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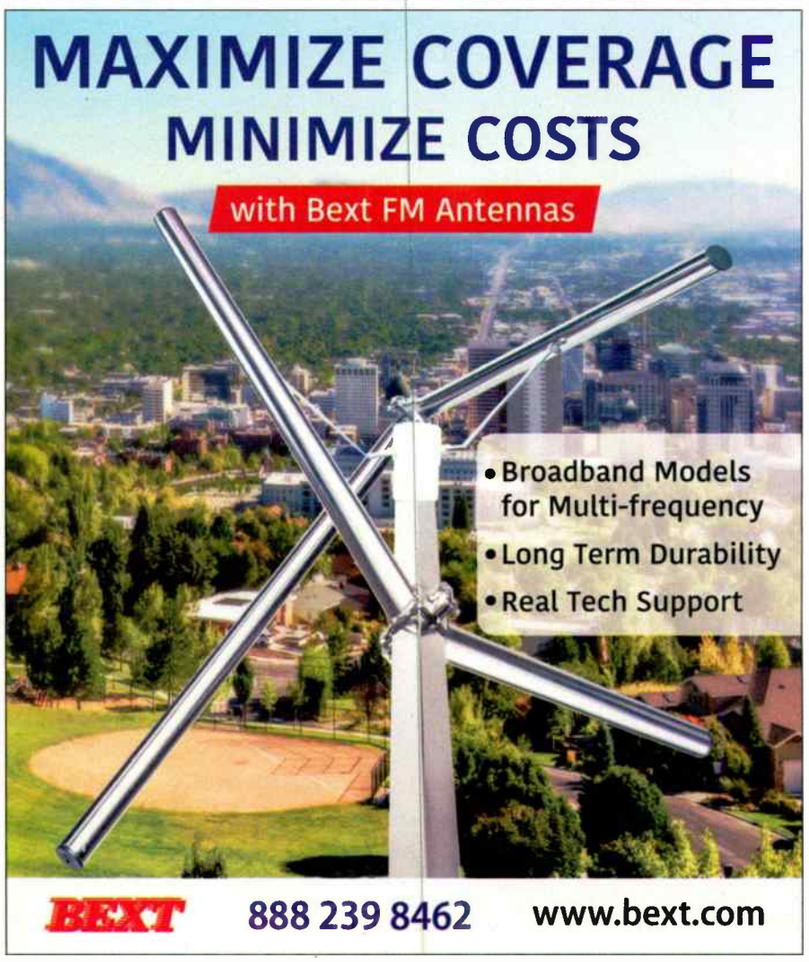

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# Cover Story

## AARON 655: Made to Measure

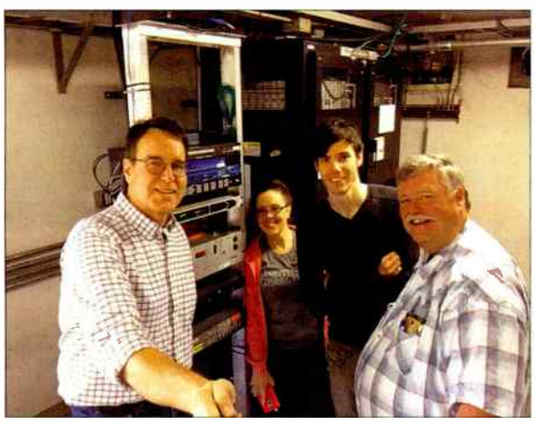
*How EMF's David Shantz helped design Inovonics' latest HD receiver and why he is rolling it out across the country.*

*by Deborah Luhrman, Journalist/News Editor – Edible Monterey Bay*

New products are often solutions in search of a problem, but that's not how Inovonics works. When the company wanted to come up with a new product to convert HD PAD data to RDS for FM, they enlisted the expert advice of David Shantz.

As Director of Engineering for EMF – which operates the K-Love and Air1 radio networks – Shantz is responsible for keeping 900 signals on the air 24/7, and for supervising a team of about 80 people, including 35 field engineers.

He and EMF Engineering Operations Manager, Natalie McElmeel visited Inovonics headquarters, in Felton, California, back in 2016. When they met with CEO Ben Barber and Sr. Development Engineer Josh McAtee, Shantz knew exactly what he was looking for.



**Left to right: Ben Barber – Inovonics, Natalie McElmeel – EMFF, Josh McAtee – Inovonics, and David Shantz – EMF**

"We had ventured into this new mechanism of feeding translators with HD signals and rebroadcasting on another translator frequency," he recalls. "That took an HD receiver, but it also took a bunch of other equipment. There were a lot of moving parts and we had a four-foot-tall rack of miscellaneous equipment to do this."

So instead of just advising on the simple HD PAD to RDS converter, Shantz came up with a laundry list of requests. "I remember saying what we would love is a one rack unit receiver that would receive the HD signal and give us audio out, or composite out, or digital out, or analog out. That would also stop a transmitter if we lost it and would also take an off-air feed – a digital or analog feed. Everything that all the devices in the rack were doing, plus taking the HD PAD information and turning it into RDS for the translators," he explained.

It wasn't exactly stunned silence that greeted his request, but the folks at Inovonics were definitely surprised. "I think it was a little overwhelming at first," said Shantz, "But Ben's got a great personality and there was a little chuckle, a little laugh, and then he said, 'Let me think about it, we'll see what we can do.'"

A few months of back and forth followed. "We were thinking we could whip this thing out, because we were thinking very narrowly," said Barber. "But when they came down and we talked about all the different things they wanted us to do, we decided to go back to the drawing board."

"They asked for things that were all very do-able, but things we hadn't thought about before," he added.

### Design and Testing

For a company that is so widely-known and respected in the radio industry, Inovonics is surprisingly small. Its headquarters sits right across the street from a state park that is home to some of the oldest and tallest redwood trees in California. Its grounds are beautifully landscaped with native flowers and plants. All design, manufacturing, sales and shipping takes place in one snug building and its 16 employees are treated like family.

In this peaceful setting the design team went to work, incorporating all of EMF's requests into one compact box and programming the software needed to operate it.

Once the prototype was finished, they were anxious to try it out. "We wanted to get one on the air so we could start evaluating it and making sure it worked correctly, because out in the field is always different than in the lab," said Barber.

Shantz gave them the combination to a lock at a small translator site near Monterey and they set out to install it. Unfortunately it was mid-winter, which can be very rainy on the Central Coast of California and they found the road to the translator site was washed out.

"It was just after a big storm and there were gullies of water running down the middle of the road, boulders strewn across it and trees down," recalled Barber. Undeterred, they grabbed the box and hoofed it a mile and a half straight uphill to the top of the mountain.

But this is not your typical transmitter horror story – although it was dark by the time they got home, all went well. The first AARON 655 rebroadcast translator/receiver worked like a champ and before long a second prototype was installed at EMF's Coyote translator site south of San Jose.

### Roll Out and Benefits

EMF now has about 15 AARON 655s in operation, with dozens more scheduled to be installed within the network across the country in upcoming months – wherever there is an HD fed translator.

**The AARON 655**

"There are three key ways that it helps our network and enhances our listeners' experience," said Shantz. "By providing more reliable signals to the transmitter, more up time and less down time; by giving us the troubleshooting tools to log in and check that signal and other signals; and by taking the HD PAD information and giving us the song and artist information on the RDS."

Shantz is enthusiastic about the product he helped design. He says he loves the way the AARON 655 is a one rack unit instead of four feet of rack, and that he can log into it remotely and see what is happening.

"If I've got some listeners saying that Bend, Oregon is not sounding good right now, for example, I can log into the Inovonics from my desk in Sacramento and listen to Bend, Oregon and do basic troubleshooting on top of everything else!" he said. "I also love that I can feed it by an IP feed and if that fails, it automatically switches over to the off-air feed."

Barber acknowledges that the AARON 655 is a niche product aimed at broadcasters who use HD2 to feed a FM translator, but its variety of inputs, outputs and back up systems makes it extremely versatile. And the AARON 655 is quickly catching on with other radio engineers.

"For broadcasters that need one, they really *do* need it, because it is a one-of-a-kind product and the only one in the market that converts HD PAD info to RDS," he says. "You can do everything else with multiple pieces of equipment, but nobody else makes everything in one box, and we're the only ones who provide the PAD to RDS."

Both Barber and Shantz embrace this collaborative process of coming up with new products and are hoping to repeat the success of the AARON 655 with future pieces of radio gear.

"We welcome collaboration with other radio networks too," said Barber. "We get ideas for new products at trade shows and through phone calls and by email, but working with networks is a great way to do it."

"We're probably not going to be able to make a new product for a single station, although if it's a good idea that might happen," he added. "But a network is going to buy enough to really launch the product and help catapult it out there."

In addition to R&D, EMF also gives Inovonics top marks for manufacturing and customer service. "They were great at keeping costs down and working with us on staggered deliveries, for the best matching of price and product when we need it," said Shantz.

Well-made, well-priced audio processors and equipment that solve problems for radio engineers around the world is something Inovonics has been making for over 40 years, and – with the help of people like David Shantz – will continue to create for years to come. – *Radio Guide* –

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# Studio Site

## Talk Show 101 – *Part 1*

### *What you need to add talk shows to your schedule.*

*by George Zahn*

As managers are electronically filing their Quarterly Public Issues, vowing to follow through on more local discussion programming to fulfill stronger community topics and more service, one thing holding some stations back is the simple lack of equipment or space to do interviews. As a manager for an all locally-produced station, my plant might be unusual in these days of satellite distributed programming, but as more and more of our listeners get their music from streaming and music downloads, adding some local discussion might be a good option for some looking for local programming.

Even if you spend just an hour a day of programming that reaches your particular community, it can help differentiate you from the many who are wall-to-wall music. The topics could range from whimsical and fun, to politics, oped, and local news – or anywhere in between. As each radio station strives to remain a relevant occupier of our listeners' time, giving them something local that they can't get on any other outlet is still a great hook. Perhaps that's adding some talk programming.

For the stations starting from scratch, wanting to try a basic talk or interview show, here are a few idea starters from a technical perspective. You can design and add your own policies on topics and style, as those will vary from market to market and station to station. If doing interviews with politicians, be sure to check fairness/equal time rules before just throwing someone on air.

So whether you're doing a simple "bring in a guest" to chat, a major public forum, or a call-in extravaganza, here are a few things to consider.

### Getting Direction on Mics

You don't need to go out and buy a bunch of brand new microphones to start a talk show, but to make the sound of your talk show acceptable, you do *not* want to mix and match microphones with different polar response or pickup patterns. Most mics in our stations are likely dynamic microphones, and many of them have unidirectional pickup patterns.

While, ideally, having all the same brand and model of microphones in your studio will give you the most consistent quality, many stations grab what microphones they have on hand if they want to experiment with discussion programming. The most important factor in this case is not the family of mic – dynamic, condenser, or ribbon – these are simply different models that transduce sound differently. The most important thing, when using more than one microphone in the studio, is the pickup pattern.

Many of the mics we use are already unidirectional or cardioid in pickup pattern. This simple means that the mic is sensitive from the front and that the mic's ability to pick up sound from the sides and back are minimized. A supercardioid pattern is more highly directional to the front. Mixing cardioid and supercardioid mics are OK at a talk table.

The microphone pattern we do *not* want at a talk table with multiple microphones is omnidirectional. The omni will pick up sound from all directions. So if you have an ElectroVoice 635 in your news kit at the station, I'd suggest keeping that omnidirectional mic out of a multimic studio setting.

### "Phasers" on Stun

Here's why. If I, the host, am seated at Microphone Number 1, a unidirectional mic, and my guest is seated at Microphone Number 2, which let's say is omnidirectional, we could have a few problems with phasing. Here's what happens. When my guest speaks, they're picked up on Microphone Number 2, but my Microphone Number 1 rejects sound from the guest because Microphone Number 1 is unidirectional, only picking up from the front. The guest sounds great.

When I speak on Microphone Number 1, it picks up my voice since I'm right in front of it. *But*, some of my voice will also bleed into the omnidirectional pattern of Microphone Number 2 (really just meant for the guest, but now picking me up as well). That bleed into Microphone Number 2 hits the mic a few milliseconds later than it hits my Microphone Number 1. When both mics get mixed together, you get a phenomenon called phasing.

The guest on Microphone Number 2 sounds OK, but the host on Microphone Number 1 may have some washed out or lisping vocal sounds, usually in higher sibilance frequencies such as "S" and "T" sounds. The best rule of thumb in any studio using two or more microphones is to ensure that the mics are at least cardioid or unidirectional to help prevent that phasing.

In music studios, there is something called the 3-to-1 rule, which simply states that you take the longest distance from a sound source (voice in this case) to its microphone in the room, then make sure that the other microphones are at least three times that distance apart. It's a nice guideline but need not be exact. The whole rule simply reminds us to make sure that we avoid phasing (which can happen even in cardioid mics too close together) by allowing some extra space between those mics.

For example, if I'm interviewing someone sitting across the table from me and we're on separate cardioid microphones, I see that I'm about 3 inches from my microphone when I speak, but my guest wants a little more space and the guest is 6 inches from his/her microphone. The longest distance is 6 inches, so my microphone and their microphone ideally should be about 18 inches apart, pretty easy. It's OK to eyeball it. No need to pull out a tape measure.

### Get on "Board"

So now you're armed with microphone info. Your console's capability will be the next determining factor in getting your talk show off the ground and on the air. Newer digital consoles will have layered assignments which might allow numerous microphones to be connected at any one time. The only challenge on those is making sure you know where the multiple mics com up on the console.

Older analog consoles have more limited inputs, but that should not deter you from trying a talk program. Some stations have built their own "submix" devices. It's basically an outboard mixer that allows you to control multiple microphone inputs, then entering that mixer output into the analog console. In our analog configuration on an old Pacemaker from Autogram, Pot 1, Input 1 is the main board microphone, and Input 2 is the Submix of all four of our table mics, including the board microphone.


**Autogram Mixer Potentiometer 1 with Mic 1 and Mic Mix inputs**

Since we never need both the Board Mic and the Mic Mix, it's an economical use of the potentiometer input. The submix we have was built by late engineer Jay Crawford and even includes basic pan pots (left-right balance) for each microphone input in addition to the microphone levels.


**Our homemade mic mixer panel.**

Small outboard mixers can mix two or more microphones and can even allow for panning and even individual EQ of each microphone, so a factory-made small mixing console can be a nice submix if you do not have a homemade model. This type of submix comes in handy in the eventuality that you interview a musician who plays an instrument, as you can EQ the instrument and have it as part of your submix.

In our next article, we'll delve more into Talk Show 101 as we discuss a second layer of talk radio – taking calls and obscenity delay for live shows. Perhaps your station has found a creative way to create talk programming. Let me know via e-mail at gzahn@mkcommunities.org.

