

Late last year I related our experience when the IPA Plate transformer of a Collins 831G-1 transmitter quite literally burned up. The Collins 831 series eventually became the Continental 816R series. It's an excellent tube-type design and hundreds of them (maybe thousands) have been in use around the planet. The serial number of ours is 140. (I wish I had a way to find out how old it is.)

When the transformer burned up, our directive was to repair it as cheaply as possible. If you recall, we had to borrow parts from an 816 that's used for backup. The station was on a 2.5 kW backup for the better part of a week before the old 831 was ready to go back on line. Keith Wright and I took great pride in the job we did to get it back up and running. Our repair job performed like it should and it looked great! But there comes a time when the best option is replacement. The decision was made to replace the 831 with a new Nautel 20 kW rig.

But, remember, we had taken parts from a backup 816. That transmitter was still out of commission. Our building was not large enough to hold both transmitters, so before the new Nautel was to be delivered we put the 2.5 kW back on and started dismantling the 831. Our plan was to remove the borrowed parts so the 816 could be brought back to life. In addition, we wanted to harvest some of the other parts. Given the age of these transmitters, some of the parts are quite literally no longer available.

As Engineers, one of our characteristics is the inner drive to keep things running. We take pride in squeezing a couple more months out of a final tube. We keep a mental inventory of parts that are likely to fail. And our shop and some transmitter locations sometimes resemble the radio equivalent of an auto salvage yard (I will *not* call it a *junk* yard!). We are sometimes criticized for this, but more times than I can count, those salvaged pieces have had what was needed to get a station back on the air (at little or no cost)!

As it turned out, the delivery of the new transmitter was a day and a half late. This gave us ample time to remove the parts and assemblies we wanted. We were able to get the heavy transformers off the floor of the transmitter and to get the nearly empty shell out of the building.



**Heavy Transformers Removed**

Let's take a quick look at this transmitter's history. In some ways, transmitters can be like people. Some live their entire life in one spot. Others move around. But all have a history (hopefully you can trace that history in the transmitter's log), not unlike a person's medical history.



**A Mostly Empty Shell**

This Collins 831G-1 (serial number 140) was first installed for what is now KTCZ "Cities 97" in Minneapolis/St. Paul. If I knew the date, I could tell you the call letters at the time. At some point, it was taken out of service there and moved to somewhere in Ohio. But before it could be installed, an Energy Onyx transmitter at a site near Wabasso, Minnesota "burned up!" (Clear Channel owned these stations at the time.) So the 831 was packed up and it took a trip back to Minnesota.



**Overload Indicator Panel**

Also, while it had been in use in Minneapolis, an Overload Indicator panel had been built. Collins had added just such a panel to newer transmitters. I had been told when we took over the station that the panel "worked," but we found out a number of years later that all the miniature incandescent lamps had burned out! We replaced them all with LED's.

I started thinking about other things we had to do for the 831. We had also replaced the incandescent lamps in the filament and plate push button switches with LED's. Those indicators tell you the status of the transmitter – for instance, the PLATE OFF button won't light up if all the interlocks are not satisfied. You can't tell that if the bulb is burned out! Some of the control relays had screw tabs molded in their plastic covers. Over time, some of those tabs had broken and some of the relays were quite literally hanging by their wires! We had mounted relay sockets to the panel and plugged the relay in. The time delay relay's timing capacitors had dried out. Since I couldn't find a direct replacement for that relay anywhere, I opened it up and replaced the capacitors. The delay wasn't exactly the same ... but close enough.

Another time, a failed blower breaker had caused a blower motor burnout. The original 3-phase monitor relays (three of them) were down-stream from the blower and fan. So we had installed another (single-relay) 3-phase monitor in such a way that if we lost a leg ahead of the blower it would shut off. All these things were coming to mind as we dismantled. OK...I'm starting to ramble. There was genuine sadness as we reminisced troubles and solutions from the past but at the same time, excitement about the new solid-state box that would take its place.

We've said goodbye to our old friend, the 831G-1, and hello to our new friend, the NV20t. So far we're off to a great friendship!

On a personal note, my wife and I just returned from a quick trip back to Watertown, South Dakota. We went for the retirement of an old friend and former co-worker. David J. Law and I worked together starting in 1972 at KS DR. Dave has become a legend in South Dakota radio news, working his entire career in Watertown, and he was hanging up his headphones. He had been working at KXLG-FM since it went on the air 10 years ago. I hear the walleye in Lake Kampeska are finding better hiding places!

In addition, Don Egert was calling it quits after some 70 years in radio! The Watertown Chamber of Commerce hosted an after-hours event at the studio to celebrate Dave and Don's retirements and the 10th anniversary of KXLG's first day on the air. My best wishes to you all. It was great seeing old friends again.

I hope your summer is going well. This would be a good time to start getting your transmitter sites ready for winter. Check the air filters, look for any "rodent access points" (or *snake* access points)! And above all ... Keep it between 90 and 105!

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



**The New Nautel**



# VIA The Remote Codec of Choice...

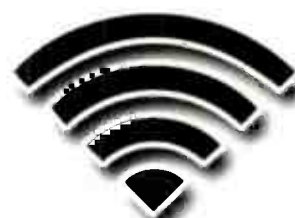
## The ViA now supports 7 IP interfaces:

- Internal module supports 2 SIM cards for Telco diversity (coming soon)
- Supports built-in Wi-Fi (no USB modem required)
- Connect 2 air cards and 2 Ethernet connections
- Rock solid IP connections with primary and redundant streams using SmartStream PLUS.
- Control remotely from anywhere with the new Cloud Codec Controller (sold separately). Watch the video.



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## Streamlining Administrative Hearings

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

It is fundamental to administrative law that there are two basic functions that a regulatory agency performs. The quasi-legislative function is represented by rulemakings and policy statements by which the agency sets the rules after due consideration and compliance with the notice and comment requirements of the Administrative Procedures Act, by which its regulated entities must conduct themselves. When they fail to conduct themselves in conformance with the rules, or it is so alleged, the regulatory agency performs its “quasi-judicial” function in which it operates much like a court of law to determine whether its rules have been violated and, if so, to mete out the punishment. Like a court of law, acting in its quasi-judicial function, the agency must determine facts and apply the law as it has so determined, while affording all parties their right to due process.

There was a time when the practice of communications law was primarily a quasi-litigation practice. Competing applicants vying for a scarce radio or television frequency in their local community were required by former FCC rules to make their case, demonstrating why they were the best applicant to provide local community service to the local audience and community. The policy was enshrined in the 1945 landmark case, *Ashbacher Radio Corp. v. FCC*, 326 U.S. 327 (1945), where the Supreme Court of the United States held:

*Where the Federal Communications Commission has before it two applications for broadcasting permits which are mutually exclusive, it may not, in view of the provisions of the Act for a hearing where an application is not granted upon examination, exercise its statutory authority to grant an application upon examination without a hearing.*

The comparative hearing was a trial like proceeding presided over by an Administrative Law Judge (“ALJ”). Initially, the factors to be considered were (1) local residency of the owners conversant with local needs and issues, (2) integration of ownership and management, (3) active participation in civic affairs, (4) broad diversification of background and interest, and (5) past broadcast experience. In essence, the Commission was interested in finding who would provide the best practicable service to the public with a maximum diffusion of control of the media. In 1965, the Commission added character of the applicant. In 1986, the FCC issued a policy statement on character, identifying the types of matters to be investigated for a factual determination. See: *History of broadcast license application process*: [[http://transition.fcc.gov/opportunity/neb\\_study/broadcast\\_lic\\_study\\_pt1.pdf](http://transition.fcc.gov/opportunity/neb_study/broadcast_lic_study_pt1.pdf)]

Additional factors were later added to the comparative criteria. In 1993, in *Bechtel*, 10 F.3d 875 (D.C. Cir. 1993), the D.C. Circuit Court found that the “continued application of the integration credit is arbitrary and capricious, and therefore unlawful.” In 1996, the Telecommunications Act eliminated the role of comparative hearings in the license renewal process. Nevertheless, the hearing process remains important in a myriad of situations, particularly where a character issue is at play, where conflicting facts are presented for interpretation by opposing parties for determination and a decision as to how the law is to be applied to them.

In possibly the most famous hearing case, *RKO Gen., Inc. v. FCC*, after a lengthy hearing, the Commission concluded that the licensee’s lack of candor before the Commission, required its disqualification. The hearing afforded all parties the ability to put forward their affirmative case and importantly, to cross-examine each witness to determine the truthfulness of their statements. On appeal, the Court of Appeals affirmed the Commission’s denial of RKO’s license. The court concluded that the licensee’s lack of candor before the

Commission, fully supported the licensee’s disqualification. RKO had submitted sworn statements that it made no willful misrepresentation. The Court held it was error to deny RKO the timely opportunity to present live witness testimony with the bald statement that RKO’s affidavits were “not credible,” stating that the FCC findings “demand that the decision-maker weigh witness credibility.”

The foregoing demonstrates the importance of live hearing testimony for a true determination of facts by the decision-maker. However, hearings are lengthy, costly and require a commitment of significant Commission resources. That is likely a big part of the reason why the Commission has been on a march to replace its quasi-judicial function with a more expedited procedure.

It is fundamental to administrative law that there are two basic functions that a regulatory agency performs. The quasi-legislative function is represented by rulemakings and policy statements by which the agency sets the rules after due consideration and compliance with the notice and comment requirements of the Administrative Procedures Act, by which its regulated entities must conduct themselves. When they fail to conduct themselves in conformance with the rules, or it is so alleged, the regulatory agency performs its “quasi-judicial” function in which it operates much like a court of law to determine whether its rules have been violated and, if so, to mete out the punishment. Like a court of law, acting in its quasi-judicial function, the agency must determine facts and apply the law as it has so determined, while affording all parties due process in accordance with the rule of law.

### The Notice of Proposed Rulemaking (“NPRM”)

In early September, the Commission issued a Notice of Proposed Rulemaking to further streamline its administrative hearing process. [<https://docs.fcc.gov/public/attachments/FCC-19-86A1.pdf>] In his concurring statement, Commissioner O’Reilly criticized the current process as being burdensome, expensive and time consuming. However, his criticism is that there have been occasions where there was a process of a lengthy hearing with “protracted trial-like hearing before the ALJ, just to have the matter reconsidered yet again by the Commission.” While Commissioner O’Reilly criticized the need for an appellate process that allows the Commission to make a determination on the initial decision of an ALJ, one might observe that that is actually the legal process of the judicial system and that the parties should be entitled to an appeal to reconsider the decisions of the ALJ, just as in litigation parties can appeal a decision of the lower court to a court of appeals.

The NPRM goes a long way toward eliminating many of the protections fundamental to the hearing, quasi-judicial process. It seeks to streamline and, in most cases, eliminate the trial-like civil litigation aspect of the hearing, replacing it with written testimony and documentary evidence “in lieu of live testimony and cross-examination.” Commission staff would act as a “case manager” supervising the development of a written hearing record, dispensing with an intermediate opinion when the record can be certified directly to the Commission for final decision. While section 309(e) of the Act requires the Commission to some “public interest” determinations for a “full hearing,” the statute does not define the term.

There have been times where parties were required to submit their affirmative direct case in writing and other steps have been taken to expedite procedures for determination of contested matters, typically where the applications raised no “substantial material questions of fact.” In support of elimi-

nating most quasi-judicial hearings, the Commission states that most disputes “typically involve criticisms by one party of the evidence proffered by another, or the legal significance of that evidence, not actual conflicts in testimony between two witnesses concerning outcome determinative facts.” However, that still leaves some cases where fundamental due process requires the ability to present and orally argue a direct case and cross-examine the opposing witnesses, as was crucial in *RKO*. Instead, the Commission proposes to require parties to file pleadings with all evidence and arguments to support their respective positions, substituting oral testimony with sworn statements based on personal knowledge. What will be lost in the presentation of written evidence instead of oral testimony is an opportunity to examine the demeanor of the witness and the opportunity by the opposing party to cross-examine that witness to determine the actual truthfulness of his/her testimony.

To obtain oral argument, a party would have to demonstrate through written submission why an oral argument may be necessary, but that may be difficult since its value is frequently unknown until oral argument occurs. It is during oral argument that the decider of law and fact has an opportunity to question the advocate and test the validity of their position.

In place of cross-examination, the Commission proposes that an opposing party may take the deposition of opposing witnesses. However, depositions are taken for significantly different purposes than cross-examination and the rules of cross-examination are significantly different than a deposition. In a deposition you must lay a foundation for questions and you cannot lead the witness. Cross-examination occurs *after* the testimony of the witness. Direct and leading questions can be asked to test the veracity of the statements made by the witness on direct examination. That opportunity is generally lost in a deposition. The Commission cites recent opinions where courts have found that agencies may resolve factual disputes on the written record, but it also notes that the D.C. Circuit suggested that it may be inappropriate for an agency to resolve issues of intent or motive on a written record in certain circumstance. In deference to the court’s decision, the Commission asks for comments on when it may be inappropriate to use a written record rather than a full hearing. It also suggests that it may designate FCC staff members to be the deciders of fact and law, even where the Commission is a party to that case. Under those circumstances, the Commission will have to act very carefully to make sure that conflicts of interest are avoided where an FCC staff member could become the decider of fact over a position taken by a colleague in the agency.

In support of the proposal, it should be recognized that long, protracted and expensive hearings can significantly and adversely impact a broadcaster’s ability to serve the local public service it is charged with under the Communications Act and Commission policy. A swift decision under certain circumstances may be highly desirable. However, the implementation of this policy and some of the positions taken in the NPRM raise significant concerns over a party’s due process right to a full defense with adequate opportunities to test the veracity of all witnesses in the quest for expedited procedures and economic efficiency.

Ultimately, all broadcasters should carefully review this proposal and weigh in with your opinion and concerns.

