Radio Guide

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March-April 2017 – Vol. 25, No. 2

Using Mic Processing in Noisy Environments

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Using Mic Processing in Noisy Environments

by Dee McVicker

Dee McVicker *has spent hours listening to and learning about audio processors, having started her broadcast career with audio processor manufacturer CRL. She is now part of the marketing team at Wheatstone.*

There's an old saying that if you hang around a barbershop long enough, you'll eventually get a haircut. Along these same lines, a similiar idea holds true in radio: if your studio environment is acoustically less than ideal, sooner or later you're going to get noise.

Of course, noise routinely happens in radio, and that's why most of us have a basic understanding of mic processing. We regularly use mic processors to smooth talent voices, but often it's also used to quiet air conditioner rumble from a vent directly above the mic or to mute a noisy fan from a nearby PC. But what of the lunchroom-turned-into-a-makeshift-studio that is still lacking adequate soundproofing? Or a repurposed room with odd acoustics?

Mike Erickson, Wheatstone's audio processing expert, walked me through a few techniques that might help.

First, consider using a good dynamic microphone instead of a condenser. A condenser mic will pick up every little sound, good or bad, whereas a dynamic microphone such as the Electro-Voice RE27 or Heil PR40 will be far less sensitive to sound—including noise. Erickson often makes the argument that instead of spending $3,000 per condenser mic, why not spend $300 on a good dynamic mic and invest the remainder in sound treatment?

EXPANSION — Your most useful ally in a noisy environment is a mic processor's expander section. This suppresses background noise by dimming the output once the microphone signal falls below a certain level. How fast and how much it does this will determine how natural (or unnatural) the resulting sound will be. Control parameters vary by processor, from basic (upper) to complex (lower). Generally speaking, the noisier the room, the more useful additional control becomes.

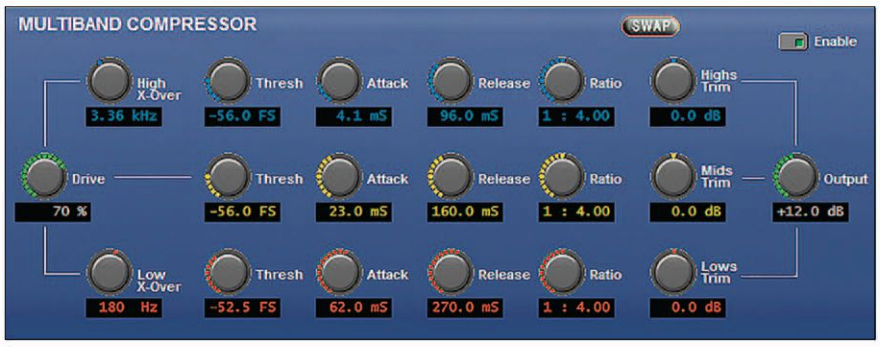
Setting the Expander for Noise Suppression

Next to the right microphone, your most useful ally in a less-than-ideal environment is the mic processor's expander section. The expander's purpose is to reduce the output signal once the input signal has fallen below a predetermined threshold. Put another way, the expander can suppress room noise. Most mic processors will give you expander threshold and depth controls for setting at what point and how much downward expansion is permitted, but a few will also give you a "close" control so you can adjust how quickly the expander acts. This last control is important because the faster the expander closes, the less opportunity there is for noise to pop up after an announcer stops talking.

In our own Wheatstone M1, M2 and M4-IP mic processors the close setting varies between 50 milliseconds and 3 seconds, with the former at the high end for aggressively attenuating noise and 3 seconds on the low end for more natural sounding ambience in a quiet room. The noisier the room, the faster that setting will need to be. But be careful! If you set the expander too aggressively in a quiet studio, it can sound "like it's sucking the jock right out of the room," says Erickson. Not enough, and you'll hear noise creep. You're aiming for a setting somewhere between these two extremes.

Compression Settings

The mic processor's compressor can also be an important tool for getting noise under control. The role of the compressor is to average out mic levels so the audio maintains a consistent, predictable output energy. Two compressor settings are especially important for noise control: the ratio and how fast the release time is set. The ratio represents the amount of gain change relative to input and output. For example, if the ratio control is set at 3:1, the input gain can change 3 dB but the output gain will only change 1 dB. A 1:1 ratio results in no compression at all, whereas a 20:1 ratio makes the compressor operate more like a limiter. The bigger the difference between these two numbers, the more the processor will take wide ranging levels and compress them together into a dense output.



COMPRESSION — The mic processor's compressor averages out mic levels so audio output remains consistent. It does this by taming peak levels and bringing up softer content. Your studio's background noise level will dictate how hard you need to push this process. Too little (low ratio and slow release) and vocal peaks (think excited sports announcer) will overload the signal; too hard (high ratio and fast release) and the compressor will start pulling background noise up into the vocals. The goal is to strike a working balance. Naturally, multi-band processing will allow you to 'nip-and-tuck' your signal more effectively than a single broadband circuit.

For especially noisy environments though, a higher compression ratio can work against you. This is because a high compression ratio is more likely to drag up unwanted background noise along with vocals, compressing both together for an overly busy sound. In noisy environments you'll want to keep that ratio on the lower end, enabling the announcer's voice to come through without pulling up surrounding noise.

Your compressor release setting can also make a difference, essentially determining how fast the compressor returns the gain back to normal after chasing an audio peak. In addition to exaggerating any reverb in the room and increasing the amount of intermodulation distortion, a very fast release setting can accentuate the speaker's breath sounds and other unwanted background content that would otherwise be inaudible. If you have a Wheatstone mic processor, you'll want to set this control closer to the 1 second rather than the 33 millisecond setting.

Don't Forget Your Filters!

In addition to compression and downward expansion controls, you should take advantage of the mic processor's filtering features. Most mic processors come with standard presets for suppressing the noise floor when no audio is present; ideally these are triggered to speech. For example, in Wheatstone mic processors the downward expander's sidechain is filtered to voice frequencies, which radically reduces false triggering. Filtering is used to roll off background noise at the upper or lower end of the spectrum.

These go-to filters are familiar to most broadcasters as a matter of course, so we won't go into detail here, except to say that there are no better tools for attenuating above a certain frequency (low-pass) or below a certain frequency (high-pass) to get rid of obvious noise issues such as traffic rumble or a squeaking computer fan. Rolling off these unwanted frequencies before you apply EQ sculpting allows you to optimize equalization across the remaining spectrum without having to take the unwanted noise into account.