*George Zahn is a Peabody Award winning radio producer and Station Manager for WMKV-FM at Maple Knoll Communities in Springdale, Ohio. He is a regular contributor to* ***Radio Guide*** *and welcomes your feedback. Share your stories with others by sending ideas and comments to: gzahn@mkcommunities.org*

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# Chief Engineer

## Standards

*by Scott Schmeling*

We work in a field full of standards. For example, our audio console has a "standard" output level. The VU meters are normally calibrated so that "0 dB" on the meter gives an output of +4 dB. (The standard used to be +8 dB.)

Quite possibly the most important standard we work with *(or in)* is TIME! In so many professions they watch the hour hand, followed by the minute hand. (Yes, this assumes they still have an *analog* clock!) In radio we're watching that second hand go around the clock 60 times an hour.

I'd like to share a story that illustrates *standards*. (This may or may not be true.)

When I was in the Army, stationed at Fort Monmouth, New Jersey, a new reporter at the base newspaper was looking for a good story about something on the base. Every evening at precisely 6:00 p.m. the Honor Guard fired the cannon and lowered the American flag. The reporter decided to write a story about that ceremony. While interviewing the section leader he asked how he knew exactly when to fire the cannon. The section leader said he used his watch. He said, "Every morning I go into town. There's a jewelry store with a giant clock outside. I set my watch to match that clock at exactly 12:00 noon. Then, during the flag lowering ceremony, I watch the second hand on my watch and when it says it's *exactly* 6:00 p.m. I signal for the cannon to be fired and the flag lowered."

The reporter decided to take the story a bit farther and went into town to that jewelry store. He found the owner of the store and asked about the clock outside. The store owner told him all about the clock and how it was so accurate you could set your watch by it. In fact, he said, "Every evening at 6:00 o'clock they fire the cannon on the base. I set my watch to that cannon fire then check this clock in the morning. And it's always right on!" (What's wrong in this story?!)

It doesn't seem like that many years ago we thought it was pretty great to get a satellite contact closure to synchronize the clocks on our computers. And if I may date myself, back in, let's say, 1965 PC (that's Prior to Computers), I had a very primitive but effective method to synch the clock. We were an ABC network affiliate with news at '55. The network was nice enough to give us a 10-second warning tone before any program started. As news time approached, we would unplug the clock's power cord and set the hands for exactly 55:00, listen for the 10-second warning, then as news started, plug the power cord back in real fast!

Later I learned that the Natural Bureau of *Standards* (there's that word again!) had a phone number. Calling it allowed you to hear the same time announcement that was heard on WWV in Ft. Collins, Colorado. In fact, you can *still* call and hear the exact time. That service is called the TTSD (Telephone Time-of-Day Service).

To hear these broadcasts, dial 303-499-7111 for WWV (Colorado), and 808-335-4363 for WWVH (Hawaii). Callers are disconnected after 2 minutes. These are not toll-free numbers; callers outside the local calling area are charged for the call at regular long-distance rates.

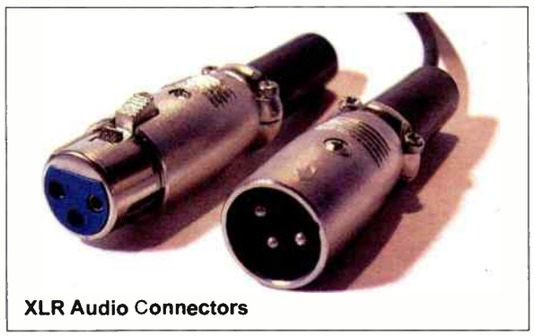
The telephone time-of-day service is used to synchronize clocks and watches and for the calibration of stopwatches and timers. It receives about 2,000 calls per day – www.nist.gov/pml/time-and-frequency-division/services/telephone-time-day-ttds

If you call (my guess is, you *will!*), depending on when you connect, you may just hear clock "ticks" until the top of the minute arrives. You can also go to www.time.gov on your computer or smartphone to get the exact time. I frequently check time.gov to check my watch before I go to work for the day.

At times (back in my radio announcer days) I would actually call the number and put it on air so listeners could set their watches. It was kind of impressive. I even had people call and ask me for the number so they could call when they needed it.

With so many program feeds being recorded automatically, synchronizing our clocks is more important than ever. And today we have multiple ways to do that. You can use the built-in Windows "Internet Time," or there are various other (some free) clock synching programs. We use two different programs, depending on what that particular computer does – *About Time* and *DS Clock*. With DS Clock we can display the time in a banner that can be sized and positioned where you want it, so it's always visible. Both allow you to synch with the NIST (National Institute of Standards and Technologies) time server(s) of your choice. Both programs give you multiple time-server options.

Of course, time isn't our only standard. Take wiring an XLR connector for example. XLR connectors are used primarily for balanced audio, both mic and line level (I'm not going to get into *digital* signals here). Here's a little trivia for you to impress your friends. The XLR connector was developed by the Cannon company and was initially called the X series or Cannon X. Sometime in the 50's they added a locking mechanism and it became the Cannon XL. Later, a synthetic rubber insulating material was used between pins and it became the Cannon XLR. Some still refer to it as a "Cannon" connector but most of us know it simply as an XLR.



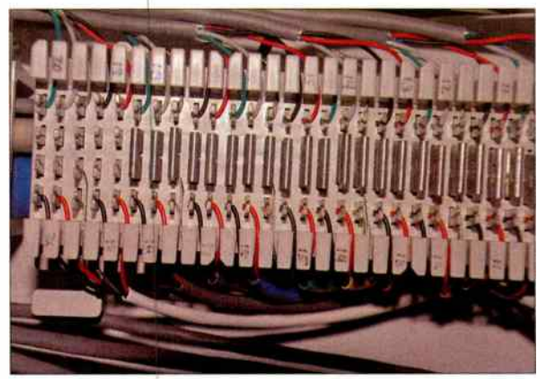
**XLR Audio Connectors**

When I first started wiring them, the one constant that I could find was that Pin-1 was ground. Signals on pins 2 and 3 varied. I couldn't find a year the wiring was standardized, but convention is now is for the positive or "hot" signal to be on Pin-2 and the negative or "cold"on Pin-3. We still have an older "remote mixer" with unbalanced inputs on XLR connectors. This manufacturer wired shield to Pin-1 and the unbalanced audio to Pin-3. Because of this, I had to make some special cables *just* for this mixer.

Speaking of audio wiring, consider simple 2-conductor shielded cable. I like Belden 9451 with a *grey* jacket. I like grey because you can write on it with a Sharpie – which can be a lifesaver! And 9451 is the same as the "standard" 8451 with one exception. If you're using a wire stripper, the foil shield on 9451 comes off with the outer jacket. I can't begin to imagine how much time I've saved not having to peel off that foil!

The conductors are red, black, and shield. I'm sure all of us put the positive signal on the red wire – that's pretty standard. When I discovered Belden 8723, 2-pair shielded, I looked through everything I could find to see which wire in the second pair was supposed to be positive – Pair-1 was red and black, Pair-2 was white and green. This was long before the Internet, so there was no "Google" to ask. We were using the Audisk computer system at the time and they wired positive to white and negative to green, so that became my standard!

There's also the discussion of which pair is left and which is right? In consumer color-coded wiring they usually have Red for right and Black (or white) for left. Easy to remember – Red is Right. I know of some engineers who follow that logic and put the right signal on the pair with red. I don't. I view red/black as Pair-1 and white/green as Pair-2. I also consider the left *channel* as the main channel. So for me, Left (main) channel audio goes on Pair-1 (red/black). Either way works. The important thing is to set a standard.



**A Standard 25-pair Punch Block**

I'm including a picture showing how I wire a punch block. A standard 25-pair punch block can easily be wired for 20 balanced audio signals. I have found that numbering the pairs on the punch blocks makes it *so* much easier to get the wires on the correct terminals. I use an ultra-fine point Sharpie for the numbering. If the block will be for shielded audio, I number for 20 pair and if the block will be for telco cabling I number for 25 pair. Unfortunately, some of the numbers appear washed out in the picture.

These are just a few of the standards we work with. There are so many more, but I think I've rambled on long enough!

I hope your summer is going well. Stay cool and – Keep it between 90 and 105!

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

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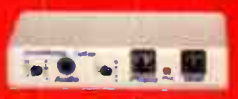

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# FCC Focus

## FM Radio Repack Relief Coming Soon to a Station Near You!

*by Gregg P. Skall – Womble Bond Dickinson (US) LLP*

From the very start of the TV Repack, moving all television stations to below UHF channel 36, it has been clear that it's going to be a tight squeeze. Secondary services and FM radio stations could be adversely affected by any changes required on broadcast towers and other technical changes. FM stations, however, were never included in the original repack planning despite the obvious fact that in some cases they must move on their towers or cease operating for a period of time to accommodate a full power TV station's reconfiguration.

For radio, it is primarily tower issues, although there are transmitter issues as well. According to FCC ASR System Data, 1,153 towers in the U.S. have co-located FM and TV stations, resulting in some 2368 FM radio stations and translators that could be impacted. V-Soft Communications did a report for the NAB a year ago that identified a total of 678 FM stations that may need to reduce power, shut down, or operate from an auxiliary facility, as work is being done on a neighboring TV station antenna to ensure tower worker safety from radio frequency exposure.

Apparently, Congress listened earlier this year enacting the Reimbursement Expansion Act (the "REA"). Known as the Ray Baum Act, in honor of a highly respected former Oregon legislator and Staff Director of the House Energy and Commerce Committee, the bill was designed to "thoroughly reimburse" broadcasters that are affected by the Repack.

The Act provided an additional $1 billion, targeting $50 million for FM radio stations. However, the funding requires that the FCC adopt rules covering the process of applying for and granting those funds to specific applicants.

In mid-July, the FCC released a proposed rulemaking and order for the process of distributing these funds to applicants, scheduled for action at the August 3 FCC meeting. Absent some unknown event, the draft order discussed in this article will be adopted.

### FM Reimbursement Proposal

The Commission proposes to reimburse up to 100% of the eligible costs for FM stations to permanently or temporarily relocate or modify their facilities. The Order uses a graduated, prioritized system, discussed below. Licensees will have to certify that they meet the eligibility criteria and include information regarding their existing equipment and a reimbursement estimate, built on the existing TV Repack model. The Commission invites comments on using this model for FM. As is the case for full-power TV, once approved, an allocation of funds will be made to the account of the licensee, which can be drawn down as approved and needed.

To avail itself of the $1 billion REA funding the FCC must certify to the Secretary of the Treasury that the exiting funds in the TV Broadcaster Relocation Fund are likely to be insufficient to reimburse reasonably incurred costs of full-power and Class A stations and the payments are necessary to reimburse costs reasonably incurred by entities eligible for reimbursement. Further, all reimbursements to FM stations must be made by July 3, 2023 at the latest.

REA funds for FM broadcast stations are limited to $50 million and may be used only for costs reasonably incurred for facilities necessary to reasonably minimize disruption of service resulting from the TV Repack. The Commission concluded that "FM broadcast station," as specified in REA, includes both full-service FM stations and FM translator stations, but is unsure whether Low-Power FM (LPFM) stations were included, since they were not specifically referenced in the REA, and invites comments on whether LPFM should be considered for reimbursement purposes.

### Licensed and Transmitting

To be eligible for reimbursement, the station must have been licensed and transmitting by April 13, 2017 using facilities impacted by a repacked television station. Stations will be eligible for reimbursement only for those costs associated with the impact at that location. Since REA seeks to reimburse costs "reasonably incurred" to "reasonably minimize disruption of service" but does not provide further guidance, the Commission must interpret what is reasonable for eligibility. Using the same standard it adopted for LPTV/translator stations, it proposes that an FM station had to be licensed and transmitting on or before April 13, 2017, the date reverse auction winners and the television stations subject to the repack were identified in its Closing and Channel Reassignment Public Notice.

### Reasonably Minimizing Disruption

To fulfill Congress' intent to limit reimbursement "to reasonably minimize disruption of service as a result of reorganization of broadcast television spectrum," the Commission includes a service disruption due to either a TV channel reassignment or a station relinquishment of its spectrum. In either case, since the TV may need to modify its facilities, it could impact the FM station. Modification could include dismantling equipment or other work on the tower that could disrupt the FM station. In any case, the Commission will require a causal link between the facilities for which reimbursement is sought and the activities of the repacked television station.

### The Priority System

The Commission would categorize reimbursement according to a scale that represents the level of service disruption. Tentatively, it concludes that only stations co-located with, or adjacent, or in close proximity to, a repacked television station will be eligible for reimbursement, requiring certification of the specific television station. The priority categories are:

- **Category 1** – Stations forced to relocate permanently or relocating their antennas to a different level on their current towers. Either change could require prior Commission approval in addition to possible disruption of service.
- **Category 2** – Stations forced to temporarily dismantle or disassemble equipment or make other changes not requiring Commission approval and other necessary modifications not requiring prior Commission approval.
- **Category 3** – Stations forced to temporarily reduce power or cease transmission on their primary facility to accommodate antenna or tower modifications. Costs could include auxiliary facilities. It would limit reimbursement to stations with no existing auxiliary or those unable to access existing auxiliary facilities and include only stations with existing auxiliary facilities that do not provide at least 80% coverage of its normal signal. Stations in Category 1 or 2 could also qualify as Category 3.

Category 3 is somewhat problematic as FM stations have been warned for nearly two years of the coming need for auxiliaries due to the television repack. The Commission should develop some test to determine whether or not a recently built auxiliary facility was acquired for, and built in anticipation of, the TV repack and allow reimbursement for the farsighted broadcaster.

Stations reimbursed in other ways would not be eligible under the REA funding.

Within Category 3, the Commission would adopt a graduated priority system, reimbursing only when the disruption would cause loss of listeners during peak listening hours, increasing the priority the longer the station is required to be off the air. Moreover, it proposes only to reimburse for replicating up to 80% of the FM station's coverage area or population by an interim facility, borrowing the Commission standard that 80% signal strength over a population or community may be considered substantial compliance with its coverage rules.

The graduated reimbursement priority for interim facilities is:

- Stations off the air for 24 hours to 10 days: Up to 50% of eligible costs reasonably incurred for new or upgraded auxiliary facilities.
- Stations off the air for 11-30 days: Up to 75% of eligible costs.
- Stations off the air for more than 30 days: Up to 100% of eligible costs.

It also proposes a prospective payment system to minimize the potential for "gaming the system" that includes certification by the TV station and substantiation of the time off the air.

As with TV, the FM reimbursement form will also include a requirement to list the station's existing broadcast equipment and the types of costs the station expects to incur. The media bureau has developed a catalog of the types of costs most likely to be incurred as it has with TV. Stations will be free to provide their own estimates of costs but they will be scrutinized and must be supported.