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

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

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## Radio

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Power Core can handle up to 128 MADI channels, standard. 4 front-panel ports (two dual-redundant pairs) with SFP make it easy to bridge your AoIP and baseband digital signals.

Think Power Core looks awesome outside? That's nothing compared to the sheer processing might inside, with a 1920\*1920 routing matrix, 96 DSP channels and 80 summing buses. All your friends will be so envious.

Information please: high-resolution color display with rotary encoder provides easy front-panel access to network information and settings.

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The Lawo logo. Your assurance of meticulous engineering and premium components, uncompromisingly crafted to the highest German standards.



Power Core is the only broadcast AoIP node with ST2022-7 Seamless Protection Switching, giving you dual discrete links to your network core. Completely redundant, with automatic inaudible switching. Now that's what we call peace of mind.

Connect your AES / EBU devices. Expansion card has 4 digital stereo inputs with broadcast-grade sample rate conversion, and 4 digital outputs.



Everybody's got a few analog sources. Line input & output cards with 4 stereo (8 mono) channels make connections a snap.

Lots of talking to do? 8x Mic/Line card with Phantom power does the trick.

Studio I/O card is perfect for on-air rooms. 2 Mic/Line inputs, 2 Line outs for speakers and 2 headphone feeds.

Got DANTE®? No problem. Power Core equipped with a DANTE expansion card gives you access to a whole world of pro-audio devices. Two mirrored ports with onboard SRC provide 64 channels of I/O.

If four front-panel MADI ports aren't enough, you can add more. Dual-port MADI expansion cards give you two SFP ports with 64 channels each.

Power Core is already the highest-capacity AoIP node + console engine in the world. 8 rear-channel expansion slots make it capable of even more.

Dual-redundant power, of course. Our hardened internal auto-switching power supply is backed up with an inlet for external power too.

As proof, we present Power Core: the modern, super-compact AoIP audio interface that packs hundreds of stereo channels into just 1RU. Handles AES67, MADI, analog, AES3 – even Dante®. You'd need 24 rack units of old-style nodes to equal all the I/O available in just one Power Core.

Impressive, yes? But audio I/O isn't the end of Power Core's capabilities. There's DSP, a lot of it — 96 channels of EQ, dynamics and mixing. AutoMix, too. Plus routing: 1,920 crosspoints, enough to switch an entire multi-station broadcast facility.

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Power Core. The Über-Node has arrived.



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## Bidding Defectively

### Electrical Work Bites

by Gary Minker

A sorry fact of life for the owner operator and sole proprietor is that you, often times, have to bid for work. You visit the job site, you even take pictures. You talk about the job with the customer and you take every precaution to cover your backside, with both hands and a safety net for hard costs, materials, labor, assistants, profit, burden, taxes, and on and on. This bidding junk chews up one too many days of your life on nothing more than a gamble that you are the winner of the work and not cousin Vinnie.

#### Be Thorough

This is the mantra of all estimators, which is only one of many hats we can wear. You spent an inordinate amount of time trying to be sure that you crossed all the legs and soldered twice. You send in the bid price and now you go on to other sure things ... and wait. Time passes, life crawls, and you all but forget that you even bid the job – then you get the email that you are the winner of the work. In this case, you are going to install surge arresting on the 120/208 three phase power panel in the transmitter room for one of your favorite people.



How wrong can this go? There are only a few parts, (or so you thought) and you will be bringing in your favorite Electrician to do the hot panel work. There are multiple UPS systems in the room to cover the power glitches if

there are any (which there shouldn't be) and this is day time work. Hallelujah! Your customer agrees to a job date and time. Your Electrician agrees to be there with you to do his part, the materials are all in hand and it's off to the races.

#### The Install Attempt

Remember the two life theorems: "What could possibly go wrong" and "there is plenty of time to panic later." Everyone shows up for the job. You and the electrician take apart the cover plates on the two target panels – no breakers trip, no wires get smooshed and you begin to mount the surge arrestors. This is existing work so you selected parallel type arrestors as opposed to series inserted models which would certainly require a shut down and massive re-wiring of the mains. So simple!

The covers come off and new 3/4" knock outs have to be drilled and punched since there are none left in the bottom of the panels. Eh, no biggie. The wires on the arrestors are long enough to reach the new circuit breaker locations and the mechanical part goes like a swim. Now it is time to mount up the new circuit breakers. Uhhh, what in the name of all that is unpleasant is this? There are no bolt hole finger mounting bars for the breakers.

Nothing in the buss bar stack even remotely matches the circuit breakers that the supply house and the panel manufacturer specified for this install. It's hard to believe, since you sent them the photo of the panel, all the labels, tags, and serial number plates. Awww come on now. This just turned in to a circus freak show and the customer is standing there eating his popcorn, staring you and the electrician trying to listen to your hushed feverish conversation that is quickly going nowhere.

You try to get the customer to go sit down, but he won't leave. You and the Electrician decide to call tech support at the panel manufacturer and once they actually answered the phone on the 11th try you have the guy rolling on the floor for your bad luck telling you that the photos that you sent can't be of the panel with that particular model tag. This model of panel is shipped with bolt-in bars for the circuit breakers. Your panel does not have any and the burn mark might be a clue why.



When you quoted the job you might have seen this act of decades old sabotage, but little did you know that if you had taken off the cover to the panel (which no one does) to price the work, after photographing all of the panel data

plates, you would still be screwed. No one in their right mind would have noticed that fingers were missing, since everyone assumes that they are naturally already on there because the panel ships fully loaded with them. After an hour of this embarrassingly hysterical laughter by the guy in tech support, he figures out that someone removed the buss bar fingers for some unknown reason, which disabled all of the remaining breaker slots in the panel. He gives you a part number for a replacement finger kit and wishes you a happy day.

Now what? The customer is rapidly switching back and forth from entertained to hostile and you try to explain to him that whoever installed this panel sabotaged it – and you find out that you just called the owner's brother a thief. Oops ... back to Now What?

The factory guy gives you the model number of a still available replacement parts kit for your panels. The parts are in stock in Northern Kalamazoo and can be shipped to you in three days because they don't ship over night.

The parts show up and the whole side show starts up again. At least the arrestors are mounted. At least the circuit breakers are on site. Now you have to convince the owner that you are going to have to shut down the panels (the station) for up to 20 minutes because installing buss bar bolt in fingers is a hot box job and, for safety, the panels need to be down. This is where the yelling starts, and the owner tells you that none of the UPS's can hold their load for more than 5 minutes since the generator was expected to come up in 30 seconds to relieve the UPS's of their job. But with the AC panels out of service, we were out of luck.

After considerable finger pointing at you, it is decided that one panel at a time will be pulled down and worked by two guys to try to beat the 5 minute shot clock of battery failure. The UPS's will be allowed to recharge and the second panel can be attacked after that. Now you are on the hook for three times the cost of your Electrician, extra parts that you did not count on, and the wrath of your popcorn eating customer, who has lost all interest in his snack food.

#### But I Did Everything Right

OK, so you did everything right. Good for you and little consolation to the fact that the panels were sabotaged when they were installed. Little consolation in trying to get the cost over runs from your now steamed customer. A long history of meritorious service went slithering down the drain on this once-so-simple install of two circuit breakers and two surge arrestors.

#### The Lesson

There is no substitute for looking at everything, touching everything and photographing all of the data plates, and having lists of the intended equipment that you have to deal with. Even with these tools in hand, the foo bird can darken your day for such a simple little \$4.00 part. There is no logic as to why someone would remove a factory installed part from an electrical panel. The likelihood that you would have noticed the bars missing would have been pretty low, especially since you, your electrician, and your combined 78 years of electrical experience stood right there and didn't see this one coming. You even had the guy at tech support from the manufacturer rolling on the floor, so don't feel too bad.

Explain the issue as palatably as possible to the customer. Show him that you handled the situation with a minimum of loss of fingers and blood, and the job is now completed with minimal loss of up-time for the equipment. Hope for the best that he calls you again and keeps you on his Christmas card list.

Gary Minker owns Radio Works R.F. Consulting Email him at: [gary@RadioWorksRFConsulting.com](mailto:gary@RadioWorksRFConsulting.com) or call 561-346-8494. Find Gary on the web at [www.RadioWorksRFConsulting.com](http://www.RadioWorksRFConsulting.com)



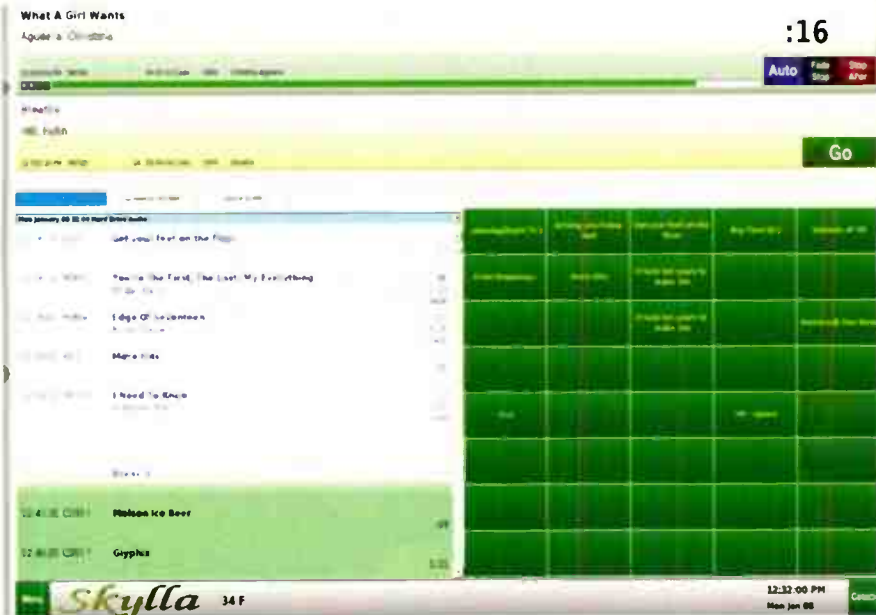


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# User Report

## PocketVNA Review

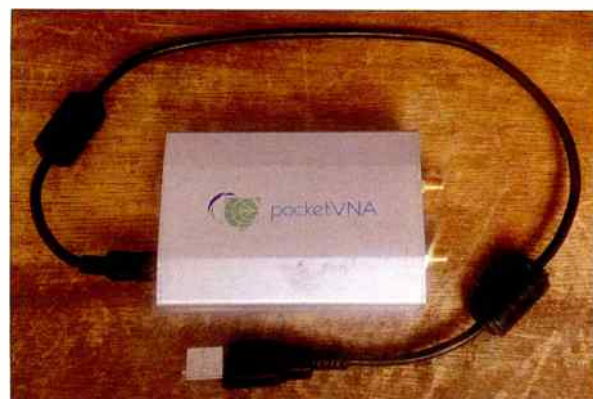
by Bob Reite CBT

If you are a “hands on” engineer that does antenna returning, moving AM broadcast transmitters to a new frequency, or builds custom ATUs, isocouplers or power dividers for FM, you need to have a way to measure both the real and imaginary values of a device. But you probably got sticker shock when you last priced an Agilent or HP vector network analyzer. Even a used Agilent 8753B VNA goes for \$3,795. On the other end of the spectrum are Chinese built VNAs selling for around \$50, however their frequency range for accurate measurements is only 50 kHz to 300 MHz and the dynamic range is only 40 dB.

The PocketVNA is manufactured in Germany. It has a frequency range of 500 kHz to 4 GHz with a dynamic range of 70 dB for frequencies up to 350 MHz. Above that, the dynamic range is only guaranteed to be 40 dB, but there are tricks for improving that for work at 950 MHz, for example. Price is \$490 direct from the manufacturer with free shipping, at [www.pocketvna.com](http://www.pocketvna.com)

### Hardware Description

The PocketVNA is housed in an aluminum casing measuring 3.5" x 2.5" x 1". It connects to the computer with the supplied mini-USB cable. The two RF ports are SMA female connectors. The device is powered via the USB cable. No other accessories are included. To use the PocketVNA, connecting cables and calibration standards are required. The standards are simply a short circuit connector, an accurate 50 Ohm load and an open circuit connector cover. Accuracy of the device is dependent on the accuracy of the calibration standards used. A set of male SMA calibration standards is available from the manufacturer for \$22.



Input to the device is limited to +20 dBm with a maximum of 5 Volt DC offset of any polarity. When measuring passive devices such as an antenna or filter, this is not a concern, but if measuring the transmission characteristics of an amplifier, a suitable attenuator must be used.

### Software Description

The real power of this device is in the software. Native software is available for Windows, MacOS and Linux. The Windows version comes as a .zip file. Extract the contents and you get PocketVna-run.exe. Run it and the program starts! No installation, no messing with the registry – it just runs. If you forget to plug in the device first, it will say “Device Not Detected,” but no problem. Just plug in the VNA and you’ll see “Connected to PocketVNA” and the

version number of your hardware. The Mac Version does come as a .pkg file. Run the .pkg file and it will ask you where to install it. If you have a previous version of the software installed, it will install at the location you last ran it. The Linux version comes as a .tar.xz file, which appears to have been compiled for the CentOS distribution. It is best to create a new directory and extract the file there, to make the .run file easy to find. The .run file needs to be executed as “run in terminal” for best results. On my Ubuntu 16.04 installation, I had to run the program as root using sudo from a terminal window. If you do not wish to do this, you will need to create a udev rule file to allow ordinary users to operate the /dev/hidraw0 device.

The interface looks exactly the same in all three versions. This version of the software and hardware will let you measure reflection and transmission coefficients on both ports at the same time (S11, S21, S12, S22), although only two graphs can be displayed at the same time.