Two Pairs of Ears

When making mic processor adjustments it's important to have two people in the room: one person to change the settings and the other to listen off the program bus through a familiar set of headphones (make sure you get a good seal around the headphones so you're not picking up feedback). This is not a do-it-yourself endeavor; if you are the only one adjusting and listening, you won't get an accurate representation of the sound because you'll be hearing your own voice in both the headphones and through your head. If you don't have a buddy, an alternative is to record the audio along with setting changes and listen to the playback.

Finally, it's critical to optimize the mic processor before you move on to the air chain. Most on-air audio processors today are good at handling voice, according to Erickson. "In most cases, any kind of improvement you do with a mic processor will make the downstream processor sound better as well."

But if you find that programming through the on-air processor doesn't sound good after you've adjusted the mic processor, he suggests going back to your mic processor and changing the settings there before making any adjustments to the on-air processor.

If you change the on-air processor to make the mic sound right, chances are you'll compromise the program in other areas. Whatever you do, don't start adjusting the mic processor and on-air processor at the same time. "You'll just end up changing too many variables – probably for the worse," says Erickson.

For more information on microphone signal processing, as well as on-air processing in general, check out Mike Erickson's videos at Wheatstone's website by clicking on the link below:

http://wheatstone.com/mic-processing

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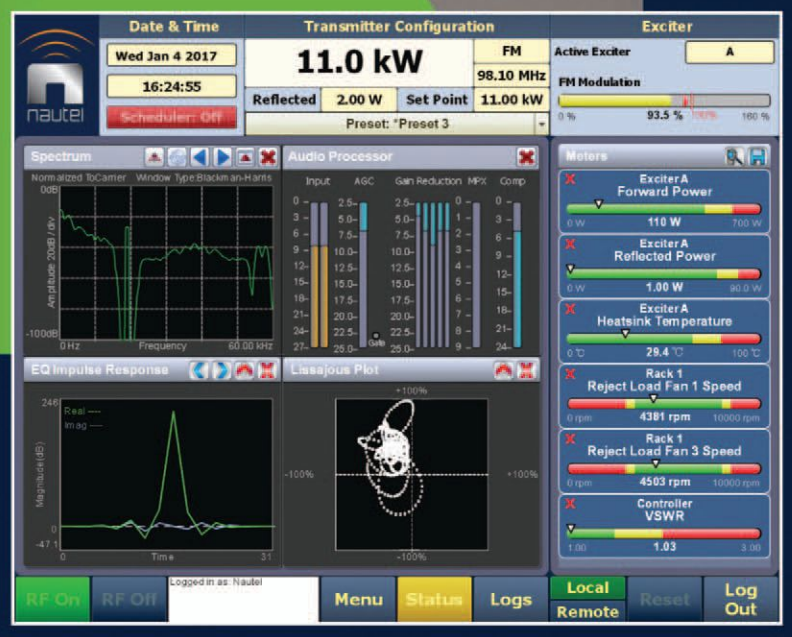

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On the Record

Could We Have a "Vinyl Countdown" Comeback in Radio?

by George Zahn

I don't know if we'll need Dr. Emmett Brown's DeLorean, but the more I witness store displays and speak to colleagues, I actually feel compelled to write about something that, fifteen years ago, I'd never have seriously considered: Could radio find a niche for, or return to vinyl? Don't get me wrong. The days of American Graffiti, Wolfman Jack, and the Outer Limits initial *Galaxy Being* episode and their radio studios are mostly long-gone (although SETI might want to look into that Outer Limits pilot!).

OK, I've reached the Radio Guide limit of historic references. This is today, and just as it has from time to time, vinyl recordings are showing a groundswell of support from audiophiles to hipsters and some radio hosts, who feel that the vinyl experience is sonically more complete. Some contend it is a fuller and warmer sound and less sterile than digital conversion. Others will say that the durability of the digital medium is the greatest advantage and the loss of some frequency response and fidelity for streaming, or the seeming "sterility" of digital, is acceptable.

Tale of the Tape

Some recording artists and producers still prefer the first generation of their work being recorded to analog tape. Some argue that the resulting sound is different, even after it's transferred to digital media. Others record analog due to a concern about logarithmically developing digital formats, rendering today's recordings archaic and unplayable, making their masters useless. During the last holiday season, some of the major department stores that rarely sell electronics, had large selections of vinyl LPs and cheaper portable, high end, or even a few USB-friendly turntables for sale – right in the middle of the young men's clothing section. I thought there was a rip in the time-space fabric.

Then a fellow radio and TV colleague shows up at my station with a wonderfully retro, yet brand new, clear vinyl LP. The record is accompanied, in its packaging, by a companion CD of the same material. Some of those in our industry are truly "geeked out" by the possibility of vinyl bouncing back. Others are terrified of the costs and retrofitting studios. While some experts will argue otherwise, this may be one of vinyl's strongest comebacks. I'd love to know if your station is indeed featuring any source material from vinyl by choice.

If your station wants to vault back to yesteryear, you may need to add turntables, even if they're used just for a specialty show. Some of the old time turntable rules still apply. Perhaps, like our station, you managed to keep a few turntables in good working order. We still have a few old Technics direct drive models that have weathered well. If you're back to square one, here are some models used in radio stations.

You Say You Want a Revolution?

Good turntables will range from a few hundred dollars to well over a thousand dollars. The classic Technics SL1200 MK2 that many of us may have used as youngsters can still be found in used condition. The latest and greatest Technics line includes a the SL1210MK5 which can run upwards of $1,900 or more. If you're more inclined to just "dip your toe into the water," there are less expensive options.

When I was cutting my teeth in radio, Stanton was more known for their cartridges, the part of the record player that, along with the stylus, transduces the groove vibrations into audio. Stanton now makes a wide line of turntables including the ST150, which lists for under $800 but can often be found in the $500 range. There are other models from Stanton, Audio Technica, and Numark that will scale down to under $150. There are also some turntables that feature USB output that allow for real-time transfer of the record audio to digital.

Technics SL1200 MK2

If you're using the turntable for airplay, you'll want a direct drive player that allows for cueing. While we're on the cueing topic, I'm flashing back to the damaged records from college days in which, even with a decent stylus and cartridge, the first 5 seconds of most of each song succumbed to cue burn from continuous back cueing and airplay. Shure makes a broad range of cartridges, some such as the Whitelabel model suited for back cueing. Other manufacturers include Ortofon, Audio Technica, and Numark, but the best option of cartridge and stylus is widely debated and remains a very subjective choice.