Once the Media Bureau completes its review of the eligibility certifications and reimbursement forms, it will issue an allocation from the reimbursement fund to each eligible FM station, which will be available to draw down as expenses are incurred.

Recognizing that the total amount of reimbursement funds may not be sufficient to cover all eligible expenses at the end of the program, the Media Bureau will be delegated authority to perform a prioritization for reimbursement.

### Waste, Fraud & Abuse

Whenever government agencies are tasked with distribution of large sums of money, there is always a great concern to adopt strong measures to protect against waste, fraud and abuse. To protect the fund, the Commission will require entities to document their actual expenses properly, including support with relevant invoices and receipts and will require claimants to retain other relevant substantiating their certifications and reimbursement claims.

Initial comments will be due 30 days after the date of publication in the Federal Register, with reply comments 60 days after that date. We have implored broadcasters to analyze their exposures as a result of the television repack in the past. That process has never been more important than it is today and FM stations should make it a priority to determine whether it will incur, or has incurred, expenses that are eligible for reimbursement under this program.

*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.*

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*Gregg Skall is a partner of the law firm Womble Carlyle Sandridge & Rice, LLC. 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.*

*Prior to private practice, Mr. Skall served as the Chief Counsel for the National Telecommunications and Information Administration and General Counsel to the White House Office of Telecommunications Policy.*

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# Transmitter Site

## The Power of Internet and a Computer at a Transmitter Site

*by Chris Ark*

Having Internet and a computer located at a transmitter site can be powerful tools. This is especially true for small, financially conservative stations, that have old microwave equipment, out of market contract engineers, no backup automation systems, and zero backup STLs. Taking the time to convince the station owner to spend a little money can make all the difference when it comes to keeping the station on-air, reducing after hours truck-roll, and giving yourself the ability to monitor, troubleshoot, and diagnose issues remotely. The entire sales pitch to the owner is simple – *revenue*. I acknowledge this is easier said than done. In addition to the fundamental functionality of a computer, there are numerous low, to no cost software and on-line resources that can help you build a robust infrastructure. I remotely monitor and manage stations in different states with the methods discussed below.

*A few disclaimers. I acknowledge that computers die. Yes, there's a linchpin in every system. But having a computer at a transmitter site will afford you reaction time when something inevitably goes wrong. Also, this article doesn't consider what audio switching hardware, PC audio cards, ISP's, or music licenses you do or don't have. It would be impossible to list every potential configuration. This article is meant to share cost-effective and creative solutions for monitoring and troubleshooting remote broadcast facilities. Let's begin ...*

### The Basics: Internet, Computer, & Remote Access

For remote connections and audio codecs, almost any ISP connection today will do. The one exception being satellite, due to latency. Most audio codecs have been designed to perform on the most unforgiving of Internet connections. This benefit becomes truly apparent when you find yourself with only one, less than ideal, ISP option at your transmitter site.

The computer itself doesn't need to be the latest and greatest. It could be a computer collecting dust or a cheap amazon purchase. If you're repurposing an old computer, be sure to remove unnecessary software, run a disk defrag/cleanup, and preform a hard drive health check through the CMD prompt. You can low-level format the hard drive and reinstall Windows (or OS of choice) but this takes more time and skill. The upside of reformatting is that you're starting with a clean slate. If you decide to reinstall the OS, make sure you have the OS product license key. If the product license key sticker has been removed or worn off, I use **Belarc PC Advisor** to scan the computer to retrieve the license key. It should go without saying but perform this scan *before* reinstalling the OS.

Other considerations for setting up your remote computer would be installing antivirus, disabling OS updates once up-to-date (and functional), and set the BIOs to turn the computer back on after a power failure. Your site will eventually loose power, regardless of UPS's and generators.

Now we need the ability to login to the computer remotely. There's plenty of free, light use, and paid remote access software available. Once you decide on one, pick a second. I always install two flavors of remote software because one can stop working for no reason. I use **DualMon** and **TeamViewer**. Again, it's all about giving yourself redundancy when you're dealing with a remote site.

### Backup Audio Sources

Let's start by pointing out that in order to have audio redundancy at your transmitter site you'll need some sort of audio switching capabilities. For the simple application of switching between two audio sources (STL & PC), I like the **Broadcast Tools Audio Sentinel Web Plus** unit. It's an affordable 2x1 switcher with a web GUI offering email notifications, alarms, and few other features. Now we'll discuss different audio failure scenarios.

In the event of a microwave STL failure, which is the only STL some stations have, I would put the station's Internet audio stream on-air. If you go this route, encode the stream with EAS ensuring you're FCC complainant when it comes time to retransmit RWT's & RMT's.

If your station doesn't have an Internet audio stream, you can create one just for backup STL purposes. In the past I've used **MyRadioStream.com** for the audio streaming service – there's a free and paid version. The free version has sample rate limitations and you have to manually start the server when you want to use it. But even with these limitations, it can still get you out of a bind. On a computer located at the station, run program audio to its audio input. Go to MyRadioStream.com and sign up for an account. Then install WinAmp with the Shoutcast plugin. Within the Shoutcast plugin you will enter the MyRadioStream host parameters and select your audio input source.

The host parameters can be found in your MyRadioStream profile. Think of this as your "encoder." Within your MyRadioStream profile you'll also find a streaming URL you can open with a media player or browser on the transmitter site computer. This will be your "decoder." You just created a backup STL for next to nothing.


Logitek is developing a software and cloud-based product called **JetLink** and **JetConnect**. It's "remote broadcasting without the remote box." JetLink is the software that gets installed on each computer. This GUI allows you to make an audio connection to other computers that have JetLink software installed. JetConnect is the on-line profile where you manage your fleet of computers. JetConnect is great because it acts as a connection intermediary, eliminating the hassle of having to port forward IP addresses and change firewall rules in order to make a connection to a computer within a LAN. Currently, Logitek is offering the products for free, as it's in the beta testing phase, but will eventually move to a paid model. Go to jetlink.co for more details.

Indeed, there are other software-based audio codecs out there, but this is what I have used in the past. And now that you have Internet out at your transmitter site, you could entertain purchasing audio codec hardware, but we won't dive into that topic as it isn't in the spirit of this article.

Let's says the power goes out at your station and you need to originate audio from the transmitter site. There's free and low-cost automation software you can deploy if there isn't budget for a second copy of Wide Orbit, RCS, etc. **PlayIt Live** and **RadioDJ** are commonly used for backup automation and are relatively easy to install and manage. Now you have the ability to play and update station content regardless of the station's operational status and for little to no cost. If your STL down time is so minimal that you simply want to play a static backup audio file, have the production dept. put together three hours of content and play it through a media player like VLC. Transferring files to the transmitter computer can be done at no cost with **Dropbox Free**. There's storage size limitations (2GB) but once the files are transferred onto the transmitter computer, just delete them from Dropbox.

If you're preparing for worst-case scenario (microwave STL and transmitter Internet go down simultaneously), I install a freeware called **Pira Silence Sense** on the transmitter computer. This program can detect audio silence at the computer's audio input and can be configured to automatically play an audio file. This is awesome for when you're unable to remote into the transmitter computer to start your backup automation. Some additional wiring is required as you will have to run an audio reference from the primary STL to the computers audio input.


### Audio Skimmer Software

Audio skimmer software can be a fantastic tool for troubleshooting audio signal chain issues at a transmitter site. There are free to low-cost audio skimmer solutions such as **PlayIt Recorder** and **Charlie Davy SureLog Free**. Most basic audio skimmers only allow you to record a single audio input. The problem for me is that I like to record two feeds, post-STL / pre-transmitter and the off-air audio. This helps me to locate points of failure before going to the transmitter site. When I need to record two feeds, I use the PlayIt Recorder for my post-STL / pre-transmitter feed and Charlie Davy SureLog Free for my off-air feed. Most stock computers only come with one-line level audio input, so you may have to make the choice of which feed to record. If budget allows, purchase a USB audio card to use in conjunction with the onboard audio input. I prefer to install PCIe audio cards but those can be costly.

### Final Thoughts & Ramblings

I like to know when the Internet goes down at my sites before needing to use it. I monitor the modem/router with a freeware by Axcence called **NetTools Netwatch**. This software is rich with features, but you can simply use it to ping the modem and send you email alerts when it doesn't respond.

And now that you have Internet and a computer out at the transmitter site, you can access equipment GUIs and keep them off public facing IP addresses. You can also have video monitoring, and can establish a disaster recovery plan, in the unfortunate event of complete loss at the primary studios. Some station owners can see all these efforts as a waste of time and money, but when you keep them on air when the station goes dark, you're a genius.

*If you have any questions, please feel free to contact me on my website CRAAudio.com. Chris Ark, CBT*

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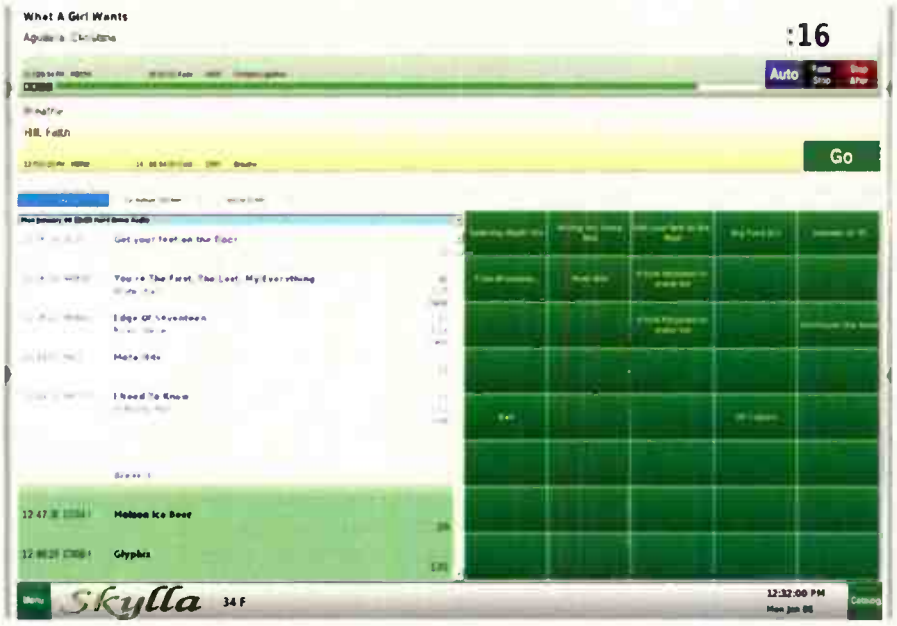


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# Practical Engineering

## Do You Really Need Shielded Audio Wire?

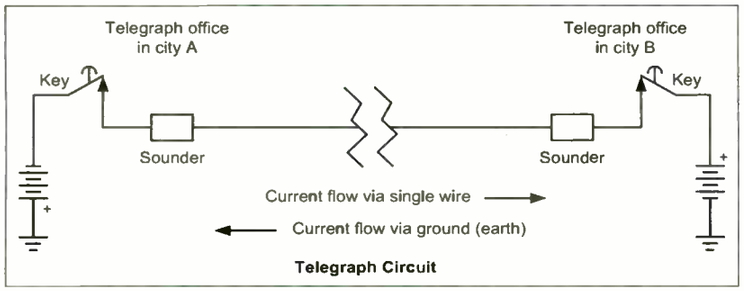
*by Mike Hendrickson*

*In the last article I wrote there was an error made in the heading. The satellite system rebuild was done by MPR (Minnesota Public Radio) and not NPR (National Public Radio).*

A couple of months ago I had an interesting discussion with an engineer at a radio station I was visiting. The discussion centered on the use of shielded audio wire. This engineer commented that he always used shielded wire because "that's the way audio wiring should be done."

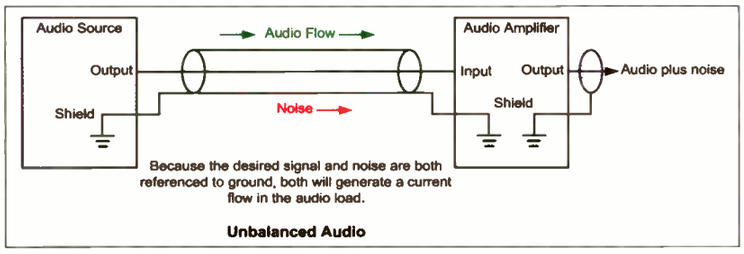
I don't share this view of how audio wiring should be done. I am firmly in that group of engineers that feel shielding balanced audio wire is a waste of money and time.

To explain why I feel that way, I first need to talk about balanced and unbalanced circuits, along with common mode rejection. The telephone companies have been using unshielded balanced wiring for over a century to transport telephone conversations, audio, and other signals. When telephone circuits were first being installed they used the same wires that the telegraph circuits used. The telegraph system used one wire to connect each office with another office. The circuit return was the ground connection. While this worked fine for the telegraph, this wiring system resulted in a lot of noise in the telephone circuits, even in unamplified telephone conversations. As a result the telephone companies began using balanced circuits.



**Telegraph Circuit**

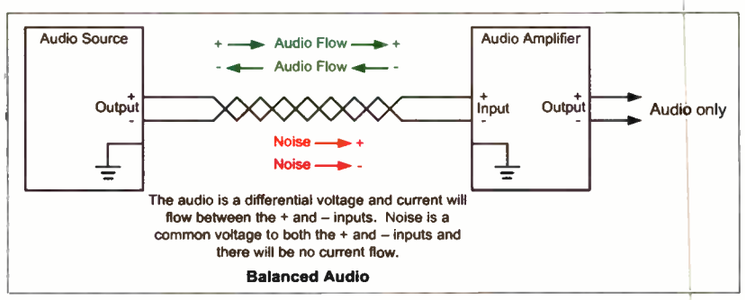
In the unbalanced circuit, the signal travels from the source to the load on a single wire. The return or common is via the shield, ground, or earth connection. Any electromagnetic noise that exists will induce a voltage in the single wire. This noise will be amplified just as readily as the desired signal. The amplifier input does not have any ability to reject the noise.



**Unbalanced Audio**

The balanced audio circuit uses two wires to transport the signal with no signal traveling via a ground or shield connection. The source of the audio uses either a transformer or a differential output to drive the balanced audio pair. The load is either a transformer or a differential input amplifier.

We commonly refer to the wires as the + and -, but since this is an AC circuit the + and - are just designations for identification of phasing. The signal from the source will travel down one wire and return via the other wire. Any electromagnetic noise that exists will be equally induced into both wires. This electromagnetic noise is the common mode noise. Because there is no difference in the common mode noise between the + and - there will be no current flow and the common mode noise will be rejected by the terminating device.



**Balanced Audio**

This ability to reject the common mode noise that is induced into both wires is called Common Mode Rejection. The measurement of the common mode rejection is called the Common Mode Rejection Ratio (CMRR) and is expressed in terms of -dB. The formula is $20log\left(\frac{cm}{dm}\right)$ (cm is the common mode signal and dm is the difference mode signal). Common mode rejection can be accomplished by the use of high quality transformers or well built differential input amplifiers.