### Using the PocketVNA

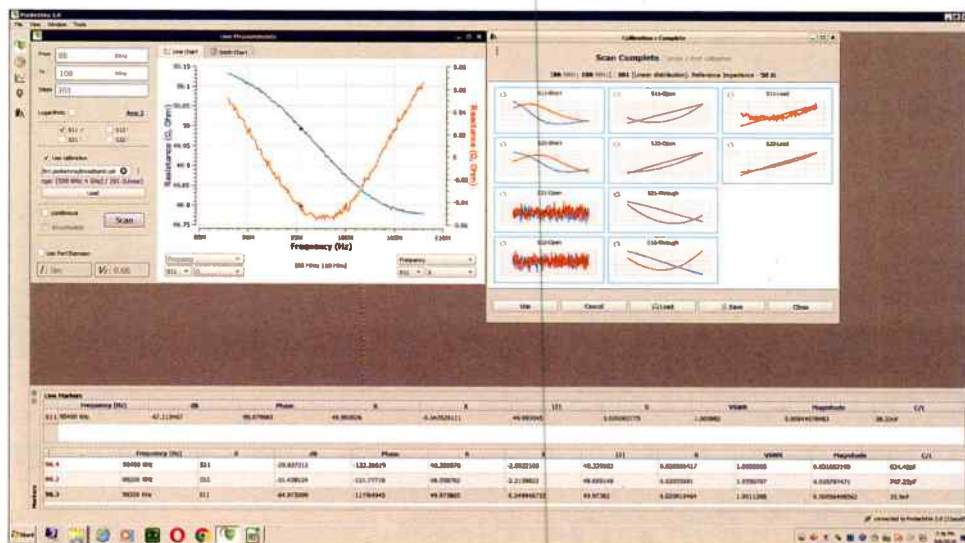
The unit must be calibrated before use. From the top menu choose “Tools” then “Calibration.” The default range is from 9 Mhz to 4 GHz, but any range from 500 kHz to 4 GHz can be used. For best results, choose a range close to your application, such as 88 MHz to 108 MHz for working on FM antennas. The default choice is “Simple 2-Port with 1-port calibration kit.” This is fine, but if you want to save some time, if you are going to be measuring a one port device such as an antenna, choose “Port 1 Reflection.” The program will walk you through the steps of doing the calibration in the best order, for the most accurate results. Bear in mind that the calibration is accurate only at the exact place that you attach the standards. Since most of my work is done with BNC connectors, I use 2-foot, SMA to BNC cables and my standards are BNC. That way the 2-foot cable length is taken into account. The software does have a “Port Extension” feature that will compute the effect of an extension cable and apply it to the measurements – all you need to know is the exact length of the extension cable and the Velocity Factor of the cable you are using to extend past the calibration point. After all steps have been completed, the choice is given to “Use” the calibration just performed, or to save it for future use. I usually do a new calibration each time, in case the device has drifted since last use.

The live measurement window will automatically load the range of the calibration that is loaded. You may choose a narrower range for display if you like. I always do a test measurement with the 50 Ohm load, just to check for system sanity. Choose just S11 for this test. The line chart window defaults to dB and Phase, the results may be disconcerting, but it auto scales and will show all the noise.

Choose R for the left side and X for the right side. There you will see that R is pretty close to 50 Ohms until you get above 2 GHz, but it’s only off by one Ohm at the higher frequencies. Likewise X will be zero until you get above 2.5 GHz with one Ohm maximum error. You can also click the Smith Chart tab and see just a thick dot in the center of the chart.

Once a scan has been made with the actual device under test (DUT), you can choose two values to graph. Use the mouse to move the cursor over the graph. The frequency and the two displayed values will be shown at the cursor location. This is not particularly useful. You need the actual marker values.

Double click and the “Live Markers” window will open. Note that all possible values are displayed: dB, Phase, R, X, [Z], G, VSWR, Magnitude and C or L. While you can’t enter an exact frequency on the keyboard (a minor quibble that I have with this software), you can carefully move the cursor and dial in an exact frequency. 96300 kHz as shown in the screen shot. Double click again to save it to the marker page. You can save frequencies of interest to the marker page, then using the three dots to the left of this window, do a “Save As” to create an xlsx file of all the parameters for the frequencies used.



### Write Your Own Software

Don’t like the provided software? The manufacturer offers Open API, again for Windows, MacOS and Linux, as well as the API manual to explain how to read the raw data from the device. The API could be used to interface the PocketVNA with LabVIEW if you are not up to writing a whole GUI from scratch.

### Use As a Signal Generator

The home page of [pocketvna.com](http://pocketvna.com) states that the device can be used as a simple signal generator. However, nowhere in the documentation can I find instructions for doing so. Obviously the device generates a signal which is then read by the receive circuit and interpreted by the software.

So here is how to do it. Set up the system as if you are going to take an S11 measurement. To set the output frequency for signal generator use, enter the desired frequency in the “To” box and click “scan.” The PocketVNA will “park” at the “To” frequency with pretty good accuracy – I measured it to be only 63 Hz low at 100 MHz with a 25 ppb frequency counter. The output level is about -14 dBm at frequencies from 500 kHz to 100 MHz and down to -17 dBm at 1 GHz. Below 50 MHz the harmonic content is pretty strong, at 1 MHz the second harmonic is down only 10 dB, however it would still be useful for aligning a receiver. An external attenuator is needed to adjust the output, there is no provision for doing so in the device itself.

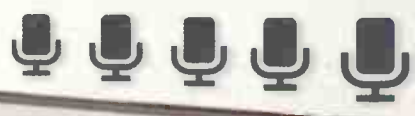
Bob Reite operates his contract engineering firm, *Telecentral Electronics, Inc.* servicing radio stations in Pennsylvania and New York state and may be contacted at [br@telcen.com](mailto:br@telcen.com)



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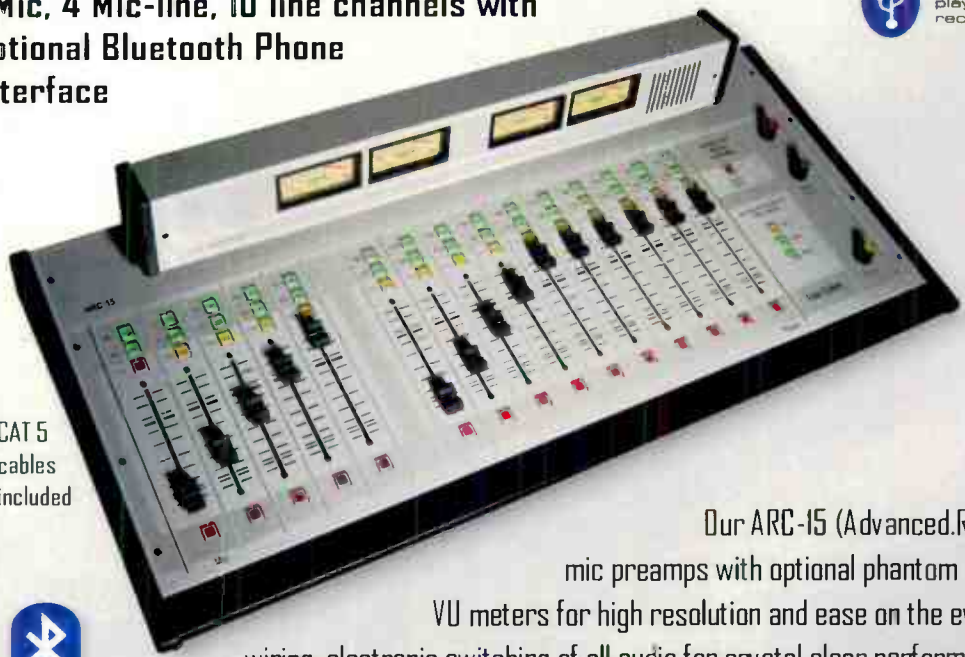
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## Linux for the Uninitiated

### Getting Around the Windows Obsolescence Situation

by Tommy Gray – CPBE, CBNE

#### Recap: Security Cameras

Hi Again! Last time we talked about Linux based security camera systems. Since that time, I have settled on a great system for my office and shop that I briefly mentioned last time. The software package I am using is called Xeoma™. Now I checked the software reviews, as I also mentioned, and most were great. However, the one that had the top reviews was difficult to install and frankly I gave up on trying to get a flexible and working system with it. It also wanted a dedicated computer to run it on. Xeoma however, can run alongside other apps and not hog all your system's resources.

The cameras I use are cheap from Ebay. I might mention that you need all your cameras to be the same make and model if you plan to use the free mobile apps that come with most of them. The reason is that most of them use proprietary apps that only work with their own cameras. Using the same units gives you the ability to use the free version of Xeoma, which accommodates up to 4 motion sensitive cameras and still have free mobile monitoring and alerting capability through the camera manufacturer's mobile app.



Xeoma does have its limitations in the free versions, in that it will only save recordings for 5 days – but I have a script running that copies the files over into another folder until I have time to review. That way when it deletes the oldest files and folder, I still have copies should they ever be needed. If you want remote access to the Xeoma system it is an extra cost option, though it is reasonable. To get remote access though, I simply use the free app that came with the cameras. The main point behind all this exercise with Linux computing I have talked about for the past year, after all, is not only reliability and capability but also giving you a very powerful system that is totally free!

#### My Hardware

I am running Xeoma and numerous other programs on old former Windows XP, Dell Laptops. In my office I have an old and very powerful XP machine I used to use for engineering and software development. The old laptops I use, I got cheap off an on-line marketplace (\$50-60 each). They have 64-bit, Dual Core Intel processors and 4 GB system RAM, and monitor capability of high resolution. I use the Dell docking stations (\$20 off Ebay) with each of them. I keep good batteries in them so if I have a power outage, I don't have to worry about having no UPS as my old one gave up the ghost. The laptops have the additional capability that if the power is off for a long time, and the batteries get run down, they simply drop into sleep mode and are ready to go when it comes back.

#### My Computers

Allow me to mention that I have a large KVM switch in my office that gives me easy access to all my computers at the push of a button. I have a nice large widescreen monitor, a comfortable keyboard, and a mouse, that follows the switch, and is there for all the machines.

**Computer Number 1:** One of them I use for a daily workstation, and run the complete set of LibreOffice apps (Office, CAD, etc. ... No M'soft Office for me!). They are fully compatible with just about any office suite out there, and have built-in PDF creation, etc., just like any other high end office suite. They are *not* cloud based, which for me is a plus, because I don't have to pay for someone's cloud storage. I use them in connection with the free version of Dropbox (Did I mention that I am "Frugal"?). The great part is that they are totally free, and updates are free as well. This machine does most of my web browsing, Internet business, email, etc., and all the daily chores most of us are familiar with for an office computer. I have several Windows apps I have to use from time to time, but can run most of them in Linux without having to boot into Windows. Now I realize that there are apps many of you use that may not work that way – a dual boot Linux/Windows machine will help you with that.

However, in all the years I have been running these Linux machines almost exclusively, I can tell you that after the first few weeks, I have never looked back and don't miss Windows at all! Frankly, sometimes I even forget I am on a Linux machine, which to me is great as it does not interrupt my usual routine. This first machine is my "Daily Driver" computer in the office. Did I mention that there is *no* antivirus software to deal with? Keep Linux updated in the Update Manager, use a good secure password, and you are good to go, as nothing will get installed on your computer without you entering the password!

**Computer Number 2:** On the KVM switch are the 4 Linux machines, and an old but powerful Windows XP Pro machine that has some of my older engineering and development software on it. It is not connected to the Internet so I don't have to worry about virus or malware infestation. It rarely ever gets used except when I want to use a certain graphics program. I like that has long since become obsolete on the newer versions of Windows. This machine also has a nice large RAID array on it so it gets used for storage a lot.

**Computer Number 3:** In addition to these two machines I have one machine that is a dedicated backup machine. It has every piece of software that "Daily Driver" has on it and has mirror copies of all the files I normally use. If something were to happen to the primary machine, one click of a button on the KVM and I am looking at a duplicate machine that has everything on it. This machine, as are all the other machines, is running Dropbox so syncing files is automatic. On Linux I am using the Dropbox for NEMO (file manager/explorer) which mirrors everything into a folder on all the machines simultaneously, so backups are a no-brainer. Drop a file into a folder and it immediately goes to all the machines. I keep up with how much available storage

there is on my Dropbox, and I have a large USB drive hanging off the KVM that is instantly available to any machine on it – used to copy some of the Dropbox files that are not used frequently. This way I always have plenty of free cloud storage available to sync my files. The Dropbox mobile apps also give me access to everything on my phone and tablets that is up to date and readily available as well. This mirror machine does not get much use but is there if I need it.

**Computer Number 4:** The next machine is the one I run my shop and office security system on. It too is a mirror of the other two Linux machines and can be used for an instant backup machine for any of the others, without losing anything. One thing I don't think I mentioned is that all my Linux machines running the most recent 64 bit version of Linux Mint Cinnamon Operating systems and are mirror images of each other. They have the same size hard drives, the same amount of RAM, and identical file and application complements. I also have two other laptops I take with me when I travel, that are all set up the same way. When I look at any of my computers, they are all the same, except the travel machines are more powerful with larger drives and more computing power/RAM. I cannot tell you how having all these identical machines has greatly improved my capabilities and reliability.

Now before someone complains that all this costs a lot of money, Au Contraire! The total of 4 office machines all cost me under \$60 each off Ebay! I bought the same models and same hardware on purpose and it has paid off. I have more in the travel machines (Which are Linux/Windows 10 machines) but most of us have at least one strong machine in our arsenal, right?