Grading on the Curve

Long-timers will recall that the RIAA (Recording Industry Association of America) has a set equalization curve for vinyl recordings. The stylus rides in the groove and moves up and down while reading the sides of the crevasse for stereo information. It's important to note that if the original bass frequencies were represented in the groove of the record, the stylus would literally leap out of the channel. Hence, bass must be attenuated while treble is enhanced before the record is pressed.

Turntables run through a pre-amplifier (sometimes called a "stage") that restores the bass and treble frequencies to their pre-vinyl state. The bass is basically attenuated for the vinyl transcription by up to 20 dB and must be brought back to have the fullness of the original master. Just as with microphone pre-amps that bring the full spectrum of a mic's level up to usable levels, it's important to have a phono preamp that does its job without adding any amplifier noise to the analog chain. There are more than a dozen manufacturers of preamps, and in many ways, the specs will read similar to the frequency response you might see for a microphone. Since it is also an amplifier, it's important to note harmonic distortion specs on the preamp.

Placing turntable audio into the broadcast chain in 2017 brings up some questions that we didn't have to ponder in the 1970s. In the days of an all-analog chain and storage system, the artifacts that made vinyl unique in sound were basically preserved. Most stations would take tracks from a 45 or LP, and record the individual songs to a cartridge analog tape and play the tape on the air. Lower budget stations often played the records directly on the air. The negative result was the natural damage to the record that occurred when the record was repeatedly cued to the beginning of the song on each use (even when using a decent broadcast quality stylus).

As most stations were playing tracks from carts, the worst sonic addition was some tape hiss inherent to the analog tape in the cartridge. Other potential drawbacks were existing record surface noise (pops and crackles depending on the condition of the vinyl), and wow and flutter introduced by cheaper turntables and the tape transport mechanism in the cart. CDs solved many of these issues, and the resulting evolution to digital audio delivery and digital consoles begs another question about using vinyl in our on-air signal.

If we simply transfer a vinyl track into an audio file on our digital hard drive, perhaps converting to an MP2 or similar format, aren't we simply "gutting" the vinyl desirability in converting it to digital? The argument could be made that the difference in the original material (Vinyl versus CD or other high quality digital file) might still make a slightly different result in the stored digital file on our system.

Ear of the Beholder

A more cynical ear might question whether our listeners can hear the difference in this day of "dummied down" MP3 files when some consumers are more worried about how many songs they can fit onto a drive or device, hence sacrificing overall quality. The other interesting phenomenon is the streaming Internet-only "stations" that feature vinyl playback. Given the lower streaming rates of these outlets (to maximize an station's bandwidth on a budget), the content is often so watered down that whatever content (vinyl or digital), will never be a high fidelity representation of the original.

I still argue that we should still strive for the best quality. If the point of differentiation for a program (or a station) is the fact that vinyl is featured, it's best to take the "high road" and keep the product at its best fidelity throughout, and hope that if there is enough difference to the "sound" of the vinyl that it will still cut through the digital conversion.

Another element beyond the studio is our station audio processing before and at the transmitter. For stations who are experimenting with or regularly using vinyl, are there EQ tweaks or changes that are needed to maximize the vinyl textures? After compression, is there enough difference to justify the needed changes?

I know I've asked a lot of questions in this article, and it's a chance for us to learn from those who may be playing and spotlighting vinyl on the air. Some stations playing older tracks may occasionally pull a needed song from a record and simply add it to their digital library. At my station, when we do that, we try to do a simple surface clean up on the record via Adobe Audition. This may be heresy to some.

I am very interested in knowing if your station is utilizing vinyl to any significant extent? What difference does it bring, and does that benefit transcend any of the digital or processing hurdles? Will we have a vinyl revolution? Let us know and we can share thoughts in future issues.

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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A Day in the Life

by Scott Schmeling

You wouldn't believe my day!

My drive to work is roughly 30 miles. When I hit the road for Mankato this morning, my plan was to change-out a couple of rack-mount UPS's and work on some plans for a production studio we demo'd for remodeling three days before. However, a phone call along the way changed those plans. But we engineers are nothing if not flexible, right?

We have a studio in New Ulm (the town I live in). Dave called from that studio to ask if I could stop there – something very strange had happened. The carpet had been shampooed the night before and today *none* of the lights are working! I was just coming up on an exit so I turned around and, after stopping at home for a ladder, I went to the studio.

The first thing I noticed was water dripping down the front door – and there were blowers all over circulating the air. Everything felt damp. It was like a sauna, without the heat.

You know how, if someone tells you the paint is wet, you *must* touch it, just to be sure? Well, the first thing I did was turn the light switches on. Of course, I knew Dave had already tried that. It wouldn't have been the first time that, after hearing an explanation of how something didn't work, I would hit the switch and everything would work just fine. But this time it didn't work for me, either!

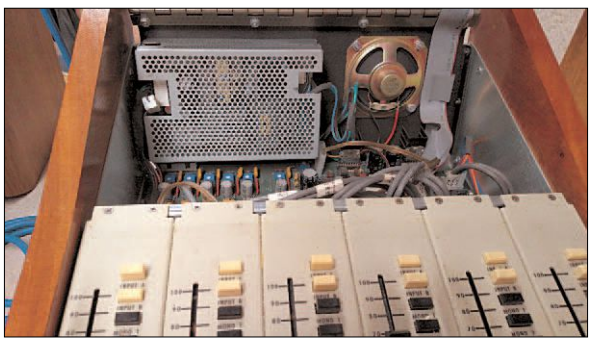
I don't know about you, but I've never seen anything like this. Funny thing was, everything else appeared to be working just fine. I climbed the ladder and opened the junction box above the ceiling to be sure we had 120 Volts going to the light fixtures ... check!

So I called Paul, my electrician friend. His company had done work for us in the past and he knew this building "backwards and forwards." He checked around and everything was fine – all the breakers were on, voltages were correct and steady, neutral was good, and the ground was good. But apparently all of the ballasts had gone out! Well, actually, all but one – the one in the bathroom. We're guessing that light probably had not been turned on while they were shampooing the carpet.

We talked about our options. We could swap out the old drop-in fixtures for new ones. But that's really harder and more time consuming than it sounds. Plus, you're purchasing a whole fixture. We could replace *all* of the ballasts, but, again, it's not cheap and is quite time consuming. Another option was to replace the fluorescent fixtures with new drop-in LED fixtures. They would be much more energy efficient. We chose to retro-fit the existing fixtures with LED replacement tubes. The ballasts are removed, wiring is modified, and the LED tubes slide right in to the old fluorescent sockets. And for a trained professional like Paul, it's a pretty quick process.