A CMRR of -40 dB is considered to be poor common mode noise rejection, while -70 dB is consider good, and -90 is excellent. Most professional broadcast equipment will have CMRR specifications of at least -70 dB. The equipment will also specify the frequency or frequencies at which the measurement was made. This means that if there is a desired signal on the audio wires of 10 Volts, and an undesired common mode signal that is also 10 Volts, after the signals have passed through a balanced device that has a common mode rejection of -70 dB, the undesired signal will be reduced to 0.0032 Volts.

Now that I've given you a very brief explanation of why balanced wiring works, I'll explain why I don't use shielded cable.

The first reason I don't use shield cable is that it may create a ground loop. If the source and load devices also have a connection to ground using the third prong of the AC power cord or the chassis is grounded via the rack or other means, an electrical path will exist between the two devices. When the devices are also connected by using the shield of an audio cable there will be an additional electrical path. Because of these multiple paths there will be a current flow, however slight, and this current flow will induce noise, typically in the form of hum, into the amplifiers following the balanced input. This hum will be amplified. While a proper installation of shielded cable has only one end of the shield connected to ground, there is the possibility that the other end will be mistakenly connected, resulting in a ground loop.

Since a lot of audio wiring is done at sites with RF present, there is another potential problem with shields. This problem is that the shield may act as a receive antenna and induce RF into the signal wires. This RF may be of a high enough level to cause the input stage of the amplifier to detect the RF and insert the undesired signal onto the desired signal. The common fallacy is that, because the shield is grounded, the entire length of the shield is grounded. This may be true for DC, AC, and audio, but at RF frequencies the shield may be significant fraction of a wavelength long. A wire that is a quarter wavelength long and is grounded at one end will have a high voltage at the end. This means that a shield that is longer than a foot in an FM transmitter site may have significant amounts of RF present at different locations on the shield.

There may be times when RF is still introduced into the audio equipment by the audio cabling. The prevention of the introduction of RF is not to use shielded cable, but to use RF filtering. One of the most effective means of eliminating RF from audio cables is the use of ferrite cores. If you wrap a cable around a ferrite core a couple of times you will eliminate or reduce the RF. You will need to have the proper ferrite core for the frequency of the RF. Capacitors will also work to reduce or eliminate the RF, but caution must be used as the capacitors may unbalance the circuit and increase other noise.

In addition to the shield possibly acting as an antenna, the foil shield of most audio cables is not very effective at audio frequencies. Foil shields are most effective at frequencies of 10 MHz and above, while braided shields are good beginning at 1 kHz and deteriorate beginning around 400 MHz. (https://www.belden.com/blog/broadcast/ground-loops).

Finally, consider the typical telephone cable running from the telephone company central office to your studio. This cable may contain multiple POTS circuits, T1 circuits, DSL, and other circuits. None of these circuits are shielded from each other in the multipair cable. There may be an overall metallic sheath over the cable, but this sheath is for mechanical and electrical safety and not noise shielding. When you consider that the POTS circuit in the cable may have 90 Volts of AC ring voltage at times, yet it is not heard on the other circuits, you can see how effective balanced wiring is.

For those of you that are still hesitant about using unshielded audio cable, take a look at the specifications of Cat5 cable. These cables are designed to handle frequency components up to the several hundred megahertz that results from digital data transport. These cables must be able to handle the data without degradation and crosstalk.

Now let's look at the cost of shielded cable. One common cable, Belden 8451, is a one pair shielded cable with a cost of about $210.00 for 1,000 feet. Belden 1504A is a two pair shielded cable with a cost of about $428.00 for 1,000 feet. Now let's look at Belden 1212, which is a CAT 5e cable with four unshielded twisted pairs. The cost is $300 for 1,000 feet. At Home Depot 1,000 feet of CAT 5e or better is $156.00 or less. In the Cat 5e all four pairs are available for audio use. (Any cable that carries the designation of a "category" cable must meet the ANSI/TIA/EIA specifications for that category. Thus even a cheap category cable must meet the minimum standard for that category.)

For those of you with an interest in the early history of the telephone companies and how they connected the nation I suggest you read Mark Durenberger's on-line book at: http://www.durenberger.com/documents/ATTEBOOK.pdf. There is more useful information on the use of unshielded twisted pair cable at Belden's web site: https://www.belden.com/blog/broadcast

I hope this short article will give you some ideas about audio wiring for your next installation. Until then happy engineering!

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

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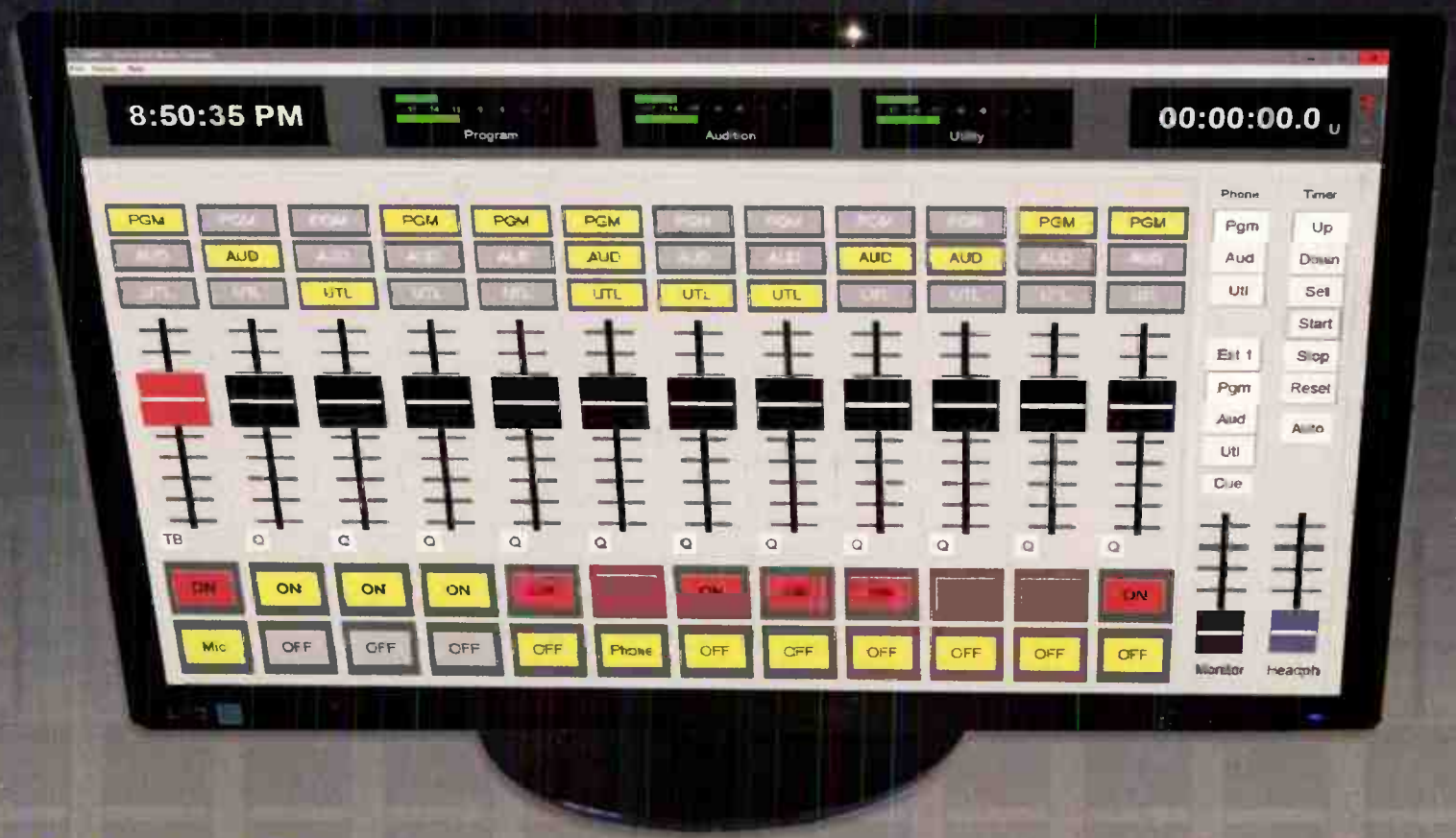


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# Tower Topics

## Single Tower Matching Using the L Filter

*by John L. Marcon, CBRE CBTE 8VSB Specialist*

Choosing the right size AM tower is a critical aspect of building an AM station. This subject matter is often times left to the consulting engineers but it is important that the station engineer also have some knowledge on building an AM station. The Antenna Tuning Unit or ATU must match the transmission line to the antenna for proper power transfer and minimum reflection. Most of the ATUs of today are designed using what is called a T network but an L network can also be utilized.

The first thing to determine in building a single tower AM antenna is the height of the tower, and this comes from the licensed frequency. For example, let us assume that the frequency assigned is 1 MHz. The next step is to compute for the wavelength with the formula: $\lambda = c/f$

$\lambda$= wavelength in meters, c = speed of the wave, f = frequency

With c as the speed of light, $\lambda = 300 / 1 = 300$ meters. The actual height of the tower will not be the full wavelength but only a quarter of the value or what is called a quarter wave. We may choose an even shorter tower but the radiation resistance would be low.

In our example, the quarter wave is 300/4 = 75 meters or 246 feet. The tower height is not only expressed in wavelength but in degrees as well. A quarter wave is equivalent to a 90-degree tower. 90 degrees is a quarter of a full 360 degrees. A tower height of between 90 to 225 degrees is usually chosen. There is some advantage to a 225-degree tower (also called an anti-fading antenna) but there would also be disadvantages because of added expense for the tower itself. Likewise, the land area needed would be wider because a guyed tower is usually designed to have an anchor distance of 70% to 80% of tower height. A taller tower would also have stronger night time radiation and might interfere with other stations.

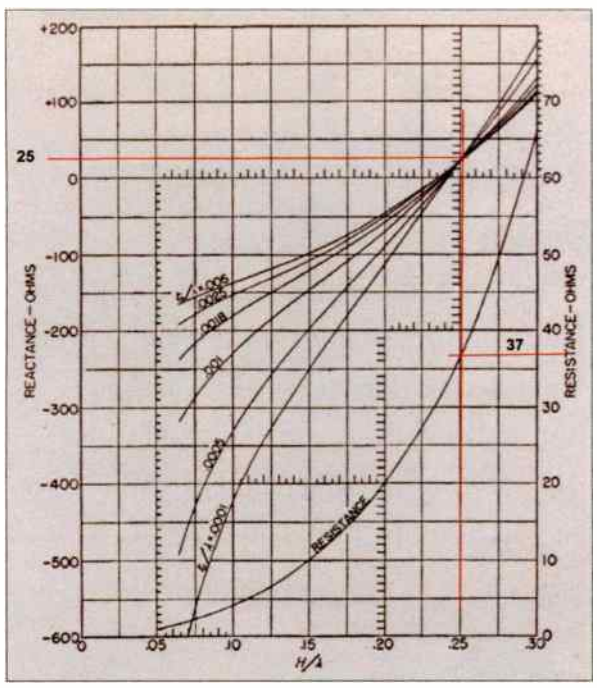


**Fig. 1 – Resistance and reactance of short monopoles. H is tower height, λ is wavelength, r0 = tower radius**

For the height of 246 feet, the next item to be determined is the width of the tower. The structural width is determined by the manufacturer who designed the tower. For example, if we use a Rohn 45G 250-ft tower, the width = 16.75 inches.

From these two values, Height and Width, we can begin calculating the self-impedance of the tower. The estimate will need a graph like the one shown in **Fig. 1**. This can be obtained from old antenna books on AM.

Note that the curves indicate "radius "of a tower. However, towers are usually triangular. We have to find out the equivalent radius of a triangular tower by multiplying the width of the tower with 0.4214:

For a tower face = 16.75 inches, the equivalent radius = 16.75*0.4214 = 7.06" = 0.588 ft, for $\lambda$ = 984 ft, r0/$\lambda$ = 0.000598(within set of curves)

With a quarter wave tower, H/$\lambda$ = 0.25. From the graph, the impedance of the tower is about 37+j25 as indicated by the red lines. This is an estimation of the self-impedance and could be within 20% of the actual value. This is very useful when the actual tower impedance is measured. Next, we have to match the tower to the transmission line. The transmission line impedance is 50 Ohms. An L Network can match any two resistances as long as neither one is a pure reactance. The formula is as follows:

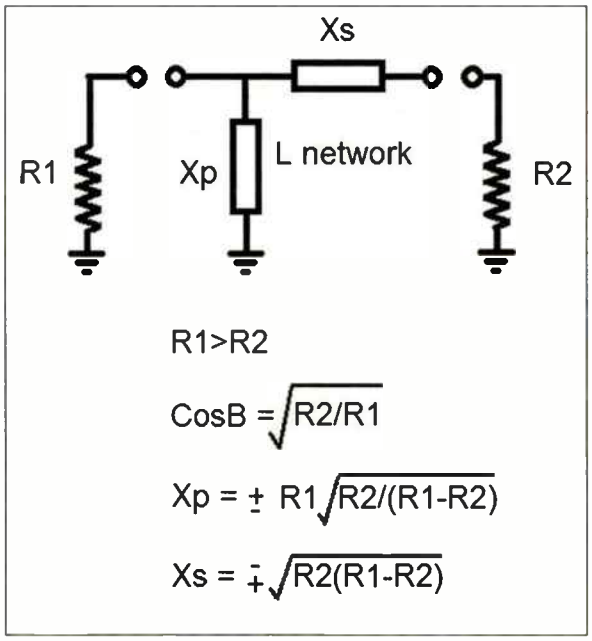


**Fig. 2 – The L network diagram and equations.**

### Tower Series Impedance

Noticed that the +/- signs in the following equations are opposites in the Xs and Xp. That is, the +Xp and –Xs go together and –Xp and +Xs is the other pair. The R1 in the equation can be designated as either the antenna or the transmission line – the same is true with R2. How do we determine which one is R1 and which one is R2? The transmission line has a 50 Ohms impedance while the tower has an impedance of 37+j25. To determine which one is greater, we first ignore the reactance value +j25 and consider the transmission impedance of 50 Ohms as pure resistance. It will then come out that R1 = 50 Ohms and R2 = 37 Ohms.

**There are two possible solutions for Xp:**

$Xp = + R1\sqrt{R2/(R1-R2)}$ $Xp = - R1\sqrt{R2/(R1-R2)}$

**and Xp = +j84.3 Ohms or - j84.3 Ohms**

**There are also two possible solutions for Xs:**

$Xs = -\sqrt{R2(R1-R2)}$ $Xs = +\sqrt{R2(R1-R2)}$

**and Xs = -j22 Ohms or +j 22 Ohms**

**We then have two networks:**
**1. L network #1 = +j84.3(Xp) and -j22(Xs)**
**2. L network #2 = -j84.3(Xp) and +j22(Xs)**

On the first network, Xs needs to be -j22 but there is already the series reactance +j25 from the tower. That is, we need to find the number that when added to +j25 results to -j22.