#### Interconnectivity

All the computers I have are on, or have access to, my in-house network and have OpenSSH installed on them. I use it along with Nemo to do file swaps, copies, etc. from one machine to the other as needed. OpenSSH is installed from the Linux Mint Cinnamon "Software Manager" found under the "Administration" menu item of the main system menu. I would suggest that on your in-house network, you use static IP Addresses for all your machines, as it makes things like accessing security cameras (all of which have an assigned static IP), and the machines on your network, easy. In order to access a machine on your network, that machine must have its firewall opened to your computer (found under the "All Application" menu, "Firewall configuration"). You need to allow the remote machine to access your computer (Incoming).

To open up a file manager to your remote computer (once its firewall has been given approval to accept your IP address) open Nemo and click <File> <Connect to Server>. You will then see a box that allows you to enter a username and password, as well as the IP address of the machine you are wanting to connect to. After that, you will see a Nemo window showing you the files on the remote computer where you can do what you need. It will also put a "mounted" icon on your desktop so that you can return to it later if needed.

I am out of space for this time, so I think I will pickup there next time, and also mention several other familiar things that computer users are used to using, such as remote desktop administration. More Next time!

Enjoy!

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



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## Keeping Up Your Cooling

by Wiely Boswell

It has been a hot summer down here in the south. Yesterday was 103 degrees, and from what I hear there has been lots of heat to go around. The heat is really tough on equipment. Capacitors will fail faster and can take semi-conductors to the point they can fail if not cooled. Shielded RF assemblies rely on forced air cooling and now liquid cooling is becoming popular on high power amplifiers.

So filters become even more critical to maintain. Air flow can not be reduced by dirty filters without cooling systems being hampered. There are lots of types of flow sensors to detect and shut down operation due to low or reduced air flow. Lots of transmitters have monitored air flow with differential pressure sensors that use diaphragms. They also use RPM monitoring in fans to detect a fan issue.

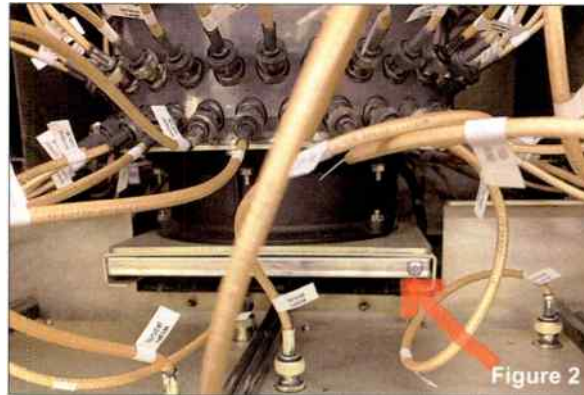
A HEPA filter doing its job in HVAC units will need changing often. Buying filters by the case saves money and encourages me to change them out more often. Some smaller equipment filters can be specialized and even rebuilt with new material. Fans/filters can also be placed deep in the equipment. A combiner filter in one of our transmitters requires a shut down to change or inspect. It is a courser, less dense, filter material such that it does not clog and restrict like a paper type of filter.

The least filtering is done by thin foam type material that eventually rots away. It primarily keeps larger objects like insects out. This material is typically used on small muffin fans held by a retaining cover and can also be used in large sheets on the equipment doors as well. These type filters do not keep the fine dust out until it becomes really clogged up with larger dust – then it starts filtering great but has little or no air flow. **Figure 1** shows various filters from left to right: fiberglass fill, foam in aluminum frame, 1" and 2" pleated hepa, and at bottom, fiber filters, old and new, being rebuilt out of a power combiner. **Figure 2** shows a combiner with fan below and filter inserted. Some older filter frames are harder to find, requiring rebuilding the frame with new material as required.

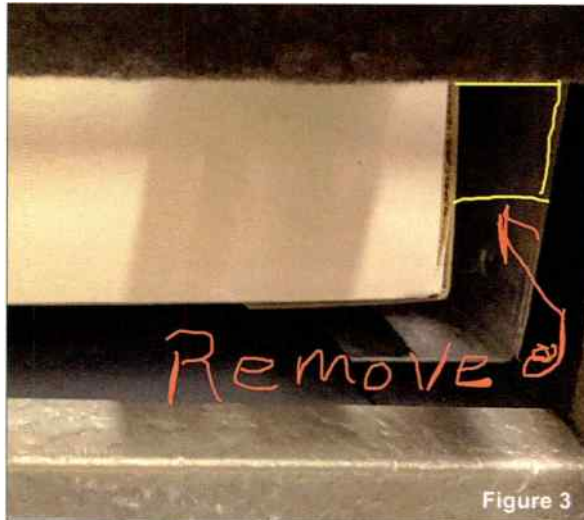


It is the job of the HVAC system in the room to keep the environment clean and minimize dust in the equipments' filters. It's always impressive to go into a very clean site with a polished floor, but remote sites and old buildings usually do not get as much attention. I have often seen where the condensate tray drain stops up and water overflows and the filter will collapse. Just improper filter installation will also allow dust into the evaporator coils and therefore the room. It is hard to really clean the inside

coils and fan blades so best practice is to replace filters every 90 days or less and ensure there is a good seal around the filter and the entire intake duct.



If an intake enclosure is modified to accept a larger area filter than normal, it reduces restriction and time between changes. Likewise, if a 2" filter is used, where there is currently a 1" filter, the surface area is almost doubled.



**Figure 3** shows the filter access door open and a two inch thick filter inserted. A simple 1" sheet metal guide was removed from each side to allow a 2" filter to be used.

If you have, for example, a wall inlet with filter frame there is a chance to build a well sealed larger frame to incorporate a larger filter. An example of this is an outdoor package system with air fed to and from the building with ducts. The intake in this case will provide the opportunity to customize the filter enclosure/cover at the intake in the building. Some units may contain the filter in the outside unit. Remember, anywhere there is an intake system you have to stop any vacuum leaks where dirt can get in. One surprise to me was a small central system that had a secondary screen filter after the main filter, right below the "A" frame coil. Make sure you don't miss any filters.

Another way to provide relief from the heat load in the building is by taking heat from the transmitter straight out of the building. The way to get large heat loads out of the building, and at the same time reduce cooling load in the building, is with liquid transmitter cooling. Modular RF Amps and power supply modules with large metal heat

sinks may contain internal liquid cooling lines. Liquid quick disconnects allow a module to be pulled out of its slot in service. The system uses a non-corrosive type of glycol, circulated with redundant pumps to outside cooling coils. Hot swappable modules come in some, if not all, systems. The module contains a small expansion cavity to handle pressure surges. This will reduce room HVAC demand providing energy savings.

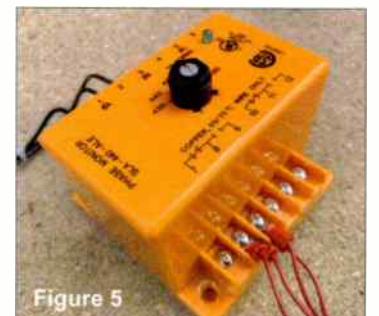
I use several mini-splits which I have touted in a past article. The first failure was with a newer inside wall unit that quit and displayed an error code. I learned that codes on inside wall units are not the same as codes on the outside units' control board. I can not say enough about the support this company called Alpine Air provided. They even answer the phone until 7:00 p.m. They learned a DC motor speed control chip had an abnormally high failure rate. They provided instructions to test the motor and, sure enough, it had 340 VDC across the dead motor. Inverter type HVAC units use high voltage DC. The higher voltage results in less current and smaller wire size.



**Figure 4** shows the teardown of an eight pole motor with magnets on the armature and the field windings sealed in the injected solid plastic housing. The internal control board is soldered to field tabs coming out of the housing. A chip controls the speed based on a 0-5 VDC control signal. The board is also fed a constant 15 VDC source. This is the newer type of motor that has ball bearings and a nice isolation mounting. The PWM IC is heat sunk to the metal cap that is pressed on to the field housing. Pulling the coil assembly up and out of the way to get access to undo a set screw in the cage fan was required. The company did the right thing and replaced the motor and gave a \$150 credit for the labor of the required replacement.

A recent cooling failure was due to a start/run capacitor. It was a 5 uF run capacitor combined with a 30 uF compressor start capacitor. Nowadays capacitors and contactors (main relay) just don't seem to last. Having spare capacitors and even contactors on hand saves time to repair.

My most recent failure was due to a phase loss to a three phase scroll compressor system. It burned up the contactor while trying to run on two phases. Lesson here is a phase detector, interrupting the 24 VAC power to contactor



coil, will prevent the unit from running with a lost phase. A true phase loss detector (**Figure 5**) will shut down the system due to low voltage, loss of phase, or a phase rotation. Phase reversals will make motors run backward. Stay cool!

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



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## Toward Becoming Irreplaceable

by Sam Wallington

The other day, I was listening to the radio (best medium ever!) and heard a song sung by a terrific, talented singer. I had heard it before, but this time I noticed the specific uniqueness of her performance. Despite using the same words, a repeated chorus sounded different every time. Inflection, tonal quality, emotion – all just part of the tremendous palette she used to bring the best from every note. She did not just sing a song. She crafted a simple melody into a soul-stirring, goose bump-inducing work of art. No one else could have sung the song in such a way – she is irreplaceable.

I wonder: Am I irreplaceable? Could my “song” be sung as well, or better, by someone else? How about you?

Perhaps we all crave being irreplaceable, to be seen as uniquely talented with unicorn-like qualities and expertise. We want to be valued, appreciated, even admired for what makes us special. Not the fame a highly gifted singer may receive, but the sense of knowing you contribute in a significant way and are valued because of your “special sauce.” How do we get to being irreplaceable?

Before I share some ideas on improving our odds of being irreplaceable, I want to clarify what it is not. It is not overworking yourself to an early grave. Some think putting in more and more time and energy will cause them to cross an imaginary line beyond which lies a paradise of safety or financial security. But the heart attack, or depression, or divorce which follows such an unbalanced life, is far from the desired outcome. Instead, I want to suggest some healthier options as fuel for the fire you are building.

### Put in the Time

The singer I heard on the radio did not accidentally stumble into her career, nor did she perfect her craft watching YouTube or singing in her car while running errands. She put in thousands of hours of intentional practice, both alone and in front of audiences. In the same way, we must show up prepared, on time or early, and consistently give our best effort. Two things result: Practice brings proficiency, and we demonstrate our trustworthiness to those we work alongside because they can consistently count on us. Both are essential elements of irreplaceability.

### Accept Critiques

Feedback is a gift. Truly! Not all feedback is delivered in a way we can hear or given by trusted advisors. It may not even seem applicable! Yet it is still a gift. The trick to receiving feedback, and creating value from it, is accepting and analyzing it. Ask yourself, what are they trying to tell me? Will it make me better? Are there any gold nuggets in what they are trying to tell me, despite the delivery or the relationship we have? How can I use this feedback to get even better?

### Be Nice

News flash! During your career, you will have opportunities to work with people who are not nice. Maybe they are harsh, disrespectful, or unkind. None of those are reasons to not be nice yourself. Hear me correctly: I am not excusing abuse or suggesting you work in a hostile work environment

(leave ASAP)! Nonetheless, even non-abusive, non-hostile people have had days or say unkind things. Regardless, their behavior does not dictate yours, and you can still be nice. When you are the one having the bad day, be the first to apologize – and do the work you need to do to minimize your bad days. Being a joy to work and communicate with is a rare skill which significantly contributes to irreplaceability.

### Speak the Language

Have you ever been to a doctor who talked using only highly technical language? Unless you happen to know their lingo, you could be baffled, confused, or frustrated by words like contusion (bruise), myoclonic jerk (involuntary muscle contraction, like hiccups), obdormition and paresthesia (the feeling when your arm goes to sleep and is numb and then tingles), or sphenopalatine ganglioneuralgia (ice cream headache).

An expert in any field can do the same thing. In radio, we might use terms like cue burn, OTT, transponder, cume, cache, ROM, or RAID. These words act as shortcuts to clear understanding, but only when we are talking with someone who has similar expertise. “The problem is your RAM,” is a useful statement for someone who knows you are describing Random Access Memory. But someone without appropriate knowledge might wonder how their livestock could cause their computer problem.

Moving toward irreplaceability requires the ability to translate complexity into something understandable and/or easy to learn.

### Communicate

Easily understood language is only part of communication. Perhaps, for example, you were running with Plan A, but someone changed the plan without telling you. How much frustration and wasted effort resulted when everyone but you was pushing for Plan B?

(Continued on Page 22)

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– Continued from Page 20 –

There is an unwritten rule used when a group of motorcyclists take a trip. Though everyone should know the destination and planned route before the ride starts, each rider makes sure the rider behind them takes each turn. As a result, a slower rider or a broken-down bike will not result in someone missing a turn (especially one which deviates from the original plan).

If we do something similar at work, we make ourselves more irreplaceable. Make sure everyone involved knows the plan (including the boss!) and then, while the plan is being worked, keep everyone updated on both progress and changes. Communication “greases the wheels,” allowing nearly painless course corrections.

### Share What You Know

Ever met someone who seems convinced that secrets are the key to irreplaceability? Being the only one who knows how the system works creates job security, right? Well, no. Someone who will not share willingly and hoards information comes across as arrogant. Information hoarding tears down communication and collaboration (and prevents the hoarder from taking a day off).

The singer I heard earlier intentionally and openly helps other singers. I cannot speak to her motivation, but even if she somehow shared everything she knows about singing and performing, she would still be unique and irreplaceable. If we openly share our knowledge, we build trust, we build up future generations, we save ourselves time – we open opportunities to learn other things (we have more time, and people are more open to sharing with us), we are not “stuck” in our career – and we can take time off. Not a bad deal!

### Learn, Always

Perhaps the flip side of freely giving of our knowledge is constantly gaining new skills and information. How? Try new things (even if it means failing and trying again); read in our own field and in others; ask questions of experts; and spend time in thought. Intentionally seek knowledge in areas where you have little experience (Music or medicine? Astrophysics or anthropology? Linguistics or law?). Studying outside our expertise often generates new ideas for our expertise.