Speaking of trained professionals, I asked Paul if I could watch while he installed the LED tube. He said something like: "Don't tell me they have *you* doing this!" As I started to respond, he repeated, "I said *don't* tell me ...!" Then he said something about a $10,000 fine and possible jail time! I was under the impression it was OK if I was doing this where I'm employed. Paul said, not if I'm not a licensed electrician. I guess I have a few (more) things to learn. We'll look at more of that in a coming article.

While we were checking out the lights, Dave noticed his audio console was dead. This is a 6-channel Dynamax MXE console. We had no lights, no logic, and no audio. The console has a +/- 15 volt supply mounted inside a vented enclosure and tucked inside the far back of the cabinet. We opened it up and measured 0 Volts on both outputs – and yes, we checked the fuse!

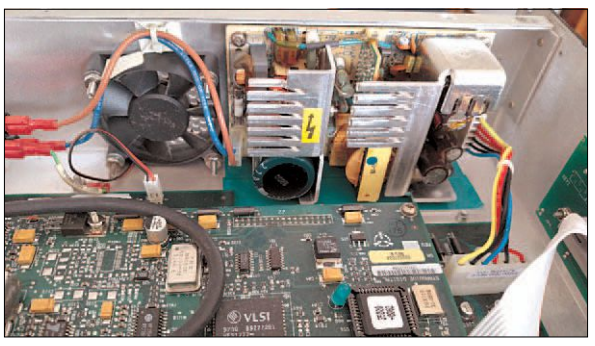


Dynamax Power Supply in Vented Enclosure

Have you ever looked inside a satellite receiver? This supply reminded me of supplies I've seen in some receivers. It has a 2-pin Molex connector on one end for AC in and a 6-pin Molex on the other end for DC out.

I headed out to a nearby transmitter site where I have a variety of semi-retired equipment "in storage." I have been the subject of criticism in the past for not throwing things away when they're no longer being used. But I think many of us have become savers and scavengers to a certain extent.

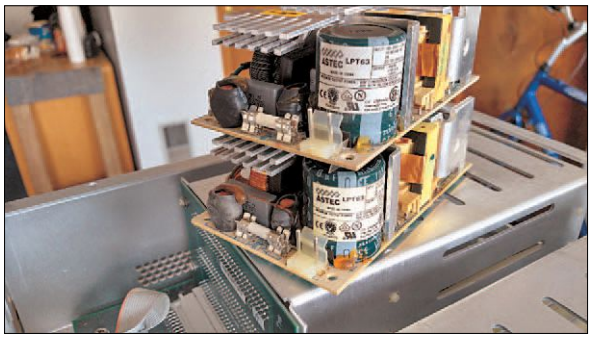
I knew I had some older consoles, among other things out there, and I figured there was a better than fair chance something would have the voltages I needed. The first couple of things I checked would not work. Then an old Starguide satellite receiver caught my eye. I remember when the Starguide receivers replaced the Scientific Atlanta SEDAT receivers. The SEDAT's had been around for years, but the Starguides had so much more flexibility and relays that could be mapped, I figured they'd be around for decades. I was surprised just a few years later when advances in technology rendered the Starguides obsolete and they were replaced with the XDS receivers ... but I digress.



Starguide Power Supply

I took the cover off the Starguide, plugged it in and checked voltages. I found a +5, then a +15 ... and a -15! That's what I needed. Hopefully the current rating would be high enough to handle the console load. We'll find out. I put a couple screws in the cover and headed back to the studio. On the way back, I was visualizing the Starguide sitting next to the console and a few wires going in to the back of the console. Not pretty – but it should work.

When I got to the studio, I took a closer look at the inside of the receiver and decided to pull the power supply out. As I was doing that, the supply seemed somewhat familiar. I took the console supply out of its enclosure to compare the two and discovered (are you sitting down for this?) they were *identical!* They were the same manufacturer and the same model number. Never in a million years would I have guessed that would happen – I mean, what are the chances I would find an exact double in an old satellite receiver?



Identical Starguide and Dynamax Supplies

My task suddenly became a lot easier. I put the receiver supply in the vented enclosure, pushed the input and output connectors into place, mounted it back into position, applied AC and (quite literally) crossed my fingers.

The first thing I looked for – and didn't see – was smoke. That's always a great first sign. No smoke, no sparks, no unwanted noises. So far, so good. The channels turned on and off, lights went on and off, and we had audio! I did a little happy dance – when no one was looking.

We still don't know exactly what caused all of this. We assume that something occurred during the carpet shampooing process that caused a problem in the power line, blowing all of the ballasts and the console power supply. Further investigation may turn up something else, but for now that's all we've got.

To me, this also affirms the value of holding on to equipment that is no longer being used. If I had disposed of those Starguide receivers we would probably be waiting for an overnight shipment of a new supply.

We have lights and are back in full operation. *And*, this all happened on my wife's birthday! And, yes, I *did* have a card and I sent flowers ...

That's all for now. Until next time, keep it between 90 and 105!