**In equation form: X+j25 = -j22, X = -j47**

Therefore, Xs = -j47. In other words, the tower reactance is used as part of the matching network. On the second network, Xs = -j3.

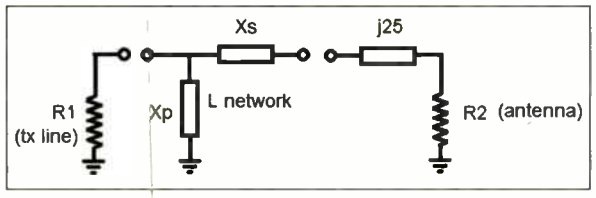


**Fig 3. – Tower reactance used in the matching network.**

**The two networks will then be transformed to:**
**1. LN1 = +j84.3(Xp) and -j47(Xs)**
**2. LN2 = -j84.3(Xp) and -j3(Xs)**

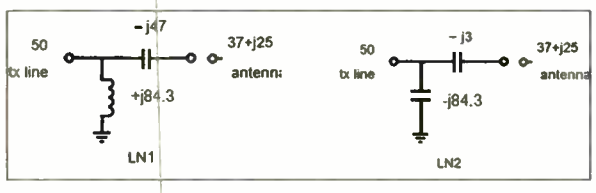


**Fig. 4 – First two L networks to match the tx line and antenna.**

### Tower Parallel Impedance

We can stop here and decide between the two L networks above. However, the tower is not only represented by a series impedance, which in this example is 37+j25. In reality, the tower can also be represented by parallel impedance. This is done by transforming the series impedance of the tower to parallel and determine the other two possible L network from that result. The equation to transform a series impedance to parallel is:

**$Rp = ( Rs^2 + Xs^2 )/Rs$ and $Xp = ( Rs^2 + Xs^2 )/Xs$**
**Rp = 54, Xp = +j80 (tower parallel impedance)**

Repeating the process in the Series Tower impedance, we ignore the reactance Xp and compute for the two other possible networks. However, in this case, R1 is the antenna resistance because it is greater than the transmission line impedance of 50 Ohms. The parallel reactance is now connected to the antenna while the series reactance is connected to the transmission line. Thus, R1 = 54 and R2 =50. From these two values, Xp and Xs can be calculated. Xp = + - 191 and Xs = - + 14.

**The two L networks are as follows:**
**1. LN1= +j191(Xp) and -j14(Xs)**
**2. LN2=-j191(Xp) and +j14(Xs)**

*(Continued on Page 20)*

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# Tips From the Field

## A Good End to a Long Night

*by Gary Minker*

There you are, at the transmitter site, working on your one and only transmitter trying to figure out why the thing quit and where that wonderful smell of Bakelite came from. Testing, testing, groping for parts, working through the night you go.

It almost sounds like a Christmas Carol but you are sure it is not. The hours run on and progress is slow – but on again, on again, slowly you go. There's that Carol again.

So dawn approaches and you are pretty sure that you have found all of the problems, and after hours of pushing "the button," you are certain that this push of the run command will be your last and you can finally go home to the comfort of your slippers and chewed up newspaper.

### Ready, Set, Go

After hours and hours of pushing that nifty little green button much too fast and too many times, you keep hoping to make your troubles go away, and suddenly you notice that the transmitter wants to come up and run. The earth stands quiet and the meters all come up – but only for that weak long instant of 4-6 seconds and "Clunk," you are down again.

### Now What?

You've fixed the blown fuses on the IPA, checked the automatic power control, poked and fixed and checked. It ran, so *now what?* It ran, you saw it ... didn't you? Oh Maaann ... *now what?!*

So back in to the box you go, searching for the latest show stopper. "Ah," you say, as you find another fuse out. You easily replace the fuse and around you go, keeping one hand in your pocket, holding on tight, and you press the little green button. Run baby run, as you hum a Cheryl Crow song – 3, 4, 5, 6 – the meters are up, the music is playing from the speakers and not from your mind. Then "Clunk!"

### Here We Go Again

After a few minutes of searching, you come up with the same fuse, so now after a few deep breaths you realize the fuse belongs to the blower and you just happened to *NOT* hear the thing spool up and you *DID* hear that nasty humming right as the fuse blew.

After running through the inventory of parts you have on hand – after all of four seconds – you realize that you do not have a new motor.

You rip into the blower and find that the start cap is open and there is, thankfully, no run cap needed; you remember that your inventory doesn't include a start cap for the blower. So you frantically start thinking of what you can tear apart to steal a capacitor from – any capacitor – just anything that might handle 240 Volts for 30 seconds and might accidentally have about 12 uF for a value. You know deep in your stomach that you have nothing and it's Saturday in outer Mongolia – you are toast!

### A Glimmer of Hope

But wait, your next door neighbor is a service technician for an appliance company. There is only 19 inches of snow on the ground but, hey, he might have just the thing you need. You sheepishly call, wake him up, and ask that all embarrassing question, "Do you have any capacitors?"


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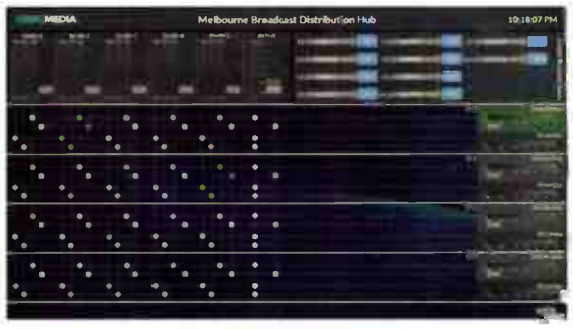








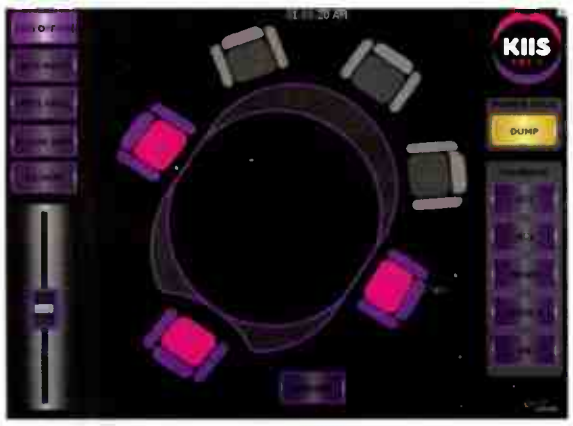


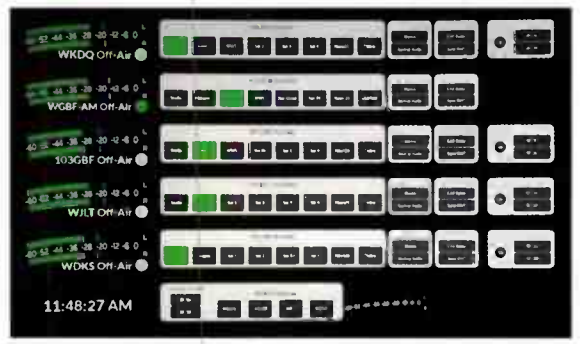




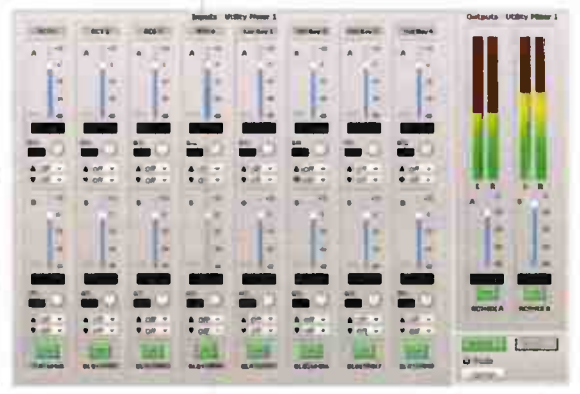

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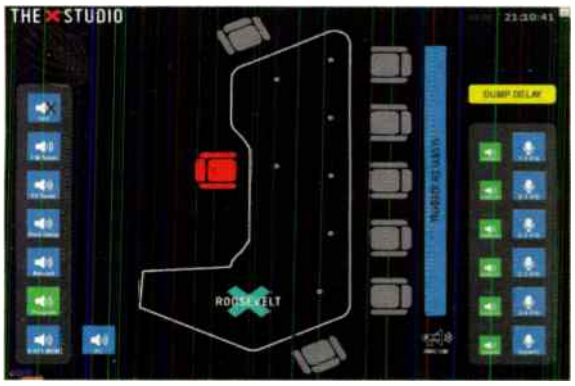





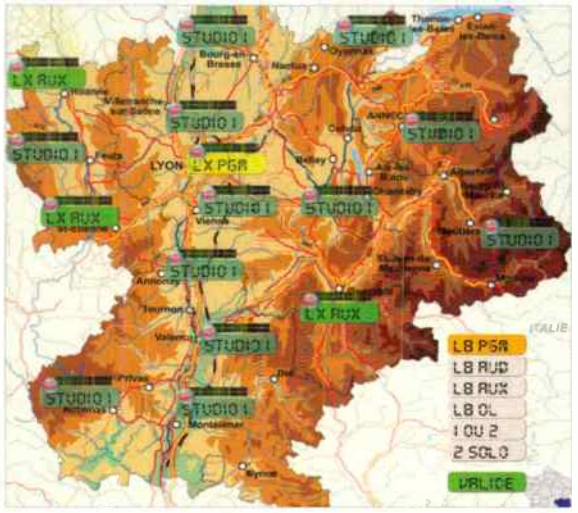



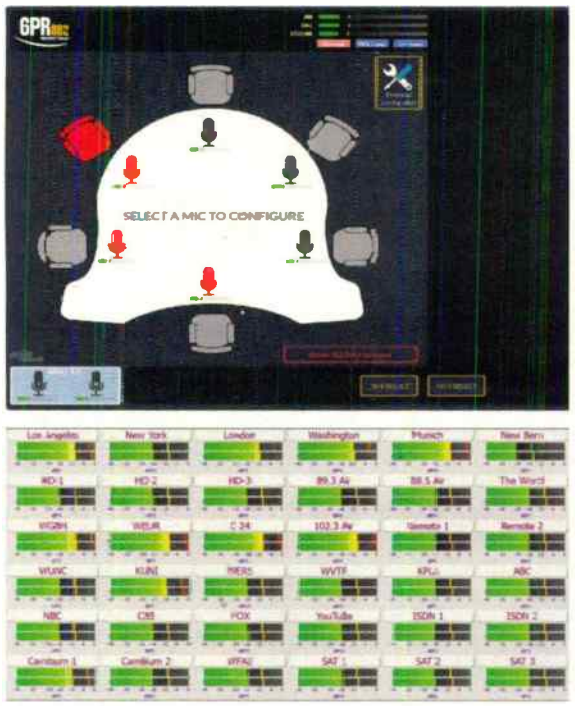



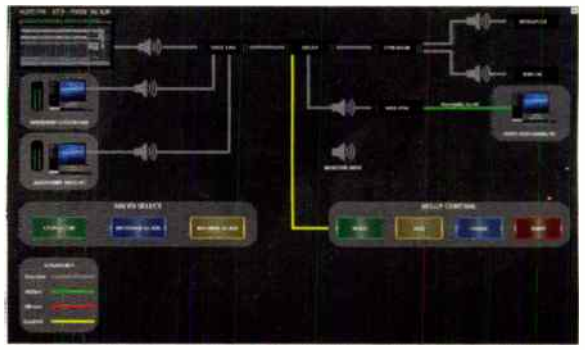

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# Engineering Perspective

## Start by Making Your Bed

*by Jim Turvaville*

I'm not usually deeply inspired by speeches of any kind, let along Graduation Commencement speeches; they tend to be given by people who have achieved popularity or notoriety by means other than academic or outside the realm related to my personal interests. So when one catches my attention, it gets lodged in the grey matter and simmers; this one happened in 2014 but is still resounding in my brain.

Admiral William H McRaven addressed the 2014 graduating class of his alma mater, the University of Texas, and told them the 10 lessons he had learned during his 34-year career as a Navy SEAL. While all of them were closely related to the military career and lifestyle, his first point was quite direct, even if a bit out of the ordinary. In a synopsis, his point was this:

### Start Off by Making Your Bed

*The barracks at basic SEAL training is a nondescript building in Coronado, California. Rooms are Spartan, with a simple steel bed on which there is a mattress, two sheets and a grey blanket. Every morning, we would have to make our beds. If the task wasn't done properly, we would be sent on a 10-mile run. Making my bed taught me the importance of getting my day off to a good start. Years later, when we finally captured Saddam Hussein in Iraq, I was intrigued to notice that he had never made his bed. It's that kind of laziness that can lead to the downfall of any dictator.*

As a child, I was always taught to make my bed every day. My Dad was ex-Army, but the motivation for me to make my bed did not come from him – it was Mom's rule and one with which she led by example. She is now in her late 80's and I've never seen her bed unmade at any time in my life; it's the first thing she does every morning even before getting dressed. Having learned that trait at such a young age – so young that I cannot even remember – to this day I can't even sleep in a bed which has not been made, even if I have to make it and then pull it down for sleeping. Fortunately, my wife was trained in a similar way from her own mother, so it's never been a point of contention in our household.

But the point made by Admiral McRaven is one which translates into not only our personal lives, but my own experiences in my Engineering career. Having the self-discipline to make your own bed every morning does get one's day off to a good start, and if you're not in that habit already, then I doubt anyone will change your mind. However, it also teaches a valuable lesson about taking care of the mundane things in our lives which, in and of themselves, are not all that critically important; but can have a deeper effect on our work day and our career. Let me share just a few of the "making your bed" items on my list and show you what I mean.

### Leaving Bread Crumbs

My wife is an accountant with a major radio group, and she reviews the books for as many as 75 of their radio stations any given month. She found out a long time ago that making those little notes in those spreadsheets and reports about "why" this particular entry was made will come in handy for more than just her – months or even years down the road. The same is true in our world – label it and write it down in some manner as you go; you're not likely to be the next, or the only, one who looks at the thing again. I've written about my propensity to carry 10 rolls of colored tape with me at all times for wire marking, etc. I usually carry an extra roll of white Scotch 33 that I use only for "temporary" labels on wires and equipment. A couple of fine tip Sharpie markers and you can leave as detailed a trail of crumbs as you need to help yourself or someone else in the future.