### Avoid Talking Down

Like hoarding information, acting superior in our knowledge is another killer of relationships, productivity, and irreplaceability. If someone acts superior when I need something, I will do my best to avoid them rather than openly collaborate or bring them new opportunities. Many times, I would rather guess than have someone tell me I am an idiot (with words, tone, or body language).

### Lose Your Biases

Consciously or not, we all have biases. Some are innocent, like a preference for blue(s), and some are destructive, such as discrimination. Further, we all have values. History is littered with stories of those who valued destructive biases, such as ideas about one race being inferior to another. My point is our need to constantly evaluate our values and biases, discarding those which do not serve the betterment of ourselves and humanity. I can smile at, say nice things to, rescue, befriend, collaborate with, and invite in someone who is different – even if they embody whatever I am biased against. When instead I am unkind or even cruel, I undermine my own joy and irreplaceability. Differences in people make life fascinating, and exposure to differences helps create my unique – and perhaps irreplaceable persona.

### Get a Life

What do you do when you are not at your job? Depending on your answer, you may need to get a life! Outside interests make us healthier, better rounded, and better conversationalists. Those other practices give our brain a break so it can surprise us with unique (irreplaceable?) ideas for other parts of our life – not to mention making life more fun!

### Artistry





Why do we enjoy watching sports, attending a concert or museum, or recommending a restaurant? I believe it is the artistry we experienced. Watching someone who is exceptional at what they do is a wonderful thing, whether we are rooting for them from the sidelines or playing along. As I shared in a previous article, expertise evolves from practice. There is, however, another layer, an extra something which moves us beyond even expertise. Odds are good there is exceptional artistry in how your favorite player, performer, chef, or boss perform their craft. What would it take for you to attain such a level of artistry in your world of radio.

### Irreplaceability

One final thought: Being irreplaceable grows from our uniqueness. You cannot aim toward irreplaceability trying to be someone else, or while failing to be your best self. But if you are willing to leverage the power of your uniqueness, your excellence in these and other areas may someday give someone goosebumps as they witness your irreplaceable performance.

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

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# State of the Station

## Planning Ahead

### Keeping Mice Out – Keeping the Station On

by Dave Dunsmoor

*There are many engineers out there on their own – perhaps as an owner/operator, or even someone new to the trade. Dave Dunsmoor shares some tips based on his personal experiences to help those without all the resources of the big shops. They are all meant to promote practical, but safe engineering. Get those jobs done, but get home safely!*

While summer is starting to turn to fall, generally the weather is still nice. The mice are playing in the fields, but soon are likely to get ready to find a place to live for the winter. Other critters will soon be doing the same. The practical engineer will plan now to keep them out of transmitter buildings, storage sheds, ATU doghouses, and even our houses and garages.

Of course, a building out in the middle of nowhere with old wooden doors and tall grass all around is just inviting mice. And mice must be among the worst nuisances with which a transmitter engineer must deal. They get into *everything*, they stop at (almost) nothing, they make a mess, they smell very bad, they eat wires, they are disease ridden. All in all, they are bad – bad for us, bad for equipment.

Therefore it follows that buildings and grounds that are not mice-friendly will have fewer problems with the little buggers.

#### Removing the Welcome Sign

What then is “not mice-friendly?” First of all, they do not like wide-open spaces; they prefer tall grass, short grass, stacked up junk next to buildings, and so on. They certainly do not like to cross 20 feet of open gravel covered ground to get to a building. They do not like to gnaw around a good quality steel door and steel siding to get inside. (They also do not like trying to gnaw through steel wool, or steel hardware cloth.)



Almost like having a sign saying “No Mice Wanted!”

It might seem like an unnecessary expense up front, but the explanation you present to management should be along the lines of increased equipment longevity, outage prevention, lower repair costs, and far lower exposure of disease to the engineering staff, etc. All these points should be immediately recognizable to any good General Manager as positives for the station’s business.

By the way, if good building construction helps to keep the smaller critters out, good, well-maintained fences will help to keep the cattle out. Do not forget to ensure the “bigger critters” are contained. Otherwise, they might make it easier for the smaller ones to gain access.

Finally, if you already have some “unwanted residents” at the transmitter building, you may wish to employ the tactic of a proper application of moth balls. This will go a long way to serving an “eviction notice” to the critters.

#### A Careful Approach to Tower Repairs

Whenever you are dealing with tower repairs, there is more than just the danger of the stick coming down, and even when you plan for some problems, others can easily “pop up” and give you a nasty surprise if you are not careful.



#### Well Maintained Fences Keep the Livestock Out

Several years ago I ran into a situation where the tower base was gradually tilting and, despite repeated warnings, the owner was not ready to drop the tower and install a new one. Neither could I get any tower crew interested in trying to re-align it. It was either “drop it,” or “forget it ... we’re not interested.”

The concrete tower base (sitting in about 3-4 feet of water, year round) was listing at about a ten degree angle; the tower itself was bent from vertical (at about the 60’ point) over to match the base at the ground. The base insulator looked like it was about to slip out of its socket; the feed point had pulled tight and was pulling out of the doghouse. Getting into the doghouse to take antenna current readings required hip waders. It was a mess.

The owner eventually found a couple of old steel workers who said they could brace it up and make it good as new. I wanted no part of this pulling-the-base-back business, and told the owner so.

#### Anticipating Problems

However, in case things went terribly wrong, while the steel workers were pulling with their cables and winches, or if the tower just dropped during the afternoon news, I persuaded the owner to install a power pole and went to work stringing up a dipole. This was a daytime one kilowatt station, so feeding this “hammered together” antenna seemed a feasible plan.



Dave Dunsmoor is shown rigging the dipole antenna.

We used some heavy wire and a center insulator, and strung it up on the pole with the help of the utility company’s cherry picker. Then we went to work to match it up to the transmitter. As I recall, this took most of the afternoon and well into the evening.

I set the power to about 200-300 Watts and ran it into a 160 meter amateur antenna tuner, and then to the dipole. After cutting and tying the ends, checking the VSWR, then cutting

some more and checking some more, little by little we got the dipole fairly well matched. To check, we drove down the road about 20 to 30 miles and found the signal was acceptable, so now it was time to let the guys work on the tower.

#### No Hurry ... Just Get Moving!

As we finished up, the summer thunderstorms were coming up from the southwest. At first they were still quite distant – the sky was darkening and only a little lightning poked out beneath the clouds on the horizon, so we felt there was no reason to worry. We just had to get the cable troughs covered up, tie the RG-8 carefully into place, hook the old coax back into the transmitter, and get the transmitter properly loaded and tuned. It seemed like a piece of cake.



An emergency antenna right on site.

Snap! “What was that?” Snap! (again) – I opened the cable trough cover and the RG-8 coax is snapping a good spark to ground every time lightning hits in the distance. As the storm drew closer, I started pulling the new coax out, rolled it up outside and grounded it.

The coax was just about all tied to the ground rod outside the building when the guy who was working with me said, “It’s time to go now!” Lightning had struck again in the (much closer now) distance, and this time sparks jumped the guy wire insulators on the tower behind us, as well as creating a large spark between the coax and ground rod on which I was working.

I have seen this particular phenomenon several times over the years, but usually during a dry wind (a snow or dust storm). The sparks that jump from the coax to ground usually are fairly low energy. But this time it was a substantial spark, and I suspect it could have done some severe damage to either me or my assistant. I (re)learned that an antenna does indeed carry energy both directions.

The moral: Remember to plan your work carefully; you will not do anyone any good if you are in the hospital (or the morgue). After all is said and done, it is just radio.

#### It Does Not Take Long

A final story will illustrate why you should plan *before* you start a job, and how quickly things can go wrong. Most engineers rarely will be directly involved in the joining of metals by the application of heat and filler material (welding/brazing type repairs or fabrication), but it is an occasional task I have seen accomplished in the back room of a well-equipped transmitter shop. Personally, I happen to like working with metal.

I was welding a small item held firmly in place by the metal bench vise. The shop was large enough and well lit, but had plenty of stuff to fill it up. The trouble was, I had not paid much attention to an object lying on the floor near the vise.

As I was nearing completion of the job, I heard a muffled “pop.” I stopped and looked around but, seeing nothing out of place, went back to my task. Shortly, there was a louder “POP,” and my hands, arms and the exposed parts of my face and neck began to burn slightly.

The object on the floor was a battery under charge, and the generated hydrogen gas ignited briefly, spewing battery acid all over the place. Fortunately, I was wearing goggles and that protected my eyes, but it could have been much worse.

So I repeat: think about what you are about to do, and how you are going to do it. Be safe, not sorry. – Radio Guide –



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## The End of an Era

by Steve Callahan

The say all good things must come to an end. It was over 20 years ago that I built WVBF (then WCEG), with just a 500 Watt construction permit in an open field, into a fun little local 5000 Watt radio station. Read on to see how this journey had some interesting twists and turns.

I had just sold my first owned and operated radio station in Florida and I was looking to come back to Massachusetts and do it all over again. I learned of an unbuilt construction permit for an AM station in Middleboro, Massachusetts that was in an area I was familiar with. Don Moore, who had owned the very successful WQRC in Hyannis, Massachusetts and then Channel 58 TV also on Cape Cod, had the permit but had to keep extending it because of his health issues and the loss of his original tower site.

This was back when the FCC had just started to get "tough" on serial CP extenders – folks who "sat" on construction permits without building out the facility on a timely basis. Don legitimately had one issue after another get in the way while trying to get the AM CP started, so I struck a deal with him to acquire the construction permit and immediately begin to assemble the parts needed to build the station.

Did you think it was going to be that easy? I sure thought it was, but the FCC had another thought. After applying for a transfer of the permit, John McVeigh, my most capable FCC attorney got a terse letter from Larry Eads at the FCC saying that, because of Don's repeated extensions, the WCEG construction permit would not be transferred, but instead it was being cancelled.

To say that John and I were shocked by the FCC's unexpected action would be a gross understatement. We picked ourselves up, brushed ourselves off, and started to file Petitions for Reconsideration, stating that I shouldn't be penalized for the actions of the former permit holder and that I had the knowledge, experience and resources to immediately build the radio station.

Weeks stretched into months and finally we got word from the FCC that our Petition for Reconsideration was denied. Next, we filed a petition for my case to be heard by the full panel of FCC Commissioners in Washington. We now drew upon John's idea to state that the FCC's draconian action to cancel the permit would do just the opposite of what the FCC actually wanted. Simply, the FCC wanted radio construction permit holders to build their stations and begin broadcasting to their city of license as a "first local aural service." We showed that

Middleboro, Mass. had no chance for another opportunity to get an AM or FM signal and especially since the FCC had recently discontinued granting daytime construction permits which WCEG was. We said that WCEG was a "Purple Cow" and that by cancelling the permit, the FCC was forever denying the good people of Middleboro, Massachusetts their local radio voice.

Again, weeks dragged into months and John suggested that we visit the FCC Commissioners one by one and try to state our case and put a face to our case. This would not be an ex parte issue because it was not contested by another applicant. John was a former FCC employee and with his bright red hair, he was well recognized as we trod the corridors of the FCC at their former digs on M Street. One by one the commissioners politely listened to our argument and shook my hand. One commissioner, who has now been gone from the FCC for many years, showed more interest in our predicament than the others, so turning to his legal aide he said, "How can we help this young fellow?" At that point, I knew we were on the right path.

A few months later, I was at the NAB Radio Show in Atlanta and saw that one of the FCC branch chiefs was speaking at a session. This fellow had eluded every attempt that my attorney had made to try to visit him and get a little face time to explain our position. I thought that this would be a perfect opportunity, so I waited for him outside the session room. When he came by me, I politely introduced myself and asked if we could speak for five minutes so I could explain my dilemma. Instead of taking the time to chat, he immediately turned away and ran down the hallway with me in close pursuit

(Continued on Page 28)

## It's Time to Get Into the Mix



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World Radio History



### The End of an Era

– Continued from Page 30 –

yelling, "Stop, I only wanted to talk to you!" I never did catch him because he had a pretty good head start on me.

Again, more months of waiting spent wondering whether we would get the approval of the five FCC Commissioners or would I have to appeal their refusal to the First District Court of Appeals in Washington DC. We finally got that phone call. I held my breath as John told me the results of the vote. It was 3 for and 2 against. I had won! I like to think that the one kindly FCC commissioner was the swing vote that I needed.

Things started moving faster now, as the fellow I had chased down the hotel corridor in Atlanta now had to send me the results of the vote and the much coveted construction permit. I immediately started to build a radio station.

If you've never built a radio station from the ground up, it's like juggling cats. You have to be a public relations expert to get the community excited for the new station. I joined the local Rotary Club and got to know all of the local business owners. You also have to know how to deal with local town boards and committees that will grant you the important local permits. Fortunately, years before at a friend's cook out, I met the fellow who was in charge of granting RF exposure permits for the Massachusetts Department of Health. Before a Planning Board hearing, I learned that the local newspaper was going to put someone up to make the claim that the new

radio station would radiate people in the neighborhood around the tower and should be denied a building permit. I jumped on the phone to that fellow from the cookout and got a certification of "No Hazard" faxed to me before the meeting. When the bogus claim came up in the hearing, I simply passed the No Hazard certification to the board chair ... and walked out with the building permit for the tower.

The years passed and WCEG grew into WVBF after two power increases and a change in tower site. I sold WVBF in August of this year. The time was right. I could have sold it many times to folks from elsewhere, but our local state senator wanted to keep it live and local so he bought it. I'll still be visiting the transmitter to make sure all is well, but he's got the opportunity to take it to the next level and I wish him, the station and its listeners all the best for a great ride over all these years.