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

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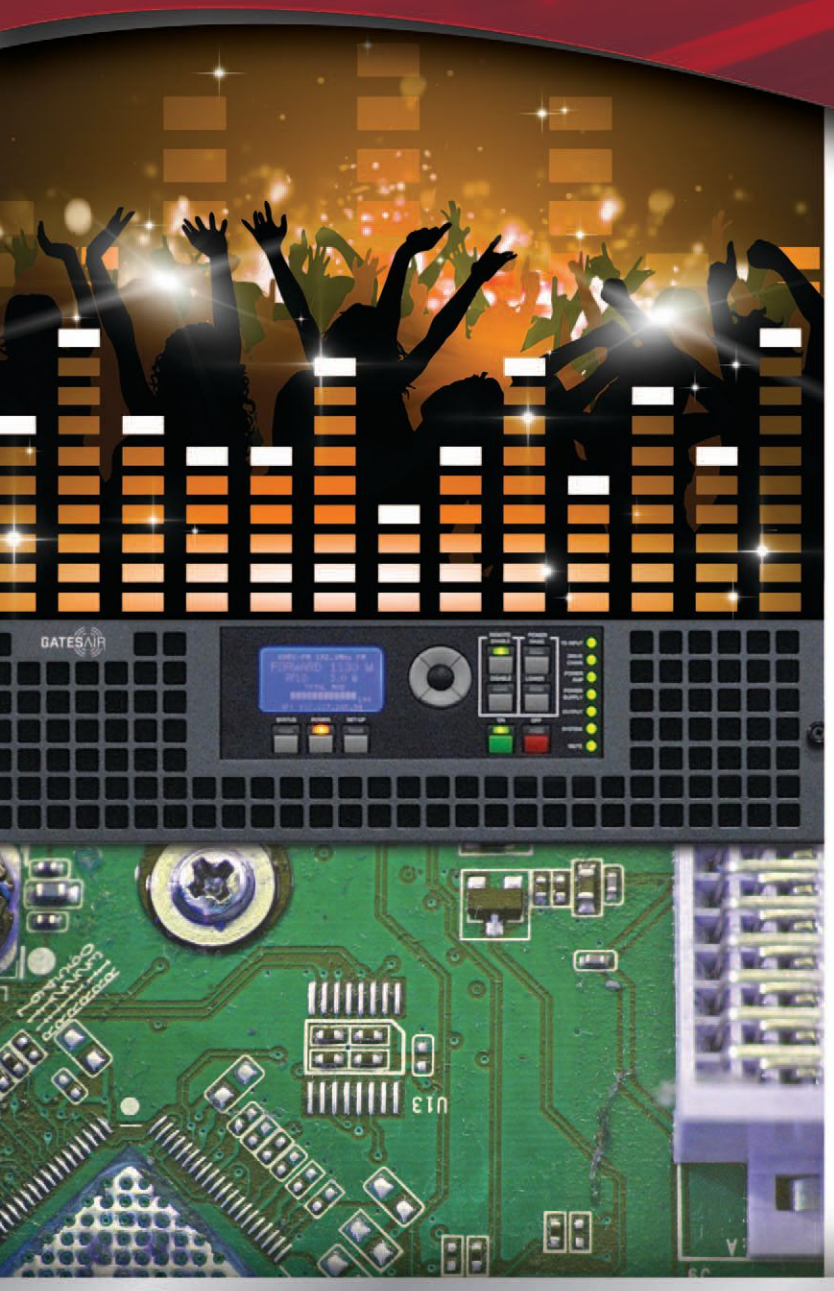

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Tower Topics

Who's Monitoring the Tower Lights?

by Michael Bradford

Lin and I were on a short trip into northern Ohio during an evening in June last year. I noticed a tower outside a small town without a top beacon and, as we were passing right by, I turned into the driveway to jot down the ASR number. You may ask why I even bother to stop, but on more than one occasion, a quick stop has generated a quick project and saved a tower owner a serious fine from the FAA.

First of all, I noted there was no fence around the tower – no RFR warning signs anywhere, no ASR sign to be found – and a tower badly in need of painting. Any one of these omissions could lead to a fine and if the tower happened to be in a flight-path to a local public-use airport, an even more serious problem.

I have to deviate for a moment to recall another incident involving a self-supporting tower (SST) south of Chicago that occurred about three years ago. A client asked me to check out the lighting controller, as the neighbor had reported no strobe at night for some time – even though my client was paying a monthly monitoring fee for a third party to keep an eye out for a lighting failure. In any case, as I pulled into the compound I found a great perimeter fence, proper signage, the grass mowed, and gravel smoothed and graded inside the compound. Once inside the compound, I located the stainless-steel controller "box" and removed the cover. What a surprise! Instead of a neat and clean interior, the whole inside was one huge mouse nest. I donned some rubber gloves and grabbed a snow brush from the truck and began to clear out the rodentia. I found bulging capacitors, chewed wires, rust everywhere, and a phone cable chewed and dangling loose. Obviously, there was no connection from the modem to the outside world, so monitoring was impossible. This begs the question, "How did the monitoring company actually check the lights?" Just about then, the neighbor walked over to say, "Howdy" and we discussed the missing nighttime strobe. He confirmed that the light had not been on for over three years! He also told me two months previous, an accident had occurred at the intersection about 1/4-mile south of the tower site. Emergency Air Transport had been called in by the Sheriff from De Kalb, Illinois. En route, the helicopter had missed the unlit tower by about 100 feet according to the Sheriff. The neighbor also said the Sheriff had a Stihl Power Saw in his hands and was headed over to cut down the tower (probably not a good idea as the SST is about 350-feet AGL), before common sense kicked in and he gave it up as a bad idea. In any case, if the helicopter *had* hit that tower, the ensuing law suits and fines would have most likely bankrupted the tower owner.

Sorry I got sidetracked for a moment, but here I am again, talking about that little tower in Ohio. I used my GPS to get the coordinates and I obtained the ASR number from the FAA data-base and jotted down the owner's phone number. There was no answer at the number that evening, so I vowed to contact the owner first thing in the morning. I called what turned out to be the town's only radio station and the "morning man" told me the remote control showed no trouble with the lights and I must be mistaken! I waited until after 9:00 a.m. to talk with the manager, who also insisted there was no issue with the lights. He also told me the tower had been relamped with the "very latest LED bulbs" the previous year and all was well with the world. He gave me the number of their contract engineer from a nearby city and I called him just to chat. Turns out, the original controller had never been upgraded to sense an LED failure and the station depended on a neighbor to report any "troubles."

At several other stations I checked on, during these road trips, I found that they were automated overnight when, in the past, there had always been a "warm body" on duty to observe the remote control for a "lights out" indication. It dawned on me that this situation was probably more pronounced during these financially tough times for many radio stations – and small-town stations in particular. I also wonder how many cell towers, Public Safety towers, water towers and such, may have no way to comply with the FAA/FCC Rules regarding observing and reporting tower light malfunctions.

FAA Rules stipulate that the *malfunction* of any flashing light has to be reported within 1/2-hour to the FAA Flight Hazard Reporting Center. According to the FAA, "Malfunction" means outright failure, flashing too fast, flashing ratio not proper, on but not flashing, or one of two beacon lamps burned out anywhere on the tower.

The above stories serve to tell you how I became interested in an alternate monitoring system for tower lighting. I began searching the Internet for "wireless monitoring systems" and found many to choose from. I also discovered that many of the systems were designed to monitor generator units and provided features to log run-hours, engine summary alarms, even battery state-of-charge. Upon further investigation, I found that a slight modification of these wireless monitoring units would accommodate a tower light controller's alarm contacts easily.