I use the term "temporary" in the guise that you, or in my case, usually my client, will come along and actually put a "real" label on the box when you're done and everything is finished. When installing a piece of gear with multiple connections, I often will just put a long strip of the white tape along the row of connectors, and write on it as I go with what goes in each. I've also placed the tape on the top of the unit with notes on how specific connectors are wired – for example if the I/O is on an 8-slot Phoenix connector, I'll jot down the 8 pins on the tape for installation ease, and to not have to go dig out the manual when servicing it later. It goes without saying that the white tape and Sharpie, along with a $40 portable label maker from the big box store, is better than

(Continued on Page 28)

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# Start by Making Your Bed

– Continued from Page 26 –

nothing at all, even if you can't afford the nice $200 model with the fancy tape rolls and features.

Another part of leaving the bread crumbs is taking notes on your work, and preferably as you go. I know, we all think we can remember how we connected all of those wires up; after all, it's only been an hour ago, right? The school of hard knocks has taught me to never trust my own recollection, even if it was just an hour ago. The old friendly legal pad and a pencil (yes, not an ink pen – we *do* change our minds and need to erase now and then) with hand-drawn diagrams and scribbled connector pin out numbers can be an amazing tool to help you trace out something a month, year, or ten years down the road. If you are really adventurous, once the project is done, take those scribbled notes and translate them into a nice printed document that you can save in several places. But try to keep that original hand scribbled note as well, just in case something was overlooked or lost in translation.

## Doing the Clean Up

Affixing those labels is a small part of the cleanup from our regular work. It can also mean lacing the cables neatly so you can still see the unit and have your hands around it without the risk of accidentally unplugging something. My old IT guy, Kevin, won me over to Velcro many years ago, and I use it in large quantities during and after installations. Only things that I'm really sure that I'll never take apart again – like power cord bundles or large multi-cable runs – get the old trusty zip tie attachment. I've accounted here before, the availability of really affordable Velcro – my Harbor Freight still sells the 15 ft roll for under $10. And that item is in 3/4-inch width, which I normally cut in half lengthwise to make them 3/8-inch wide, a size much easier to use on smaller bundles of wires, and giving you twice the product for the money in the process. Lacing up cables and making it all look neat may not make it run any better, but it certainly will help keep things from accidentally getting disconnected. And if the non-technical people in your world (like your boss) sees it all looking neat, they automatically think you do good work. Trust me, it's happened more times than I can count. And don't forget to do a bit of sweeping up, or at least picking up, of the scraps on the floor. It only takes a few minutes, and it keeps the area looking like you take pride in not only how your equipment operates, but how it looks as well.

## Filling Out Logs

The last item that I will mention on my list is filling out those logs; especially those which you think (at the time at least) will have little or no value. I still contract for a few stations for routine maintenance checks at tower sites, and they all have processes and procedures for keeping logs of the site visit. Yeah, it's sure dull and boring to write down *all* of those parameters *every* month, but on more than one occasion it's come in *really* handy to have a clue what normal parameters should be on one of those seemingly obscure items. During a monthly check of readings, that RPM indication on Cooling Fan #4 looks a bit odd ... yes, going back to last month's log says it normally runs at 6800 but today is reading 4800. Well, you just spotted a dying cooling fan before it became a real problem. You don't have to be a doctor to know that "Prevention is cheaper than cure," and in this case you can get a replacement fan on hand and schedule a preventative maintenance visit and part replacement on *your* time, instead of managing an emergency call on the transmitter's schedule. Just when was the last time something broke at a convenient time? Yeah, I thought so.

Finally, just because we now have the Station's Public File in an on-line format with the FCC, the "Station Operations Log" is still required to be kept; it's just not required to be posted on-line is all. That means your EAS activity, station maintenance items and tower lighting inspections and notations still have to be kept in a log, and that log kept at the station. It is unclear if there is a requirement to keep that log at the Authorized Control Point, since that is also in the grey area, now that the Main Studio Rule is gone. But it is very clear that this Station Operations Log is to be kept, and made available if an FCC inspector comes calling. If you have a central studio operations location, this would be a good place to keep this log. But if you have a group of stations run from a distant location, then keeping it at the tower is also perfectly permissible; it's assumed an FCC inspector would come calling at your tower in that circumstance anyway.

Having self-discipline to manage the little things in our work will most often end up making our job easier; and working smarter and not harder is one of the main keys to success in any line of work. So start your day off with success – and make your bed, please.

*Jim "Turbo" Turvaville is semi- retired from 39 years in full-time Radio Engineering and lives in Rural Wheeler County Texas in a "tiny house" where he maintains a small clientele of stations under his Turbo Technical Services (www.jimturbo.net) operation providing FCC application preparation and field work.*

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# Breathing New Life Into an Old Computer

## *Getting around the Windows Obsolescence Situation! – Part 3*

*by Tommy Gray – CPBE, CBNE*

### Where Did This Come From?

In my last couple of articles, I have been discussing the transition from Windows™ (which changes almost daily and has caused a lot of frustration in the computer community), over to a free solution called "Linux." You may be familiar with a computer operating system, that was around and popular with the tech community years back, called "Unix." It saw a lot of use in high end computer systems, mostly at industrial and collegiate facilities. Many colleges taught courses in Unix and Unix programming, among others. I for one did not like it at all, and though there were several other systems out there that were used in engineering applications, such as Fortran and Cobol for example, there was nothing that the average computer user could sink his or her teeth into that did not require months and even years of experience with, to fully understand and implement.

A lot of us (including myself) got our first real start into computers and programming with the advent of the Commodore and Radio Shack computers, as well as some of the Heathkit computers, just to name a few. The evolution of these saw the implementation of floppy drives for storage, and ultimately hard drives, which at the time were very expensive for the average person, and had very limited storage. I recall my first hard drive was a 10 Megabyte (Yes *Megabyte* not Gigabyte) Seagate. It was a full height noisy drive, but it worked. It cost me over $300, and was, at the time, a great innovation in the computer world. Before that, you had to either use a cassette to store programs, or when they were available, a floppy drive. I eventually bought a Radio Shack Color Computer which used an old television set for a monitor, and had an external cassette deck to store and load programs. Later on I got my hands on an external floppy drive. Before that, we had to write and read programs from the cassette deck, that was hit and miss at best. You could spend 10-15 minutes loading a program into your computer only to have it crash at the end and not load in the last few seconds – then you started all over again. Programs had to be loaded into it a line at a time, using a programming language called BASIC. Though it was limited, we had a lot of fun and even managed to implement a few of the systems into broadcast applications. You could even write some pretty complex programs, if you had the time and programming skills.

Later on, I hand wire-wrapped my own computer which was a real nightmare to do, but it worked after a fashion. I then bought a surplus XEROX 820 motherboard out of a magazine, built a power supply and case for it, and made my own powerful computer system. I replaced the PROM socket with an EPROM ZIF socket and began to write programs onto the chips. I could prototype by simply swapping out the EPROM. I came up with a programming language for the XEROX that was called Nevada PASCAL, and learned to do "real" programming for the first time. I remember writing programs into the wee hours of the morning that could do things from simple word processing all the way up to some pretty complex engineering calculations. One of the first programs I wrote calculated AM power. Today you might laugh at such a "feat of programming," but *then* it was amazing to use a computer for something like this. I eventually bought a surplus dual 8" floppy drive for the Xerox – one drive had the Operating System on it, and the other was for the program language and for storage. A real computer system it was!

### Moving Right Along

Well, now that I have wasted all your time on a trip down memory lane, let's get back to the heart of the matter – finding a use for all those old computers that Windows updates have rendered obsolete.

A fellow by the name of Linus Torvalds, a Finnish-American software engineer, was the creator and, historically, the principal developer of the Linux kernel, which became the kernel for operating systems such as Linux, Android, Chrome OS, etc. The operating system name, Linux, was taken from Linus and Unix. In 1991, Torvalds was a student at the University of Helsinki in Finland, where he had been using Minix, a non-free Unix-like system, and began writing his own kernel. He started by developing device drivers and hard-drive access, and by September had a basic design that he called Version 0.01[1].

*(Continued on Page 32)*

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– Continued from Page 30 –

This kernel, which is called Linux, was afterwards combined with the GNU system to produce a completely free operating system, and was the predecessor of what we know as Linux today. Though there are many versions of the operating system, each having its own differences for the most part, they were driven by the need to satisfy preference, or for the reasons of hardware management for the different machines, etc. Some were written simply because someone wanted theirs to look different from everyone else's. Nonetheless, there are a lot of great versions out there and most are free. There are some commercial versions that you have to purchase, but the average person will have no problem finding a version he or she would prefer, and totally free.

### My Personal Choice!

Having said that, and as I mentioned before, the one I personally like the best is Linux Mint Cinnamon. I am currently running it in the office on several older computers and a few newer ones as well. The one main machine that I use as a workhorse, and the one this article was written on, is an older Dell and it was becoming slow, running Windows XP™, but runs Cinnamon very well. Linux has breathed new life into the old machine. Now that you have decided on a version of Linux, and have your old machine up and running with it, it is time to find something to do with it.

### Office Systems

We are all more than likely familiar with Microsoft Office™. You have probably used their suite of office applications and probably do so daily, for everything from writing a letter to doing your budget spreadsheets, etc. If this application suite is one of your staples, you are probably wondering how you might get by without using Linux. As you know this particular office suite evolved from a locally installed application on your computer that you had to purchase to use, into a now, "Cloud Based" system where usually you have to pay for a subscription to even open up, and that you have to have Internet service to access. If you are like me, you flatly refuse to pay for a cloud based system that requires payments to continue as long as you use it. On top of that, you probably would rather refuse to pay for an operating system that requires updates that can crash your computer, that can render it a "brick," and cause the loss of all your data. That my friends, is not something I want to tolerate, and refuse to do so anymore!

Fortunately there are free alternatives that, even though in the beginning, were a little limited and required the user to know a little more than the average Windows user, in order to use in a "non-frustrating" manner. I cannot tell you how many times in the early stages of Linux development I had to edit scripts, learn bits of programming languages and learn to work with command line operations, just to get everything working. Those days are, for the most part, gone. It is entirely possible to load Linux onto a computer and never have to touch a script – doing everything right from the desktop, and with a GUI that is pleasing to the eye, and entirely functional. Need help? There are hundreds of videos on the web right there for you, that will answer just about any question you may have regarding your "new" Linux computer.

### Where Do We Go From Here?

The Office Suite I use here in my office is called "LibreOffice." You may have heard of OpenOffice a few years back as well. Let's get the names out of the way. OpenOffice is now officially Apache OpenOffice. This was the same software that was once owned by Oracle and then relinquished to Apache. All of these software titles – OpenOffice, Apache OpenOffice, LibreOffice, NeoOffice, and more – all come from the original StarOffice (which was actually a proprietary office suite).

Apache OpenOffice™

Which do I use? Well, Linux Mint Cinnamon has made it easy for you. If you installed the complete distro of Linux Mint Cinnamon, guess what? You already have a fully functional copy of the complete LibreOffice suite installed and ready to use on your computer. Check your list of applications and you will find them.

I will give you a comparison to help you know which is which. There is 'Writer" which is like MSWord. There is "Calc" which is like Excel. There is "Impress" which is like MSPowerpoint, then there is Math and Draw as well. You might ask what do you use for Email? Well there is an app for that too. It is called Thunderbird and it is free and on your computer. Now it is not quite as versatile as Outlook but for the price you can't beat it. We will talk more about the Office software in the next article. Stay cool my friends!

[1] *Info obtained from a Google search and Wikipaedia.*

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

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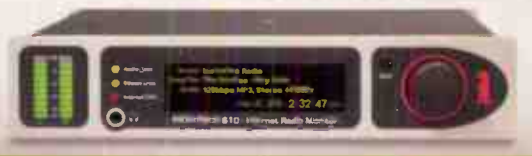

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# Tech Support

## Tech Support and Customer Service Really Matter

*by Wiely Boswell*

We have all been there, we need help and find out their "support" is what needs the help.

I have been on both sides of the phone. The impact of good help can be immediate and can also be long term. A simple example is a restaurant. The server gets a tip based on service, *right then*, where the reward for the establishment is long term. It builds a reputation based upon price, consistency of food quality, condition of surroundings, and of course service. Even though you really feel obligated to tip, there are those times when the tip really deserves to be made negative, and deducted from the total. That option would give the management viability and server accountability but it would likely create a bad relationship between customer and business.

Let's take it up a notch to the professional broadcast equipment providers. The main contacts are the Sales people, Field and in-house Tech Support, and the factory repair department. You have to have experience on the other side of the phone to really understand what the challenges of Tech Support are all about.

I *used* to be an SME (Subject Matter Expert) on large "important" telecom switching and transport systems. I had started as tech support on TDM (time division multiplexed) systems when they had just come out, then followed the developments into larger systems, where the competition was intense. The Tech Support and Integration Support of these systems typically was the tie breaker to winning business. Customers do talk to each other and your reputation will precede you and your company. It could get tense when you had a software or manufacturing defect in a circuit card that could result in loss of data traffic. A defect could be rated such a major issue that we would change cards on site at our expense. As an SME, I spent lots of time on the phone getting problems addressed and escalated, as need be, to product managers. We were the tech support to the phone company tech support staff and their technicians.

Well, TDM is going by the wayside quickly and it is all code division / Internet Protocols now. No longer am I an SME. I am now *just* a customer, an oxymoron for sure. It's hard to be right all the time, so I usually need the help to make a call and always try to thank those that help me. There is the saying you will tell a couple of people about some good help and maybe ten people when it is bad. So quality service is an uphill battle all the time.