I got a nice response from long-time friend Criss Onan after my mention of the Connecticut Antique Radio Museum:

*"Feel free to add the Antique Wireless Museum near Rochester, NY to your bucket list."*

*"The AWA expands and deepens historical study from Morse's first journals to the serial number 1 cellphone."*

*"The museum holds many pieces that were donated to it by developers even though the corporations that they worked for had a policy to destroy them. For instance, the AWA has a very early prototype transistor radio from Bell Labs."*

*"Additionally, the museum holds many valuable collections, such as those from the Radio Club of*

*America; from Major Armstrong's associate Harry Houck; RCA original tube documentation and from WOR-AM, WOR-FM and WOR-TV director of engineering as well as VOA director Jack Poppele. (Last year, Poppele's daughters donated serial number 1 of DuMont's first mechanical TV receiver to the AWA.)*

*"While being a member of the AWA for a number of years, I finally had the time to volunteer when I retired a couple of years ago. It's about a half hour from my house."*



*"The Antique Wireless Association Museum is located at 6925 Route 5 in Bloomfield, NY just west of the Route 444 intersection. They're open Tuesdays 10 to 3 and Saturday 1 to 5."*

*"Tell them that Criss Onan sent you!" – Chris*

If there's an antique radio museum near you, send along the info and I'll mention it in a future story in Radio Guide.

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

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## A Convenient Economy

by Jim Turville

As I have opined in previous writings, things have certainly changed in the world we know as radio broadcasting. My wife has even been referring to me as "The Nostalgic Engineer" lately—really, it's not *that* bad, I hope. But from the technical perspective, things could not be more different than 40+ years ago when I began this trek, and just a couple decades prior to that were even more removed from what some of us knew as radio when we started. And in spite of my continual reference to "the way it used to be," I'm pretty sure that I'd not trade what we have now as radio, for those previous ways—with my current mileage level, I'm leaning to trying to work smarter and not harder more every day.

I recently built another small studio for a client, and realized that I should share my process and it might be helpful to someone in a similar situation. I've made reference to this before, but the details of what I've been doing for myself and my other small market clients should be told for any possible benefit to others.

Like my own small stations, this client is the only signal in their county—this one a full time AM (one of the "graveyard" channels) and a co-located 50 kW FM. In the five years or so since I built the FM for them, the AM has already fallen into the "step-child" category, and is no longer the breadwinner for the owners. So when I helped them get a translator for the AM last year, we decided to re-launch the AM with it's new FM signal, and re-brand it with a new format.

Having quite limited resources, we needed to build a fully working studio for at least some portion of live broadcasting, but the balance would be automated with new computers and software. We also needed the room to function as a production facility when not in use for live broadcasting on the AM. It was decided to purchase the Arrakis ARC-8 console, as it had the operating features needed for both functions, howbeit not at the same time, as it only has one programming buss for audio. Therein was the creative solution which is the subject of this writing.

We began with the balance of the 1949 original studio getting gutted down to the concrete floor, and everything was replaced for the new operation. There was a nice 3-inch wide and 1 inch deep trench in the concrete, which got a run of MC electrical cable, three runs of shielded CAT cable, and six runs of stereo shielded audio lines from the center of the floor to the equipment rack in the back wall. The trench was covered with .032 steel flashing and new carpeting glued over it all. The electrical line let us have a dedicated circuit to that counter top, the CAT lines became the LAN connection for the two computers and the VoIP phone, and the stereo cables were sufficient for the needed I/O to the console. The counter was a re-purposed (howbeit very nice) executive office desk with drawers on both sides and a beautifully finished top. It set right over the top of the cable exit in the floor and all the lines came up into the right side of the desk, unseen from the side

or front. The right drawers were removed and two computers, plug strips, a small exhaust fan, etc. placed inside; the left drawers are fully functional for studio needs.

The ARC-8 console has both balanced and unbalanced audio inputs for the line sources, and both a balanced and unbalanced Program output. I have built nearly a dozen radio studios using factory remanufactured Dell business class desktop computers, and this was no exception. Again, for the economy of scale, we used the integrated audio in the computers, for both on-air and production needs. And the ARC-8 console accommodates these with no problems, having the unbalanced inputs and output available. The production computer was plug-and play—the line-out into one of the unbalanced console channels, and the unbalanced console Program output to the line-in on the computer. Everyone at the party is happy and play together in the unbalanced -10 dB environment. The on-air computer will connect to an unbalanced Console input in the same manner, but I used a different setup, however.

I have found a very affordable and extremely functional "match box" in the ART Clean-Box Pro units (Figure 1) which retail for about \$70. These have very good amplifiers which are extremely quiet, and the "Pro" version has an added advantage of having 1/8" TRS jacks which parallel the unbalanced RCA plugs on the unit. This is important because I can take standard pre-made cables for this installation, which can also be replaced as needed without soldering or other skills that may not be present in case of a failure. Using the off-the-shelf 1/8" TRS Male-to-Male cables, I connect the line-out of the computer to the TRS unbalanced line-in on the Clean-Box Pro.

Since this input parallels the RCA input on the box, I can use the off-the-shelf RCA Male-to-Male cable of the needed length from the Clean-Box Pro to the unbalanced RCA input of my choice on the ARC-8 console. In absence of a match box

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with this dual configuration, a set of “Y” cables can be used in the same manner. The console is happy, match box is happy, everyone plays in the same unbalanced environment – just pot up the computer on the console and you’re playing radio.

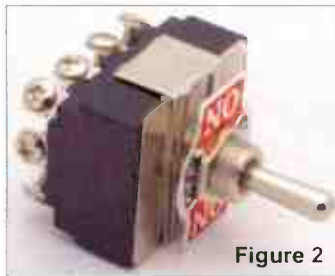


Figure 2

sition, as long as the computer is potted up to normal levels on the console. See the drawing in **Figure 3** for how all of this looks on paper.

In this studio, we also chose to have the Internet streaming software on the on-air computer, since it integrates seamlessly into the On-Air software for TTA data and listener counting. However, we needed the audio to it to be reflective of the position of the “Air Switch” as well, so “live” studio programming also would stream normally.

To accomplish this, I tapped the Processor line from the Common contacts on the 4PDP switch, and fed it to a set of XLR Male cables that went back into the Clean-Box Pro. This let me plug the Unbalanced output of the Clean-Box back to the line input on the on-air computer. So no matter the position of the “Air Switch,” what is going on the air is what comes back to the streaming software, and any production being done in the studio will not incidentally get on the air or onto the Internet stream.

XLR High Level Outputs on the Clean-Box Pro. By setting some levels properly, the audio feed going to the Processor in the rack will be the same with the switch in either po-

Is using unbalanced onboard computer audio optimal? Not always – but, depending on your specific situation it can certainly be usable, and with some affordable creative additions you may find flexibility will not cost as much as you might think.

Jim “Turbo” Turville is semi-retired from 40 years in full-time Radio Engineering and lives in Rural Wheeler County Texas in a “tiny house” where he maintains a small clientele of stations under his Turbo Technical Services ([www.jimturbo.net](http://www.jimturbo.net)) operation providing FCC application preparation and field work.



Figure 1  
ART Clean-Box Pro

However, we were still left with the need for production in this studio – and therein is the use of the matchbox. Finding a nice, heavy-duty 4-Pole Double Throw toggle switch, I used it for an “Air Select” switch. See **Figure 2**. The center set of contacts are the “common” and the 4 poles go to the Left & Right “+” and “-” wires running under the floor to the rack for the input to the broadcast processing. The two sets of contacts for the alternate positions of the toggle switch then are wired to XLR Female plugs, with all three sets of “shield” connections tied together at the switch. One set of the XLR Female plugs connect to the main XLR Program Outputs on the ARC-8 console. The other set of XLR Female plugs connect to the

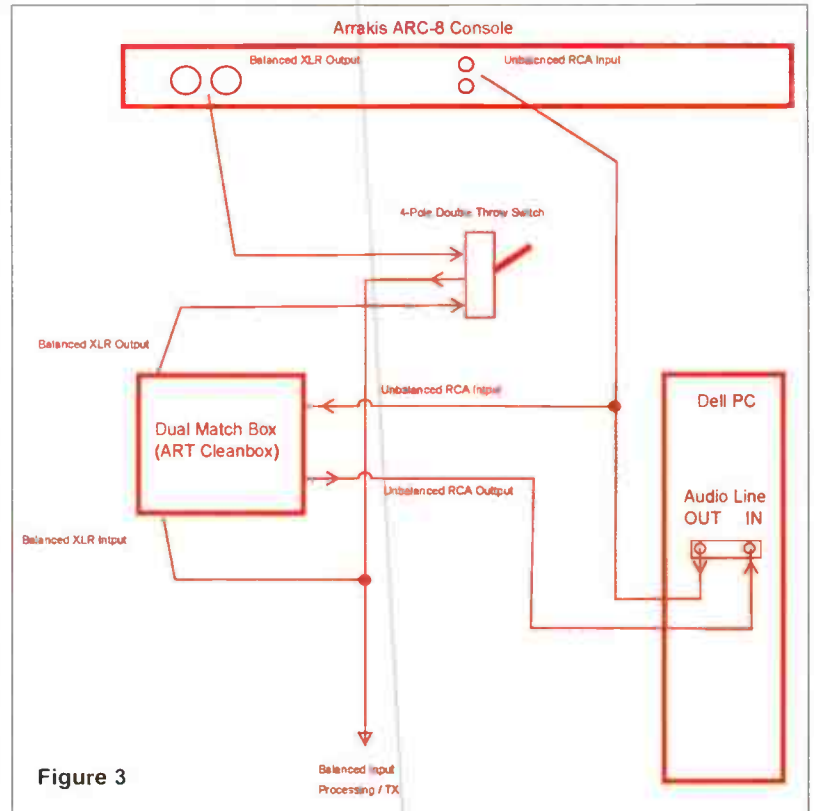


Figure 3

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World Radio History



# Shop Talk

by Steve Tuzeneu, CBT



## Miscellaneous Tips and Thoughts

One of the nice things about writing a column is hearing from readers. A few issues ago, I talked about the challenge of finding a good receiver to use with your EAS unit, and I got some thoughts from engineers who read *Radio Guide*. If you have any hot tips or thoughts about this, or a previous article, or even something unrelated to a topic in this column, feel free to contact me at the email address at the end of this article. You could be helping others by contacting me

Be aware that I reserve the right to quote you in whole or in part, as part of my column.

Michael G. McCarthy, CSRE, CEA, Director of Engineering for Newsweb Radio Company in Chicago, writes about his experience:

Steve:

*Was just browsing the May/June Radio Guide. When we needed to use hyper selective receivers to receive a LP2 signal 40 kHz removed from our co-located AM 8 years ago, I was able to secure a location a couple blocks away and employ Innovonics INOmni AM receivers. Sure, they were \$600/ea. But no splash or BFO compression from the TX up the street.*

*It also helped we used a Belar loop RX antenna with the null aimed at the undesired signal as well.*

*The INOmni's have a plethora of features and front panel displays and rear panel closures as well as balanced +4 dBm output.*

*Best regards, Michael G. McCarthy*

Jim Gorman of Gorman-Redlich Manufacturing writes:  
Steve:

*Saw your article in Radio Guide on tuners for EAS. I got the same results with the testing of RF Engineers equipment and I am keeping the WATCHDOG in stock. When Dayton Industrial went out of business I bought all their finished stock and am down to a few rack mounted AM/FM/WR units which we ship with the interconnect audio cables and tuned to the frequencies that the state plan calls for.*

*I think that RF Engineers equipment is every bit as good as the Dayton Industrial tuners.*

– Jim Gorman

Scott Todd, field engineer for the KLOVE radio network believes there is a more cost effective way of sending audio to your EAS unit:

Steve,

*I wouldn't bother racking up three Watchdog units. For the same amount of money for 3 Watchdogs, you can have a Crown RFBA-1 instead, plus it has professional level outputs on the back and tuner #1 can be used as a translator receiver with composite output in a pinch. Receiver #3 can be set to receive two NOAA stations simultaneously for areas that straddle NWS territories.*

– Scott Todd

As you can see, there are a few ways to send audio to your favorite EAS box; what works for you is the best way to go.

By the time you read this, you should have updated your EAS firmware.

### Modern-Day Transmitters

When I had my first experience with modern, solid state transmitters, I thought, "Wow, you can log in and check all kinds of parameters, and the thing will just run." Yes, that's true, but I also learned that modern, IP-based transmitters are like computers – you will eventually need to update the firmware. The controller inside your transmitter is essentially a built-in computer.

We had a couple of transmitters in our group do some strange things, and the fix involved downloading and installing a newer version of firmware, so beware.

Downloading a newer version of firmware isn't a big deal if you have Internet access at your site and a good, fast connection. If you don't have Internet access, or it's slow, like you might find using an "Air Card," you may need to download the update elsewhere and bring it with you on a thumb drive or on your laptop.

Even if you have fantastic Internet at your site, at least one of the manufacturers says you shouldn't, or can't, download the firmware update directly into your transmitter. Technically, the update goes into the controller located inside your transmitter.

A firmware update can take anywhere from 15 to 30 minutes, and then the transmitter needs to be restarted so the controller can load the firmware and relearn what modules are connected to the internal network.

The update also means your transmitter will be off the air while the transmitter loads the software during the restart process; it could take several minutes, so plan accordingly.

Most manufactures recommend that you put your controller on a UPS, so if the power goes off, your transmitter will

(Continued on Page 36)

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## Miscellaneous Tips and Thoughts

– Continued from Page 34 –

come back on the air faster. If you have a backup generator, your transmitter will drop off for as long as it takes for the transfer switch to restore power.

### Reserved Power Secret

When you purchase a new transmitter and ask them to build a 10 kilowatt box for you, the unit is actually capable of much more than the quoted capacity. A few companies build their transmitters with 25 percent reserve or more – your license only gives you what you paid for. Then, if you need more power for HD, they receive your payment and you get the extra power.