I settled on a basic model PPE-842 module from Ayantra; the unit features an on-board battery back-up in case of primary power failure, 5 alarm inputs (two of which are intended for generator status reporting) GPS tracking and two dual-purpose antenna choices for optimum mounting. I talked with sales manager, Andy Rogers, and in three days I had one of their modules in my hot little hands for a 30-day T&E.

I bought a suitable Stahlin fiberglass enclosure (see **Figure-1**) and mounted the monitoring unit, small power supply, two remote-controlled relays and a terminal block so I could demonstrate the unit. I also installed a small toggle switch on the front panel to simulate an "alarm" for show-and-tell.

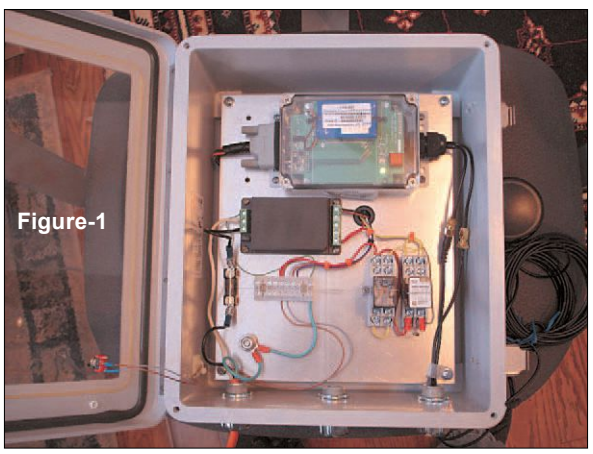
Figure-1

The two relays shown are for remote starting of a generator (or command to a tower light controller to switch from "day" to "nighttime" mode) and monitoring of actual output from a generator. (Ever have a generator start and "run," only to discover that Mr. Mouse and friends had damaged the voltage regulator and the generator was not producing any output voltage?) The Ayantra web site lets you set up email recipients and text destinations for selected alarm notices, determine log entries and alert definitions. I tested all the alarm inputs on my demo unit and set out to make a presentation to a client early in the morning. As I passed around the Stahlin enclosure with the AC cord plugged in, someone tugged a little too hard and unplugged it – with 18 seconds, my cell phone chirped with a "loss of battery" alarm. At the same time, another inquisitive tech flipped the little toggle switch – again, in about 18 seconds, my cell phone chirped with a "#1 alarm" notice. This presentation led to a sale of a self-contained system for the client's generator and it was fun watching people's eyes light up during the "tests."

Granted, the GPS feature isn't a big factor where a radio tower is concerned, but if you have a portable generator that suddenly moves from your assigned site, you can actually track its location on a map available on the Ayantra website and alert authorities.

It's nice to note that you could use a "system," similar to the one I built, to monitor your on-site generator *and* the tower lights, separate from any existing remote control. It could alert several staff of any FAA reportable malfunction and provide you with a hard-copy log for filing. If your contract engineer lives many miles (or hours) away, he could still call the FAA and obtain the NOTAM from anywhere he might be – and in less than 30-seconds from the actual event.

Interfacing with the popular TLM-1 or 2 monitor units from Stoney Owens is a cinch **(see more info on page 45)**.The open collectors on this monitor have a common emitter that appears separately on the terminal strip. Most other lighting controllers have dry relay closures for summary alarms. The enclosure I chose from Stahlin is weather-proof and can mount outside near a controller at the tower base or inside the shelter. The Ayantra module itself is weather-resistant and could mount near or inside your controller if space allowed. If your controller doesn't provide a source of 12-24 VDC you could use a small wall-wart or modular power supply (as I did) for primary power. The unit draws less than 1amp in full transmit mode. It comes with step-by-step instructions, a 6-foot wiring harness and "hockey-puck" styled dual cell/GPS antenna. (see **Figure-2**)

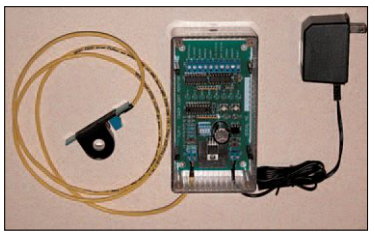
TLM-1 Tower Light Monitor


Figure-2

To email Andy Rogers at the Ayantra sales department: **arogers@ayantra.com**

To email Stoney Owens regarding his tower light monitors: **stoney@wkbcradio.com**

To email Jared Babcock at Medler Electric, my Stahlin enclosure dealer here in Michigan: **jaredb@medlerelectric.com**

Best regards and stay safe out there!

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

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Open Source Environmental Monitoring

by Sherrod Munday

Imagine this: It's the middle of the summer, 90 degrees outside, and your racked equipment at the transmitter site is all quite content in its 70-degree dehumidified climate-controlled building with redundant air conditioners ... right? Or maybe not – are you sure? Will you know that there's a problem before your site monitor or transmitter calls you, telling you that it's shutting down from high temperatures?

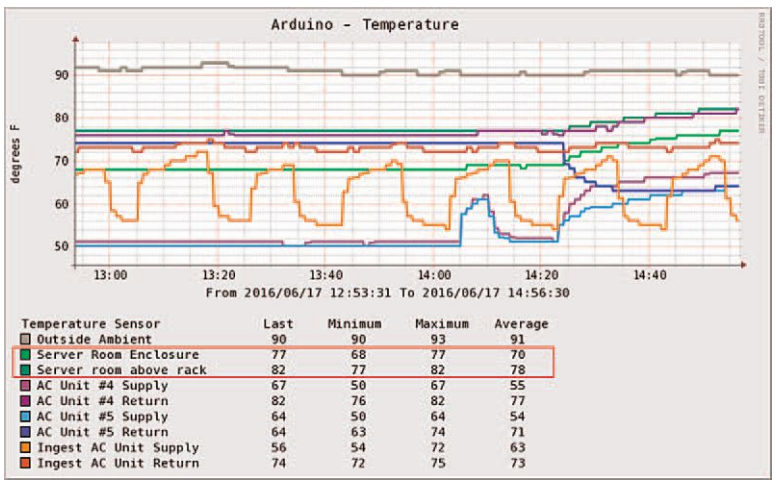

Figure 1: When an A/C unit stops, temperatures can quickly rise.

Have you ever wanted to pull up temperature data from last week, last month, or even last year, to review A/C system efficiency? What about your UPS system? Have you been surprised by premature battery failures when commercial power failed and your UPS couldn't hold the load until your generator fired up? If you've ever tried to file a warranty claim with certain UPS or battery manufacturers, you might find that they want proof that the batteries have not been subjected to improper temperature ranges – which they may interpret to be anything over 72 degrees.