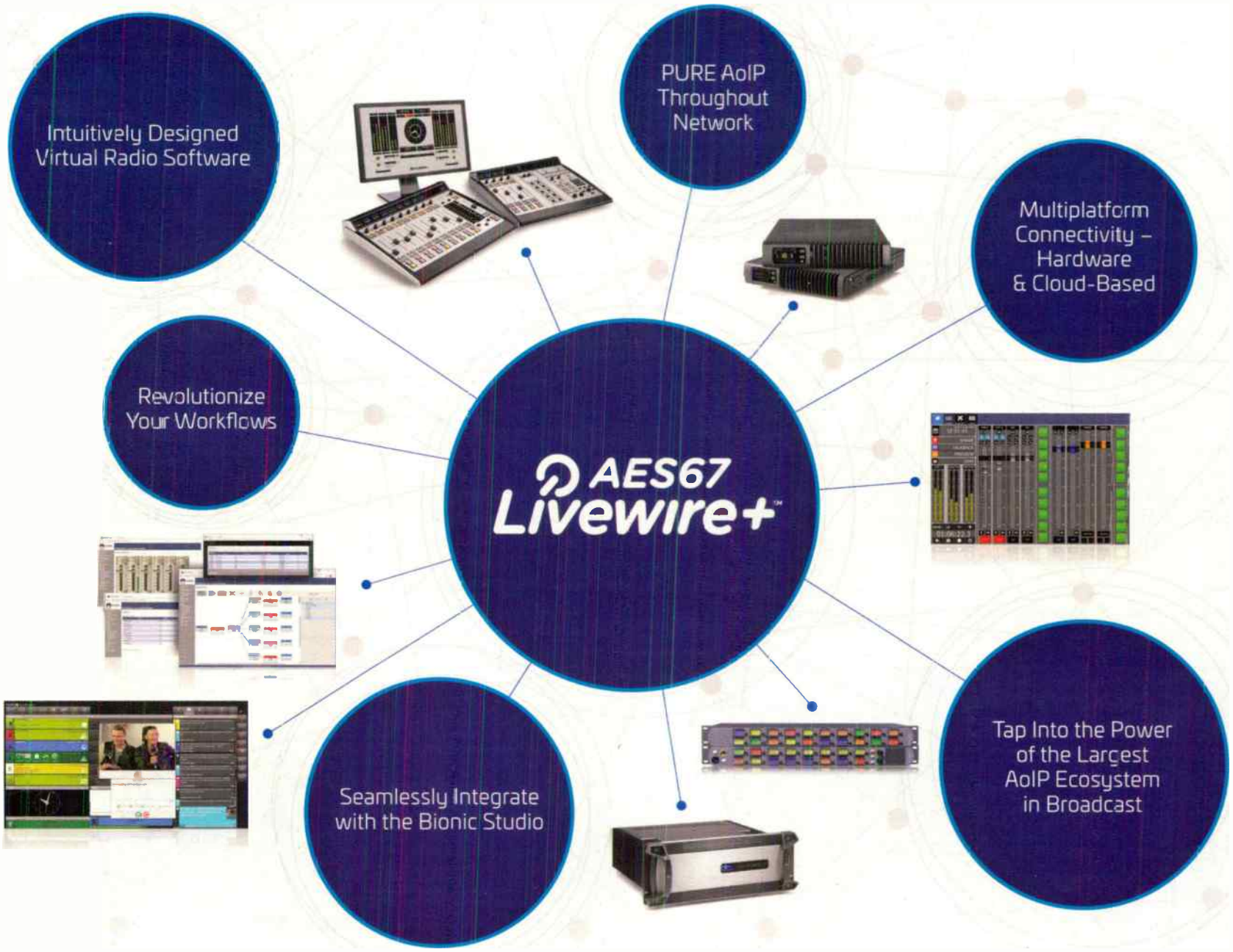
The more complicated the purchase, the greater the chance that tech support will be "clarifying" what the salesman said the system would do. The more the tech support gets in on the discussion and the quote the better. A good example of this in the broadcast industry is automation systems. They all have their pros and cons so a study of "have to have" features is needed. One example is a programmed sports station when a rain delay occurs. Just because your old system handled it does not mean a new system will. At a minimum it will be different.

The tech support will help bring it all together. Some products are small throw away boxes needing little support availability. Others are mission critical. Critical elements will require redundancy and or spare parts. A tech support overnight shipment can not always be counted upon. After all, your lack of contingency planning does not always appear as an emergency to the factory. But a support team willing to perform when necessary is a winning team. Excellent support is support you can depend on. You may well have the spare components but a little hand holding goes a long way. There are two types of support: no charge and service contracts. A service agreement is where you expect superior service and experts. When you have no charge and good service, you should appreciate and complement the sales person on the service you get. Find out the chain of command and give this good feedback to their supervisor.

You need to have your credit straight. Vendors can see you as having an outage "emergency," but way too often they may get left holding the tab and that will certainly throw a wrench in a support relationship.

*(Continued on Page 36)*

# Welcome to the Ne(x)twork

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## Tech Support and Customer Service Really Matters

*– Continued from Page 34 –*

The best support is from people with whom you can develop a relationship. It starts on the first call. It is an opportunity, not a problem, and yes I am trying to reach a few vendors here. It would be of interest to read some good support stories in future editions.

Here are few examples of my recent good contacts, taking the risk of leaving someone out ...

Lightning / EMPs always take their toll. We had a phone system affected and of course there was some upcoming event requiring dial-ins. Comrex has a system in which you fill out a form to clearly explain what you need, and there is a cutoff time to be able to get an overnight shipment out. In this case it was a loaner system. It was close to cutoff time, I was not at my computer, and the person helping me actually filled out the form for me and got it there the next day! That was impressive.

Gates Air has helped look up all the large electrolytic capacitors for a vintage Gates One AM transmitter work horse for me. Some of this equipment gets old, support gets tough, and a company struggles to keep up. Then there is the manufactures' end-of-life, where support is officially over. Repair service is discontinued when the parts are no longer available.

There is also field support like Bill at Tieline. I feel like I can always get him on the phone and he is an SME that helps with intense IP situations. In today's world IP STLs have taken down traffic. There is help at Crown – Don, an SME that actually works on equipment. Quoting Don, "Hold one and let me get the heat sink compound off of my hands."

Some companies are in other countries, like Nautel. Different time zones can be an issue, but they are there on call and are all SME rated. They help getting parts in and out across the border. Jeff is well known help, who started in the field and is now in sales, with know how. Sales types really need to work well with support. It is a team effort.

Some products are needy when it comes to support. Take a consumer Internet support line. They take beaucoup calls. Some times you can not even understand them and there may also be several layers to make it thru, to resolve a difficult problem. They will read thru a script – they really have no option based on the volume of mostly non-tech callers.

Asking if it is plugged in is *not* actually a stupid question. I remember a customer calling me after they had been working on a problem for several days. I have to confess, I had to drag out the quick resolution just a bit, so as not to insult or confound them with their oversight. Good support will take this as a training opportunity and leave the customer a happy customer. I now find myself on the non-SME side and can have just as simple a solution to a problem provided to me.

I also remember thinking, did this customer even touch the manual? So an SME should lead them in the manual to the spot quickly and then try to explain the layout of the documentation. Great documentation has had input from tech support, extracted from real world issues, and is worth the effort for manufactures. I do end up calling support when the manual does not clearly explain an option or its effects. Speaking to you SMEs out there, please note the calls you get, listen, and make input suggestions to documentation. Little handout guides like Comrex's IP audio booklet are really helpful.

As equipment just sits there and works, you tend to forget, or never even had to learn, how to trouble shoot it. SMEs work on their products every day and get experience from trouble calls, learning what documentation information might be missing – where customers error, and what common defects exist. So every chance you get, please tell the manufacturers' sales people how important good documentation is. With so much on line nowadays, they can be living documents to make customer support work for both customer and the manufacturer.

So call your best support today and tell them nothing is broke, thanks for your help.

That would be a call to make their day !

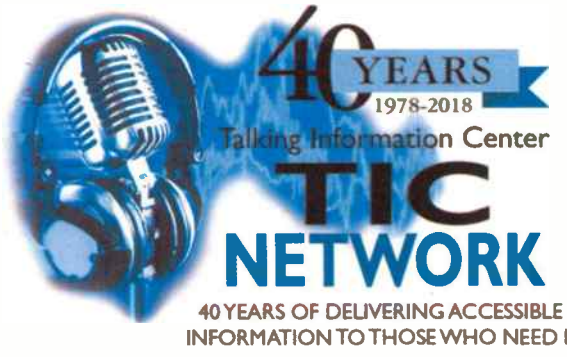
*Wiely Boswell is Chief Engineer of Faith Broadcasting, Montgomery, AL; CBRE, CBNE, and SBE 118 Chairman. He may be contacted at: Wiely@faithradio.org*

# Facility Focus

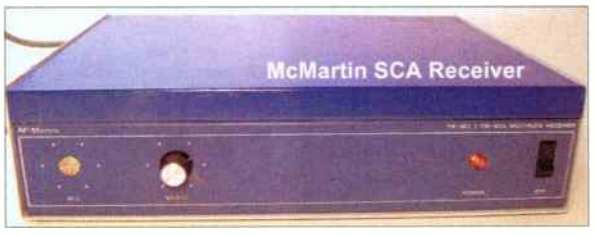
## Happy 40th Birthday TIC Network

*by Steve Callahan*

No, it's not my 40th birthday, but I wish it was. Forty years ago a good friend of mine, Ron Bersani, started the Talking Information Center, a subcarrier (SCA) delivered radio reading service for the blind. Thirty eight years ago I joined him as Chief Engineer, and since then I have had the privilege of contributing to a truly worthwhile endeavor.




The Talking Information Center, or TIC, started as a one room studio in the basement of WATD-FM in Marshfield, Massachusetts. We called it the "egg crate" studio because the sound treatment on the walls was one foot by one foot cardboard egg crates stapled to the walls. By contemporary standards, they weren't too acoustically efficient but we could get lots of them for nothing. From this humble beginning we read daily newspapers the same day and that week's magazines to the blind and print handicapped.




We used reel-to-reels in the early days. Volunteers would come to the egg crate studio and read live, but also record their publications on tape. The tapes were physically spliced together for a delayed, second airing at night. All of this was done from a studio no larger than a generous closet. We relayed the SCA audio to the WATD transmitter via a broadcast loop. We used McMartin SCA receivers in the early days – they were good but expensive, because there weren't too many choices for SCA receivers back then.

After several years, we had the opportunity to grow and to feed the SCA of WERS, at Emerson College, in Boston. This was a huge step forward for us and we utilized another broadcast loop to get the reading service programs to WERS. Subcarrier generators in the early days were of varying quality. All too often you would get one that would generate "birdies" on the main channel and that was enough to convince FM stations not to utilize their SCA capability.

It took a few more years but we had the chance to grow again. This time, we had the opportunity to grow to Worcester, a city west of Boston and to the student radio station at the University of Massachusetts at Dartmouth, which was south of Boston toward Cape Cod. I recall being on roofs in Worcester and Dartmouth with directional FM receive antennas and McMartin SCA receivers, trying to get a usable over-the air signal for rebroadcast. Surprisingly, it worked and we had our third and fourth affiliates. Every time we had a wind storm I could plan on having to re-aim the antennas at Worcester and Dartmouth.


About this time, the late Eric Small developed his SCA generator, the Sidekick. It was the best thing to happen to an SCA. It had built in processing and was extremely flexible, so you could change frequencies in the field from 67 kHz to 92 kHz with just a wire wrap tool. We decided to standardize on the Sidekick at all of the affiliate locations and that was one of the best decisions we ever made.

*(Continued on Page 40)*

## Happpy 40th Birthday!

***– Continued from Page 38 –***

Remember the reel-to-reels back at the studio? With our increased coverage, we needed to increase our local newspaper and publication recording. I built a rudimentary automation system consisting of four Otari ARS-1000 reel-to-reel playback machines. At the time, they were pretty common in most radio station automation systems. The TIC producers would put a 25 HZ cue tone at the end of each 10.5 inch reel, which ran at just 3-3/4 IPS, and that would directly start the next daisy-chained Otari. This system worked just fine as long as you remembered to record the cue tone and one of the splices on the reels of tape didn't break.

TIC always wanted to be a state-wide radio reading service and we proved that we could do it with our coverage of the eastern half of the state. Unfortunately, over-the-air relays to the western half of the state would be next to impossible and broadcast loops, even in those days, were getting expensive. Remember, this was in the pre-Internet days!

We had the good fortune of getting the Secondary Audio Program (SAP) channel of three television stations across the state. In addition to getting to more FM SCAs, this also gave us the ability to provide programming to the Public, Education and Government channels of local cable TV systems statewide. At one point, we were providing 300 PEG channels with reading service audio that filled the times between their recorded video shows.

Now with SCAs at stations in Springfield and Pittsfield in the western part of Massachusetts, we built local studios for volunteers in those communities, to insert the reading of their local publications in the statewide schedule. In those days we couldn't get local newspapers from Western Massachusetts on a timely basis, so we depended on our ever-growing army of volunteer readers state-wide.

We continued to build new studios across the state and at the network hub in Marshfield. Volunteers would come in, practically 24 hours a day, to the seven studios we had for pre-recording publications and serialized books. Where we could, we standardized on studio configurations and equipment to make it easier to diagnose technical questions over the phone. At our remote studios, we had to move the studio locations many times to find the best long-term lease and the right landlord.

One of the worst setbacks we had was when the TV stations that had been letting us use their SAP channels decided that they wanted to put Spanish translations on their SAPs so we had just 30 days to find an alternative. Enter our good friends at Comrex, just up the road in Devens, Massachusetts. Up to this point, we had been a one-way network but some of our local affiliates were producing shows that were very worthy of state-wide distribution. Comrex showed us that telephone company DS-0 circuits were still cost-effective and by utilizing their Euro Nexus codecs we could get two-way communication between each of our affiliates and also provide contact closures to them.

By the time the Internet came our way, we decided that the phone company's DS-0 circuits were getting too expensive and we again approached Comrex for an alternative. The first time I saw a Comrex BricLink, I was sold. That started a conversion to the BricLink which gave us high quality bi-directional audio and statewide coverage at a very workable cost.


Unfortunately, over the years, some radio reading services in other states haven't been as lucky as we have been. Many were contemplating shutting down and closing their doors. That's when we stepped up with the help of Barix Exstreamers. To help keep a struggling reading service alive, we offered them a free Barix Exstreamer so their service could rebroadcast our national feed. At this point, we had added servers for multiple regional program streams in Massachusetts and one national feed consisting of national-interest publications. Presently, TIC provides a national program source to reading services in 16 other states.


It's definitely been a wild ride over the years. We now offer podcasts and audio-on-demand, but the subcarrier audience, which is mostly elderly and not "computer comfortable," still relies on their local volunteer reader and SCA radio to bring them the news and information they depend on. It's hard to predict what tomorrow will bring to the Talking Information Center, but I hope it's another 40 years of success.