I'm told you can get that extra power for free, on a temporary basis, if one or more RF modules fails. Then the controller powers up the extra so that you can be at full power. Once the failed modules are replaced, the controller ramps back the power to what you initially signed up for. Nice to know you have back up when you need it, but don't take my word for it. Ask your sales representative to go over this in detail before your new transmitter is built.

### Bird Meters

I once asked engineers on a forum how often they sent their watt meter in for calibration. It was interesting to read the responses I got.

I'm not quoting anyone here, but the answers ranged from every five years, to someone else who said they have never sent their meter in.

Bird recommends you send yours in once a year, but I think once every five years should keep things legal and accurate. Some of us don't have the budget, or the time, for an annual calibration.



Bird Power Meter

How often do you send your Bird meter in for calibration? And what thoughts go through your mind when the transmitter RF output meter and your Bird meter disagree?

I have heard it said that you can trust your transmitter's RF output meter and the reflected meter, especially when it's a new install. I would like to know your thoughts on that.

### Computers

Back when we were using Windows 95 to run our on air computers, we had to restart the server and affiliated work station(s) once a week. That was due to a system resource leak in the operating system (software). I would have thought that in the 24 years that have passed since that operating system came out, resource leaks would have been a problem of the past.

I have recently learned that Windows 7 has a memory leak and needs to be restarted on a regular basis, especially if it is a mission-critical computer running twenty-four hours a day, seven days a week.

One of the engineers on the forum I read suggested using a freeware program called "TOFF." This program will reboot your computer at a time that is convenient.

TOFF is available at: <https://dennisbabkin.com/toff/>

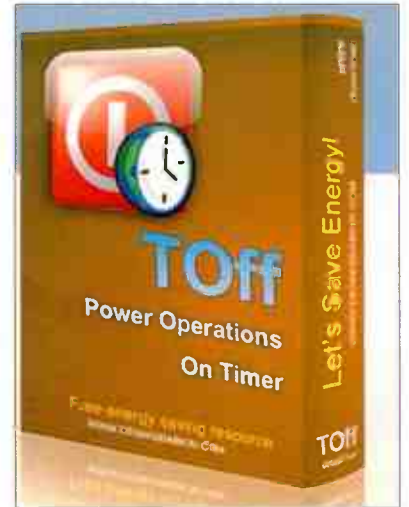
The website says it works on Windows XP/Vista/7/8/10 and Server.

The description from the website sums it up: "This utility will be handy for people who would like to leave their computers unattended for some time before automatically turning them off (logging off users, rebooting, hibernating or putting them into sleep mode). TOFF can perform these tasks at a certain day and time (one time or every day), as well as after a certain period of mouse & keyboard, CPU or network inactivity, with the seconds precision. TOFF is unequivocally your ticket to save energy."

Naturally you don't want to reboot your on-air computer using the above software, but for a production computer, it would solve some problems with a resource leak. Finding the time for a scheduled reboot during the day could be a problem, but with TOFF, that could be done automatically during off hours.

So there's this month's thoughts. I hope you have learned something. What's your interesting and educational story? If you have some information that will help a fellow engineer, please let me hear from you today. My email is [stuzeneu@sbe.org](mailto:stuzeneu@sbe.org).

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





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World Radio History



## The Untold Story of Edwin Armstrong Inventor of Frequency Modulation

by Roger Paskvan

This story is motivated by the last issue of *Radio Guide*, an excellent article by Steve Callahan; "The *Unsung Heroes of Frequency Modulation*." (July-August issue, p16.) I thought some of our readers would be interested in the battle for FM and how outright down and dirty the process really became.

Edwin Armstrong was a brilliant electrical engineer of his time. He invented and patented the regenerative circuit before he even finished college. This circuit enabled the output to be fed back into the input many times through a process called regeneration, making radio reception possible in the early part of the century in 1916. This sole invention set the stage for a series of lawsuits that plagued Armstrong throughout his life and eventually took this great man down.

A second player in this drama is a clergyman's son, Lee Deforest. Deforest was an inventor but spent a good deal of his time stealing inventions, finding ways to attach his name to them. Such was this regeneration lawsuit that went on for 12 years, one of the longest law suits in history. Deforest won in the end on a technicality, even though he could not even explain to the judge how the circuit worked.

Armstrong was hired by RCA, one of the most powerful corporations in America at that time, run by a Russian immigrant, David Sarnoff. Sarnoff and Armstrong were friends and RCA provided a nice laboratory on the top floor of the RCA building for Armstrong to work. Sarnoff,

president of RCA, wanted Armstrong to find a way to eliminate static from AM radio, since RCA was in the radio manufacturing business. Armstrong eventually concluded that AM modulation had the same format as static and it would not be possible to accomplish this task while still recovering receive audio. To solve the problem, Armstrong came up with a whole new form of modulation which he called frequency modulation. FM was immune to static and provided quality, high fidelity sound compared to AM radio. Sarnoff was not interested in this new discovery and saw it as a threat to his AM radio empire, RCA.

Armstrong was fired and moved to his own laboratory to continue his research. He patented his new FM invention and began constructing FM radio stations along the east coast. With the help of DoLittle, Armstrong developed the Yankee network of FM radio stations. Armstrong also manufactured FM radios through a company called Philco but had a patent problem competing with the RCA empire, who controlled the parts. Sarnoff and Armstrong now became enemies. RCA was secretly inventing Television and was utilizing FM for the TV sound but refused to pay royalties to Armstrong's patents. This became another law suit against RCA for patent infringement that would go on and on for years. These lawsuits placed an enormous financial drain on Edwin Armstrong. He was fighting the biggest corporation in America, single handed. RCA did its

best to downplay FM even to the point of telling the public that they would get sick if they listened to FM radio. The advertising campaign was relentless and did a lot to stunt the growth of this new FM technology. FM remained a suppressed medium until the mid-1960.

RCA under Sarnoff's direction pulled, in my opinion, one of the dirtiest legal stunts to finally crush Armstrong's FM advances. Sarnoff knew FM was a superior delivery mode and resorted to unethical practices to suppress FM development. RCA with its political power and financial influence was able to convince the newly formed FCC to change the frequency of the current FM dial. (42-50 MHz) Sarnoff petitioned the FCC to move the entire FM spectrum up to 88-108 MHz Under RCA's political influence, the FCC approved the changing of the FM dial to frequencies that were not easily obtainable with the technology of the time. Going from 42 to 100 MHz in 1935 was like building a transmitter circuit for 100 GHz today. It would be a challenge, to say the least. This fatal legal move made all of Armstrong's Yankee network FM radio stations worthless, overnight. He was broken, bankrupt and depressed. Everything he had built, his life's work, was shut down by an FCC report and order. RCA had won!

The pressure of his failure became so great that Armstrong committed suicide in 1962. He saw his life's work destroyed by an evil empire controlled by RCA. Edwin Armstrong died broke, with most of his moneys paid to legal fees. He was a brilliant mind who never saw how wonderful his invention, Frequency Modulation would become. His widow eventually won all his lawsuits. Today, we rely on FM as our radio source and the suppressed modulation has now become AM.

Ref: "Empire of the Air." Ken Burns. www.PBS.org (film)

Roger Paskvan is a Professor of Mass Communications at Bemidji State University, Bemidji, MN. You may contact him at: [rpaskvan@hemidjistate.edu](mailto:rpaskvan@hemidjistate.edu)



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## The Switch Crisis

by John L. Marcon, CBRE CBTE 8VSB Specialist

Five months have passed since we switched over to the new RF channel as part of the FCC frequency reallocation, also known as the Repack. This project included a new transmitter, new main and spare antenna and also two new 6-1/8 inch RF switches. The first switch is for switching between the antenna and dummy load, while the second one is for switching between the main and spare antenna. The spare antenna and its 6-inch Heliac cable were used during the interim period and were connected directly to the old transmitter. However, after the switchover, the spare antenna Heliac end was left dangling from the wall instead of being connected to the antenna RF switch. The contractor already moved on to another Repack project and we did not know if they would come back to fix this. About 30 inches of rigid line was needed to connect the Heliac to the RF switch. The rigid line needed must be cut precisely so that it will make excellent mechanical contact and also be strong enough to be tightened with eight 3/8" nuts and bolts. This section can be easily manufactured at the factory – the logical next step was to order the section from them.

On the other hand, we could also do this ourselves because we have plenty of 6-inch rigid lines, about a hundred feet of 20 ft sections just lying around. Not only that, we also have inners, elbows, flanges, and nuts and bolts. It is prudent to use these items. Also, if we tried to fabricate the section ourselves, it doesn't matter if we make an error the first time because we have plenty of materials to practice on.

If we make a short section, it will be from a 20-foot-long rigid line which has flanges on both sides. Once it is cut to the desired length, one end has a flange while the other end is without one – another flange needs to be welded on that end. There are at least three ways to attach a flange to the copper pipe: soft solder, hard solder and mechanical clamp.



Figure 1 – Three ways of attaching a flange to a pipe.

### Off Air!

While we were thinking about all of these, we were also working on the transmitter building to clean up all the stuff that was hanging on the ceiling. Unfortunately, when I was moving the ladder, it hit the bottom indicator disk of the antenna RF switch and momentarily dislodged the contacts. This shut down the 33 kW transmitter (the switch has an interlock that connects to the transmitter control system). I tried to manually turn it and it did return to the latched position but the transmitter reflected power went up from 52 Watts to 400 Watts. I tried to use the motor switch controller but the SWR problem remained. I also tried to manually adjust the

switch using the mechanical bypass but the result was the same. I called up the consultant and he said that some of the finger stock on the arm maybe damaged due to the bump that happened. This potentially can make the other finger contacts carry more current, heat up and completely damage the switch finger contacts. Dielectric also said that if the reflected did not change even after precise positioning, then there could be a problem with the RF switch.

The suggestion was to bypass the RF switch. At that moment we decided to let the transmitter run but at a bit lower power. Thankfully, the reflected power did not go up as time went on.

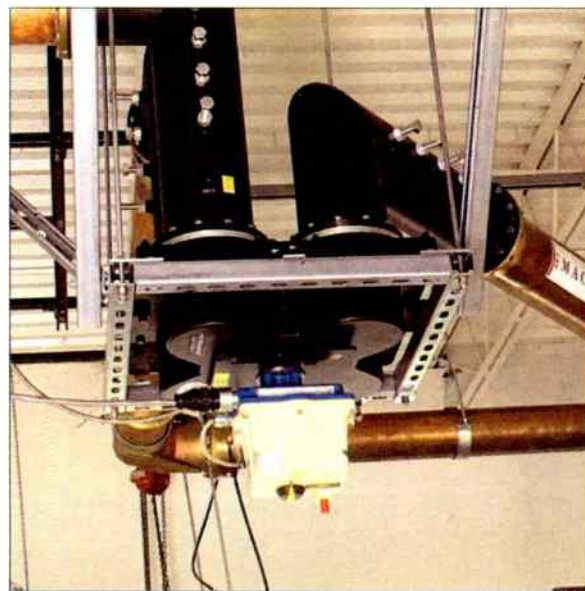


Figure 2. The Dielectric motorized 6-inch diameter RF switch. The motor is the white box at the bottom. Below it is the indicator (black disk with a yellow line). This was bumped with a ladder.

At any rate, I figured we only needed one elbow for the bypass. However, what we had were 75 Ohm 6-inch rigid lines and *not* 50 Ohms. The 50 Ohm elbow has the same outside diameter but have a bigger inner conductor. I thought this was the end of it and that we would just have to order parts and wait for a tower crew to come and install them. I called the consultant again and he suggested that we use the existing output port elbow of the RF switch. I thought it could not be done because the length of the other elbow arm will not reach the other end of the transmission line.



Figure 3. The damaged motor assembly and direction indicator. This whole assembly was replaced by the manufacturer.

I called the consultant again and he suggested that we use the existing output port elbow of the RF switch. I thought it could not be done because the length of the other elbow arm will not reach the other end of the transmission line.

Then Ronnie, our other engineer, figured out that we could still use the RF switch elbow and just make a short section to bridge the gap between the elbow and the end of the main antenna transmission line. It dawned on me that this bypassing was still possible. I thought about it a little more, did some more measurements, and figured out how we could remove the elbows from the switch ports and then finally decided to go for it.

We only had one tall ladder to reach the switch and it would be difficult for one person to be working alone up there in this kind of work. Fortunately, one of the subcontractors currently working for us still had his electric scissor lift on site and it could reach the switch and transmission lines. This was just what we needed.

### The Switch Was Bypassed

To bypass the damaged switch, the elbow connected to the input port of the switch (this was the elbow connected to the line from the first switch) must be loosened, turned and directed towards the line going to the antenna.

We removed all the 3/8" nuts and bolts that attached the elbow to the antenna switch input port. Once the bolts were removed and the elbow loosened, we then loosened the other end (which was also an elbow) of the long rigid line that was attached to the other RF switch, and lifted up the whole rigid line with the elbows by about a half inch, so that the inner of the input elbow could be freed from the damaged switch.

We used 2-inch ratchet straps to pull up both ends of the line. We then removed the other elbow on the output port of the damaged switch. A short section that connected this elbow and the main transmission line was also removed. After this, we turned the input elbow 90 degrees to face the main transmission line. The gap between the input elbow and the main transmission line was about 35 inches.

The next task was to make a precise measurement of the gap. To do this, I used four threaded rods to connect the elbow flange and the flange of the main transmission line. This way all will be tight, straight, and square – I used metric for an easier read. I removed the threaded rods after the measurement.