A couple of years ago, our main equipment building, that has redundant 10-ton A/C systems, experienced a near-meltdown when both units failed in quick succession on a hot summer morning. Fortunately, we were onsite when it happened and were able to quickly set up fans and save all the equipment until the A/C units were repaired that afternoon. Determined to not get caught off-guard again, we decided to add environmental monitoring to our existing open-source monitoring system.

There are many options for proprietary commercial off-the-shelf (COTS) remote site environmental monitoring: Broadcast Tools, Burk, Asentria, Davicom, etc. all have IP-enabled monitors to remotely see and/or report basic environmental and other parameters. Costs can range from <$400 for the basic BT products to >$4000 for the Davicom units, and everything out there has its definite niche and purpose. But as we compared the options and costs to monitor the two original A/C units plus three more smaller, more efficient units we later added to supplement the older 10-ton units, costs quickly added up beyond our target budget for the project.

What was our solution? More open-source systems to the rescue!

You may already be familiar with free open-source software like the Linux Operating System, Paravel Systems' full-featured Rivendell automation system and Libre Office's complete office productivity suite, but you may not be aware that the popular Arduino controllers are actually open-source hardware (www.arduino.cc). This brings costs down and increases flexibility, functionality, and compatibility. A simple Arduino microcontroller can be purchased for well under $100 (some models are less than $10), but it offers lots of connectivity for both analog and digital I/O and buses. Ethernet connectivity is available on some models as an add-on module, but for our project we chose the older Yun Model that has built-in Ethernet for around $70. This particular model has a fully functional Arduino controller along with a separate full Linux OS integrated onto the same board with all the conventional Arduino I/O pins.

After researching various sensor options, we settled on using the Dallas One-Wire protocol, since it allows long multi-device cable runs with only three wires (Vcc, Gnd, and Data), or just two (Data/Vcc combined and Gnd) if you don't need high-speed or long-distance runs. The main benefit of using the 1-Wire protocol is that there's a large variety of devices that speak it, and multiple devices can share a single I/O pin on the Arduino.

After experimenting with some free samples from Maxim Integrated (www.maximintegrated.com), we acquired around 25 DS-18B20 temperature sensors in TO-92 form factor. Each sensor is highly accurate and uniquely addressable, meaning that it's possible to string a sequence of them on a single long cable and poll specific sensors individually as needed. Using provided Arduino software libraries and code, we noted each sensor's address and confirmed they worked properly, then proceeded to build and install the cable in the equipment building.

To make swapping out the sensors easy, in case of future failure, we used RJ-45 jacks along the 1-Wire cable wherever we needed to deploy a sensor, and then wired the sensors on short pigtails with RJ-45 jacks on the end. Maxim has a whitepaper on best practices for installing 1-Wire networks, and we did have to consult it several times to troubleshoot some reliability issues we encountered during installation and testing.

Sensor placement was relatively easy: we drilled a small hole in the rigid ductwork about a foot away from each heat exchanger unit on both the supply and return sides, and inserted the sensors (properly electrically insulated with heat-shrink) into the middle of the airstream through a rubber grommet. This ensured that we would be able to measure both supply and return temperatures to monitor the differential (and therefore the efficiency and general health) across each A/C unit independently. We mounted another sensor near some of the thermostats to sample ambient temperature in the building, and we ran another one outside to a weather station enclosure to monitor outside ambient temperatures as well.

As we had also had some humidity problems in the block construction equipment building, we added a humidity sensor to monitor levels inside. Lastly, we used additional Arduino digital I/O pins for more 1-Wire buses and ran cables to our redundant UPS systems. We installed a sensor in each of the four battery trays and the exhaust vent of each UPS.

In total, we have 22 temperature sensors and 1 humidity sensor (that also offers barometric pressure and a separate temp reading if needed) spread around our equipment building.

For our monitoring system, we used our existing Cacti system. Cacti is a free and open-source project that allows interfacing with anything that speaks SNMP (and other types of data sources, albeit with more work). To get the data from the many sensors into SNMP, that Cacti can easily poll, the Arduino side of the Yun saves the values to a file on the Linux side of the Yun. When Cacti polls the Yun for new data, the Linux SNMP daemon reads the values from the SD Card and reports them using extended custom variables.

Cacti logs the raw data into round-robin databases, and consolidates the values over time to show varying levels of detail depending on the age of the data. We routinely save all data for the past year, but at any given moment we can see minute-by-minute temperatures for the last four hours. This can be quite helpful when an A/C unit stops, as seen in **Figure 1**.

Cacti can be set up to send emails or trigger other actions if values get out of spec, but sometimes a simple visual inspection of the graphs will reveal a problem. This happened last year when we noticed that the Supply temp on one air conditioner had inverted and was warmer than the Return temp (see **Figure 2**). Inspection of the system revealed that the condensate drain line had clogged and the drain pan had filled up completely with water – the float switch had properly disabled the compressor while allowing the fan to run.

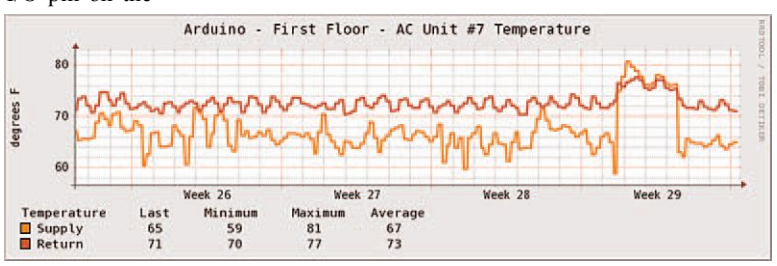

Figure 2: The mysterious hot supply of cold air.

After carefully draining nearly 25 gallons of water from the ceiling-mounted unit into a large trash bucket and cleaning out the drain line, the unit started cooling again normally.

By logging the temperature differentials, it's also possible to monitor A/C unit efficiency to detect when the filters are dirty or the unit needs attention. We've noted a two- to three-degree improvement in temperature differentials when we replace overdue dirty air filters with new ones. That's money saved!

The latest low-cost addition to the system was a simple unpowered DC muffin fan installed directly inside an A/C vent (register) to generate a linear DC voltage when air is moving. Wired directly to an analog voltage input pin on the Arduino, we can now log relative airflow to ensure the A/C unit is blowing when it should be.

Another add-on would be to add simple air pressure sensors in the ductwork to monitor when the filters are dirty. Wouldn't it be nice to get an email when the filters actually need to be replaced? With open-source hardware and software, this type of task is possible for a lot less money than the COTS products out there.