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

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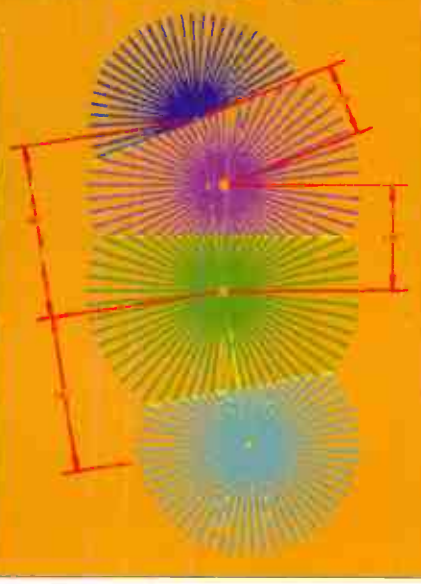

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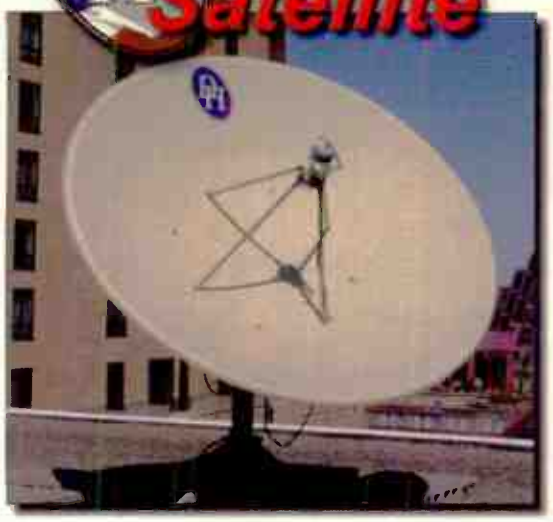

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# Small Market Guide

## Saving Money on a Common Continental Transmitter Problem

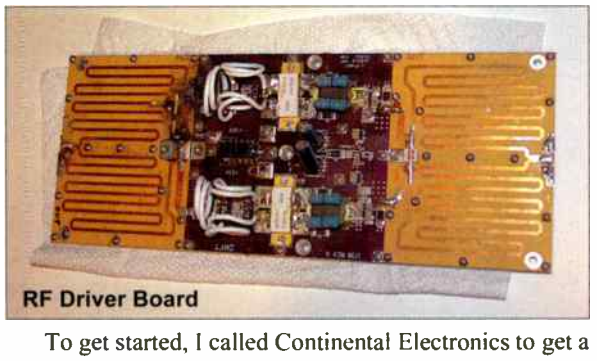
*by Roger Paskvan*

The Continental 816R FM transmitter has been around for a long time. It is a work horse of the industry, finding its way into many small market radio stations. The Continental Electronics company still provides support for the transmitter even after thirty years of service. This article is one engineer's quest to repair a common 816 problem and save money in the fashion of small market radio.

The typical 816 transmitters come in two types, mainly distinguished by the type of drive system to the final amplifier. The earlier versions came with two 4CX250 tubes under the final cavity, that developed 400 Watts to feed the grid of the final tube. Later, Continental replaced the tube driver with a solid state pallet amplifier that sat in the middle of the transmitter with three cooling fans. Incidentally, check these fans often, since if they quit, up in smoke goes your solid state amplifier.

One afternoon, the PD called and said that the Country station was down to 40% power. Of course it was a holiday and close to 95 degrees. I didn't want to go off the air on the 4th of July. A close inspection of the transmitter revealed the drive was real low, about 200 Watts – we had an amplifier driver problem. Normally you could just replace a tube but this was the solid state driver version and half the board was out. I also noticed that all three fans had stopped working, further contributing to the speed of the failure.

I keep a spare amplifier assembly so I installed it in place of the defective unit. In a short time we had 450 Watts of drive and the final was happy at 22 kW, output. The fans can be replaced with **Digikey** part number (381-1094-ND), and they are a perfect fit. The bad board is another animal and not so easy to repair or replace.



RF Driver Board

To get started, I called Continental Electronics to get a replacement amplifier. The price tag was over $5,000 and that blew my socks off. There had to be a less expensive way to repair this. Since the transistors shorted, some of the board foil was burned off. Just replacing the transistors wouldn't do it. I began the search for an alternative replacement pallet. After some Internet time, I found three companies that came real close to the original board. **PTEK** provided a nice amplifier, listed on their website under spare parts, that sells just under $1,000. (Part #110956) Another company **Silicon Valley Power** amplifiers out of Carson city Nevada, provides a direct replacement pallet amplifier, ready to go for $1,095. (Part number PLT-P750-FM-18) This amplifier fits right on the original heat sink. **Communication Concepts Incorporated**, (Communication-concepts.com) provides a board and parts for $375, that will provide 1kW with proper heat sink. The amplifier is called model FM 1 kW Amp. Althoug you have to solder the components to the board, you would have a standby for emergencies. Calling their engineering department, they recommend a 6 dB 20W attenuator pad in series with your exciter to throttle the IC down to 500 Watts at 0.5 Watts drive. A good manual is provided with power curves. This would be a cheap spare amplifier just to have around for a spare.

After doing my homework, I ordered the Silicon Valley Power Amplifier pallet (P750) since it was the most direct replacement for the original parts. Use a generous amount of heat sink grease between the pallet and the heat sink. The board was tested at the shop at 500 Watts and the repaired amplifier was installed in the 816R transmitter. All was well and good as new.

I was able to replace the transistors (Available from **RF Parts**, MRF151G) and repair the burnt foil on the failed pallet board, which made it operational, providing a second spare pallet amplifier for future use. The tricks of the trade help keep our small market radio stations on the air at an economical cost. Let's keep small market alive and well. We all know that nothing in radio runs forever, only this time we are tooled up and ready.

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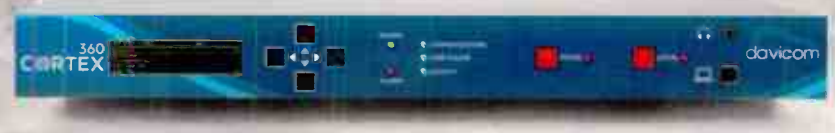


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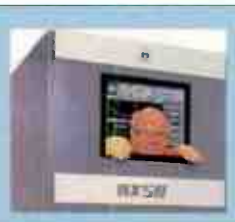

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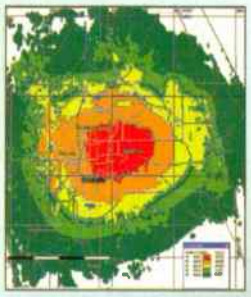

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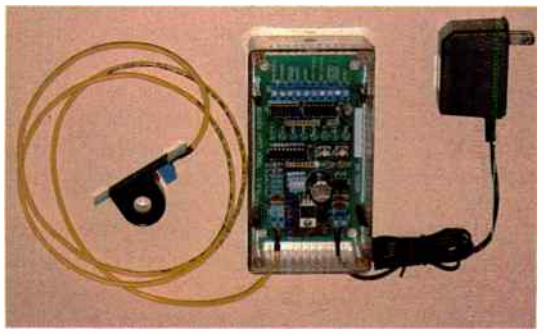

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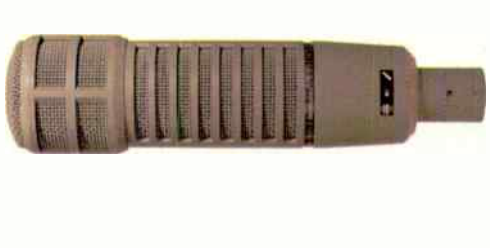



# Gear Guide

## Immigration & Antennas

*by Ron Erickson*

We hear a lot these days about how we need to reform our nation's immigration policies and the last thing I want to write about is something political. But I set the tone with this statement: Our country and the broadcast world is much better off since one immigrant and his son came from Italy in 1997. Hoping to grab a slice of the American dream, Franco Piagentini and his son Dario made that move to a new country – they chose to live in San Diego, California.

Franco worked in the broadcast industry in Northern Italy but his dream was to own a company that built broadcast equipment. An expert engineer in FM Antennas and broadcast equipment, Franco established NiCom. It's not easy to bring out a new broadcast product, let alone launch a whole new line of products. NiCom offers a complete line of FM exciters and transmitters, antennas, FM processors, TV transmitters, auxiliary transmission equipment (like STL's) on virtually any frequency, and a 450 MHz RPU. They also feature the Atlantis audio mixer and the new Atlantis XD studio console.

**Franco Piagentini and His Son Dario**

The competition in the industry is strong with companies like Harris, Crown, BE and Nautel and yet NiCom has not only found a niche for transmitters, FM processors and antennas, they also have a nice audio console which I hope to review here in a future issue. Now, years later, it's a family affair as Franco's son Dario and his wife Shannon Piagentini work together with Franco to offer FM and TV broadcast equipment – proudly stating: "Made in The USA." Dario and Shannon have three sons and, who knows, maybe they'll all be part of the family business one day.

In my capacity as a broadcast equipment sales engineer, I have had the wonderful experience to get to know the Piagentini Family over these many years. The equipment and FM antennas they offer have been very reliable and they provide excellent customer service – like you, the customer, were an extended family member.

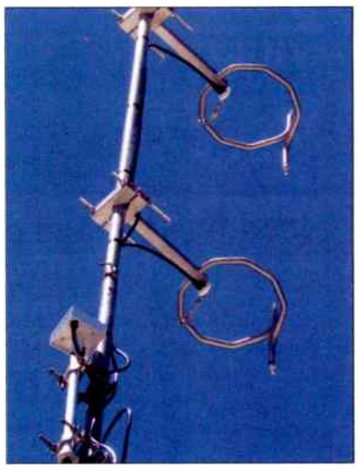
Now that you know the people, let's examine the FM antennas they offer. My favorite is the NiCom BKG77, a broadband circular antenna with an inverted V design. Made of stainless steel, this is a fairly heavy antenna. I have used this antenna in building a number of low power applications, both LPFM and translators. One installation in Oroville California had me very concerned because the transmitter site was so elevated that the FCC lowered the transmitter power to 33 Watts. Since the city was about seven miles away, down a hill hugging road, I was positive that the signal in town, and even the car signal driving into town, would be a disappointment. To my surprise, during the first ride down the hill, reception was near solid, without noticeable multi-path. I will say shadowing of some buildings created areas of fade, but overall, the performance of the 33 Watt signal was impressive. We also had a report that a small portable radio inside a house downtown received the station using a simple rod antenna. Dario recently told me that the company will have a lighter weight version of the BKG77, made from aluminum, in the near future.


More recently, I worked with another LPFM. This time the challenge was a low elevation antenna site with a short roof-mounted tower. The station started using a dipole antenna which generates, as you may know, a vertical only signal. In this case a BKG77 would be too heavy in a two bay configuration. With the lower elevation rooftop, we needed to maximize the coverage while minimizing the level of RF at the site. To fit all these requirements, I chose the NiCom BKG88, two bay antenna. Why two bays? Imagine, if you will, a giant invisible donut with the hole centered at your antenna array. The relationship between the bays causes this type of effect, pulling in the radiation above and below the array. The result of installing the new NiCom antennas? In a word, excellent. The transmitter confirmed that there was all forward and zero reflected power.


**Dan Mooney from Ridgeline Broadcast Service, Marcola Oregon**

The cost of NiCom antennas is lower or competitive with most other companies and the quality is never compromised.

Special thanks to Dan Mooney from Ridgeline Broadcast Service, Marcola Oregon. Dan performed the installation and is shown on top of the tower in the photo. By far, he is the best tower guy I've ever worked with.



Shown here, is the final installation photo of the half wave spaced, two bay BKG88.

For you LPFM licensee's, before ordering a two bay antenna for your low power station, consult with an engineer to determine if it is right for your situation. Only a reputable engineer *(check 'em out before paying any money)* can determine if your station could benefit. An LFPM is still limited to 100 Watts ERP (Effective Radiated Power)

Antenna Gain is a term you've probably heard. A common misconception is that your signal strength doubles for every antenna bay you add. *Fake News!* Actually while a dipole antenna ideally has a one to one ratio (1 Watt in = 1 Watt out), a circular antenna, due to the fact that it is operating vertically and horizontally, has roughly a 0.47 to 1 ratio. It takes *more than twice* the TPO (Transmitter Power Output) to create the proper ERP. It is generally accepted that a three-bay antenna will provide two times the Effective Radiated Power. Of course you will also have loss of power in your coax or transmission line– your amount of line loss will depend upon the length and type of coax used. Again, consult your engineer.

You can discover complete information about NiCom antennas and other products on-line at www.nicomusa.com

FYI: No matter how many antenna bays are used, the "center" of radiation will be at the middle of the array. FM Antenna bays are mounted a certain distance apart in a vertical line with each other bay. Usually full wave spacing requires nine to ten feet of vertical "Real Estate" on the tower. The exact distance will have an effect on the amount that the "invisible donut" of RF radiation is compressed.

*A quick historical notation: Originally, FM broadcast stations were supposed to radiate a horizontal signal – so chosen as the best technical choice for high fidelity music reception at fixed locations. With portable radios and car radio antennas being vertical, it was decided that radiation in both horizontal and vertical would be acceptable.*

---

*Ron Erickson, Owner EBS Radio, may be reached at 541-460-0249 or at ronerickson@gmx.com*

# Final Stage

## RADIO ROUNDUP

### The Radio Guide Event Register

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

**2018 Nebraska Broadcasters Assn. Convention**
August 15-16, 2018
Embassy Suites, LaVista, NE
http://ne-ba.org/news_and_events-convention.asp

**NAB Radio Show**
September 25-28, 2018
Orlando, Florida
www.radioshowweb.com

**2018 IEEE Broadcast Symposium**
October 9-11, 2018
Key Bridge Marriot, Arlington, VA
http://bts.ieee.org/broadcastsymposium/

**WBA Broadcasters Clinic**
October 16-18, 2018
Madison Marriot West, Middleton, Wisconsin
www.wi-broadcasters.org/events/broadcasters-clinic

**Ohio Broadcast & Multimedia Conference**
Novenber 8, 2018
Columbus, Ohio
http://oab.org/engineering/obec/

**2019 NRB Convention**
March 22-29, 2019
Anaheim, California
www.nrbconvention.org

## Radio Guide Advertiser Info – July-August 2018

| Advertiser - Page | Website |
|---|---|
| Altronic - 39 | www.altronic.com |
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| Arrakis - 17 | www.arrakis-systems.com |
| Axia - 35 | www.telosalliance.com |
| Bay Country - 3 | www.baycountry.com |
| BDR - 43 | www.thebdr.net |
| BEXT - 4 | www.bext.com |
| Broadcasters General Store - 33 | www.bgs.cc |
| Broadcast Electronics - 20 | www.bdcast.com |
| Broadcast Software Intl. - 19 | www.bsiusa.com |
| Broadcast Tools - 37, 46 | www.broadcasttools.com |
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| Davicom - 43 | www.davicom.com |
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| Deva - 22 | www.devabroadcast.com |
| DH Satellite - 41 | www.dhsatellite.com |
| DM Engineering - 46 | www.dmengineering.com |
| Econco Tubes - 42 | www.econco.com |
| Enco - 43 | www.enco.com |
| ESE - 47 | www.ese-web.com |
| GatesAir - 21 | www.gatesair.com |
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| Henry Engineering - 2 | www.henryeng.com |
| Inovonics - 1, 27 | www.inovon.com |
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| Propagation Systems (PSI) - 36 | www.psibroadcast.com |
| Radio Systems - 28 | www.radiosystems.com |
| RF Specialties - 43 | www.rfspecialties.com |
| SCMS - 13 | www.scmsinc.com |
| Shively - 40 | www.shively.com |
| Smarts Broadcast Systems - 15 | www.smartsbroadcast.com |
| Stackley Devices - 47 | www.stackleydevices.com |
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