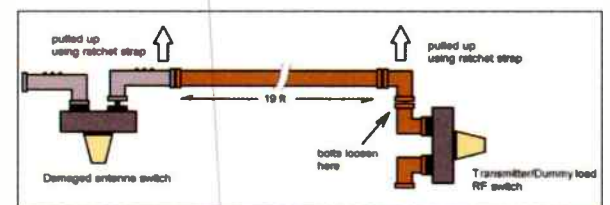


Figure 4. Removing the elbows from the switch.

The cutting of the 6-inch line was the next critical phase. We did not have a deep cut band saw or any specialized cutting tool. The only thing we had was an angle grinder and a manual hack saw. I searched the Internet to know how to precisely cut a six-inch pipe. The grinder, a piece of paper and a hose clamp was apparently all that was needed. I was able to cut the six-inch copper pipe with a little less than 1 mm difference along the circumference.

As I previously mentioned, there are three ways to attach the flange to the rigid line and at this point our only option was to do it with soldered flange. Fortunately, we had two six-inch flanges that were solder type. We cut a pipe to the required length, cleaned the pipe end, applied some flux, then soldered the flange to

(Continued on Page 42)



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## Transmitter Site

– Continued from Page 40 –

the pipe using an acetylene torch. I also cut the pipe for the inner conductor. We installed the section and it fitted nicely into the gap. The reflected power went down from 400 to 65 Watts. (Using a newly calibrated power meter, I measured 18 Watts reflected power from the output of the first switch. That was a lot better.) It was a long night. We started 7:00 p.m. and ended at about 3:00 a.m.

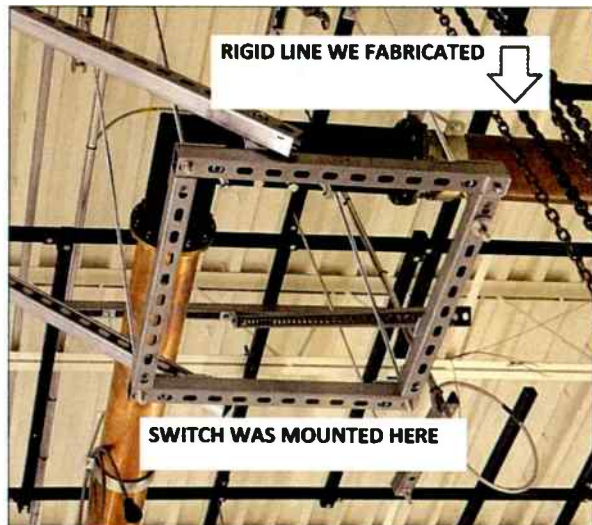


Figure 5. The bypass was done by turning the black colored elbow 90 degrees and connected it to the section we fabricated. The switch was then removed from the mounting.

The 200-pound RF switch was shipped to Dielectric for repair, using a special wooden crate they sent us. It was shipped as freight, because of the weight and volume, and was picked up from the transmitter site. The shipment and the freight insurance were expensive since the cost of a new switch is about \$23,000.



Figure 6. The RF switch was brought down to the floor.

After the switch was repaired, we reinstalled it, and like what happened before, it was another overnight job. The final reflected power is 14.85 Watts which is a pretty good figure. There was a sigh of relief after we installed the repaired switch.



Figure 7. The section as installed between the RF switch and spare antenna coax.

Since we already know how to solder a 6-inch flange, we thought of doing the other section needed for the spare antenna. However, to our surprise, the contractor called, saying that he will install the section for the spare antenna. He came with only a flange and we helped him

fabricate the section using a pipe from our stock. The flange was soldered to the pipe and the section was a perfect fit.

To prevent the same damage, we thought of having a cover for the RF switch. Unfortunately, the manufacturer does not have anything like that, but they would probably consider that in future editions of the product. I know that other switches have their indicator inside the switch housing and that indicator can be seen through a hole covered with glass. This is a better design than having the indicator outside the switch housing and that indicator can be seen through a hole covered with glass. This is a better design than having the indicator outside the switch housing and that indicator can be seen through a hole covered with glass.



At any rate, we fabricated a plexiglass box to “cover” the switch. With this protection, we expect the switch to withstand any bump and be in service for a long time.

Figure 8. The repaired RF switch with plexiglass guard. Also shown are the connections to the main and spare transmission line.

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

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... edited by Barry Mishkind - the Eclectic Engineer

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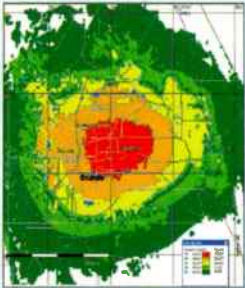


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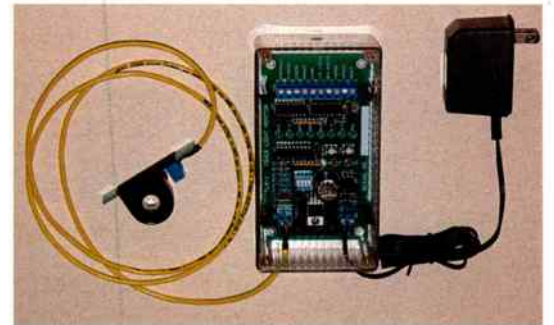
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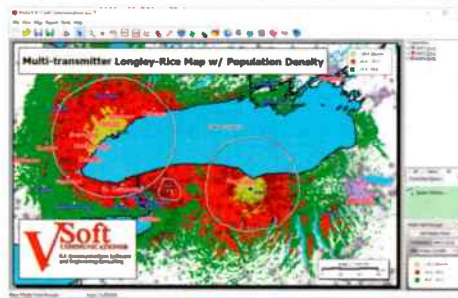
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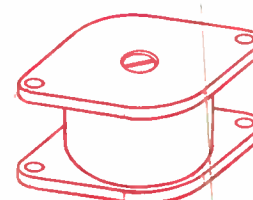


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# BROADCASTING Then, Now & Beyond

by Ron Erickson

Is there a surviving industry in America that has endured as many changes as broadcasting has? Probably, but at this moment I cannot think of any other technical business that keeps reinventing itself like ours has. American know-how has led the way with many marvelous technical achievements that allowed broadcasting to come to fruition in the first place.

The business of electronics, and the creation of the broadcast industry, has inspired more than one generation of kids who grew up to become radio & TV engineers, HAM radio operators and a new group of hobby broadcasters playing around with 100 milliwatt, FCC approved, Part 15 transmitters. I do wonder what will inspire kids to become the next generation of broadcast engineers.



Flashing back to what radio was in those early days, radio receivers quickly became a "must have" for most homes. With music, comedy, news and sports, all on the dial on various stations, listeners soon needed a published "Radio Guide."



No relation to the publication you're currently reading, but that original *Radio Guide* listed programs with times and other information, much like the later published TV Guide. Speaking of TV, radio had to reinvent itself when television became the new source for news, sports & entertainment in the home. AM radio stations started music formats: Country, Rock 'n Roll, Easy

Listening and Religious. A format called "Talk" was uncommon. FM stations generally played Classical or Jazz.

AM radio spawned a new hobby for night owls, DX'ing. It was the fine art of turning the dial slowly and straining to hear distant radio stations identify themselves. DX'ers would then write to those stations and request a reception report card or letter. "Border Blaster" stations from Mexico transmitted with large amounts of power and directed it northward, claiming an audience in the USA. One such station was XERB 1090 kHz, at one time, home to the famous Wolfman Jack. If you've never seen or heard him you should find a copy of the movie *American Graffiti*, as he is the DJ heard throughout the film.

I hope you will indulge me as I relate to you a personal story. Many years ago, cable TV companies encouraged customers to connect their home stereo FM receivers to the cable as well. Most cable companies received distant FM stations along with the TV signals. Back then, I happened to be underemployed at a radio station, and then laid off. I contacted the local cable company and asked if they would allow a new, local cable-only radio station to operate on their system.



They agreed and said I had to buy a cable FM modulator. They mentioned a company called CATEL. Contacting the company in California, the price of the unit was \$700, a small fortune at the time for an unemployed DJ. I asked them to ship one C.O.D and they agreed.



After creating and printing the worlds cheapest advertising rate card, I hit the streets pre-selling advertising on this new cable FM station. By the time the modulator arrived, I had enough cash to pay for it. The phone company installed one 15 kHz equalized phone line from my studio to the cable TV company and, just like that, our new station was cablecasting! Except for broadcasting in mono, listeners could not tell the difference between my "originating from a spare room in my house" radio station and the 100 kW signals being retransmitted on the cable system. I went out each day and sold spots while my wife changed the reel-to-reel tapes. We operated that small cable station for several years, during which time our oldest daughter was in grade school. She had a sleep-over at a friends house and was given a tour of their home.

Growing up with a radio station in her home led her to ask her friend, "But where's your radio station?" She honestly thought everyone had one. Our youngest daughter learned quickly that the silence sensor buzzer I placed in the kitchen would cause her Mom to race out to the makeshift studio and change the reels on my home-made automation system. After being bumped into more than once, the next time the buzzer went off she said in a loud voice, "Oh-oh, badio station offa air mommy!" and with that she dove under the breakfast bar for protection.

At the time, I wondered if the future of broadcasting would include more cable operations like mine and fewer licensed ones? As it turned out, I had the right idea but the wrong mode of transmission. After all, we had a very "modern" Commodore 64 computer at the time, along with a dot matrix printer. Who could have envisioned what the Internet, or computers with enough digital storage to keep thousands of songs on a hard drive, would become.

Of course that brings us to today. Traditional terrestrial AM and FM stations are now streaming on the world wide web. The choices for listening are no longer just your local stations, but you can choose from thousands of stations from all over the world—each one as close as your computer or cell phone. Google the web for radio stations on-line and be prepared to be completely overwhelmed with station and format choices. Sites like: Internet-radio.com, Slacker Radio, Accuradio.com, Onlineradiobox.com, Live365.com, Streema.com and of course iHeart.com. There are so many more that you could never list them all. If you're still not satisfied with the available sources on the net, create your own streaming station. You'll need to plan to pay for licenses to play music, but it's easier than ever to get a professional sounding radio station on the web and operating 24/7 from a spare bedroom in your home.

Even if you don't have years of experience in producing creative liners and station images, I have recently found something very useful and even fun when it comes to creating audio imaging. Its free to try it out and affordable to buy. It's found at [imagething.com](http://imagething.com). What is it? Imaging, music promos and sweepers produced in the cloud and on-line in seconds. Includes voice-overs, and you can upload your own image voice with your call letters. Once you play around with it, you'll discover that you really can use it as a very affordable way to brighten up your station image. I'm using it for several of the LPFM's that I work with.

In a future article, I plan to review a very professional automation system that was originally designed and built for hobby webcasting but has grown into a full fledged serious automation that works with popular traffic and billing software and is almost foolproof in it's execution of programming. Stay tuned.

Ron Erickson is a Writer, Radio Consultant and Engineer. Call 541-460-0249 [ronerickson@gmx.com](mailto:ronerickson@gmx.com)

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The Radio Guide Event Register

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October 1-3, 2019

Hartford Marriott Downtown, Hartford, Connecticut  
<http://bts.ieee.org/broadcastsymposium/>

### WBA Broadcasters Clinic

October 15-17, 2019

Madison Marriot West – Madison, Wisconsin

[www.wi-broadcasters.org/events/broadcasters-clinic-2/](http://www.wi-broadcasters.org/events/broadcasters-clinic-2/)

### Midwest Bdcst & Multimedia Technology Conference

November 14, 2019

Columbus Convention Center – Columbus, Ohio

<https://www.mbmte.oab.org>

### 2020 CES Conference

January 7-10, 2020

Convention Center – Las Vegas, Nevada

<https://ces.tech>

### 2020 NRB Convention

March 25-28, 2020

Nashville, Tennessee

[www.nrbconvention.org](http://www.nrbconvention.org)

### NATE Unite 2020

February 17-20, 2020

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<https://natehome.com/annual-conference/nate-unite-2020>

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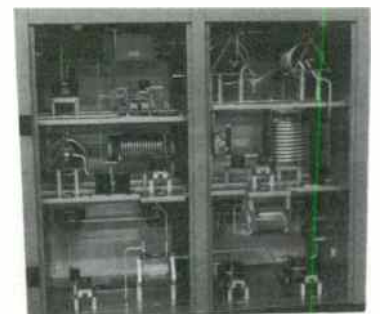
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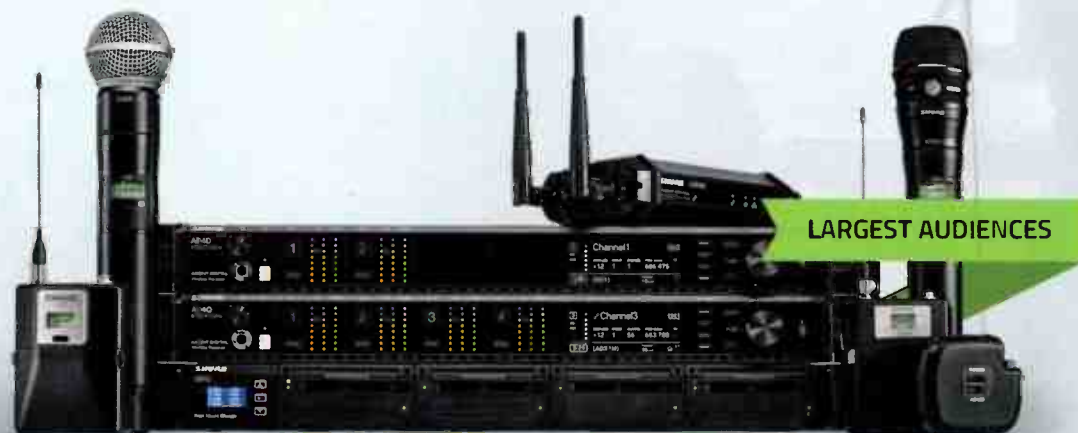
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