Our Arduino project cost around $100 for the initial system. After seeing how well it worked, we added another Arduino and network of DS18B20 sensors at our studios to monitor the studios and server room temps. We now monitor around 40 sensors between the two sites for under $300, and constant monitoring and logging of all temperatures gives us much more peace of mind and troubleshooting capabilities.

Sherrod Munday currently serves as VP Engineering for Sky Angel, a 3-channel TV network found on Dish Network. His experience includes full-time and consulting services in both TV and Radio, delivering live and preproduced content over the airwaves, building syndicated satellite networks, and broadcasting directly to viewers/listeners over the Internet.

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Simple Equations

Ratio and Proportion

by Rolin Lintag

There are some equations that have practical use in our work. One of those is what we call Ratio and Proportion. It describes a relationship where one parameter increases/decreases in proportion with another. The ratio of the two parameters is said to be constant. Putting it in another way, the ratio remains the same for different pairs of X and Y values as shown in Figure 1.

Since the ratio is the same for Figure 1, we can determine the value of Y2 as long as we know the value of the other three parameters. We can determine (or predict) what the value of Y will be for any value of X.

We say that this is true for linear relationships, i.e. when a straight line is produced with different sets of X and Y forming similar triangles. The hypotenuse of the triangle should be a straight line for this equation to be true.

This is a simple concept that, if understood, can be usefully applied in many ways. We just need a few examples to drive the concept home.

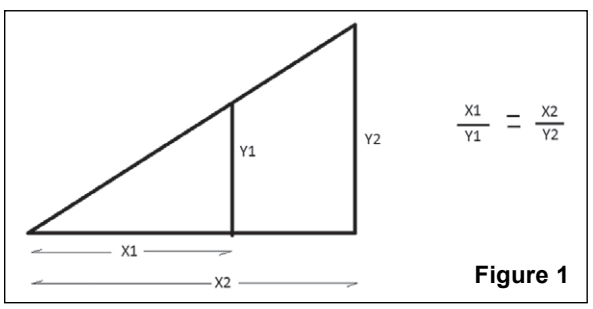


Figure 1

Similar triangles formed by parameters of equal proportion.

Man and the Tower

Suppose you wanted to find out the approximate height of a tower. You may be able to estimate the height just by looking at it, based from your experience, but you can get a better estimate if you'll use ratio and proportion as follows. Figure 2 shows the diagram to illustrate the point. If you know your height to be 6 feet and the shadow that you cast on the ground is 2 feet, then you will be able to come up with the equation as shown, if you know the shadow cast by the tower measured as 10 feet. From this equation, you can reason that the height of the tower is approximately 30 feet, as calculated from this equation.

Although you will not base your FCC filing using this technique, it is good to know you have another way of making tower height measurement if all you have is a 12-ft tape measure. Off course, one can argue that it is better to measure the height of one section and just multiply it with the number of sections the tower has. Just remember that section height may be shorter the higher you go up the tower.

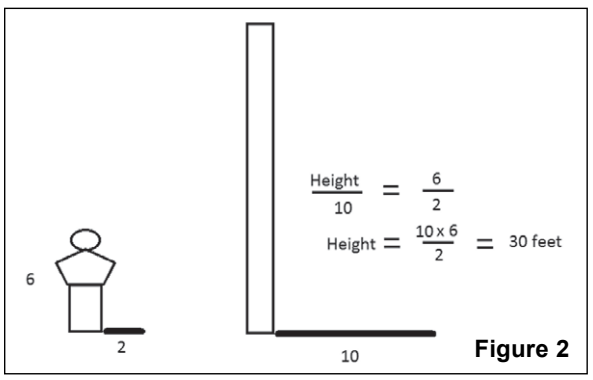


Figure 2

Estimating the height of the tower when you know the length of the shadows cast.

Disk Requirement

You wanted to know how much additional storage disk space the station will need to for archive programming for regulatory compliance (2 years). Assuming the same data throughput in MBps (referred to as bandwidth by IT people) is used, you can determine the unknown quantity if you have tabulated some needed data. Figure 3 shows a sample tabulation of hypothetical data you collected over time, with the average usage plotted as a straight line. Then you may use ratio and proportion as shown in Figure 4 to determine the additional storage space needed to hold 2-years worth of programming.

Off course it is understandable that the amount of data saved depends on how much live production you do but if you quantify your needs objectively like using ratio and proportion, you minimize the risk of guesswork. Take note that your conclusion as to how much additional storage you need depends on the accuracy of the data you collected and how many data points there are. The sample data in Figure 3 is only 2 months worth of data so determining what is needed for 2 years may not be close to what is actually needed after two years in operation. You may want to choose your average usage on the higher side as shown in Figure 4 to play it safe. After installing the needed storage, you just need to set the archiving application to store on a FIFO (first in first out) basis.

Week	GB storage used
1	250
2	775
3	1350
4	1860
5	2408
6	2920
7	3430
8	3902

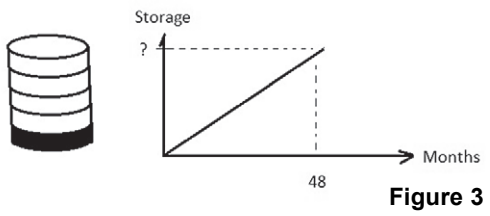


Figure 3

Estimating storage needed to archive 48 months of aired programming.

Average usage = 2 TB per month

Let S = storage needed for 48 months

$$\frac{S}{48} = \frac{2}{1}$$

$$S = 48 \times 2 = 96 \text{ TB}$$

Figure 4

Solving for the required storage for 48 months.

Generator Fuel

There are different ways to determine the answer to the question, "How much is the capacity of the fuel tank you need in order for the genset to operate for 7 days?" It is simpler and more straightforward to use the equation in Figure 5, using the data from the generator log. Granted that the genset consumption varies with the load, i.e. modulation of the AM station, but it is still possible to get a good approximation of the fuel capacity you need by averaging the fuel usage over time. One can argue that you can just use the published specification for the genset, if you have one on hand. That will work, but gensets that have been around for a while may use more fuel per hour than what the paper says. If you are running a 300 kVA genset for 168 hours, the difference of the actual consumption with the value on the specs may be quite a number of gallons.

Unless I have no other way of getting empirical data, I'd prefer to use the actual consumption of the genset for planning contingencies. For this example, the average fuel consumption of the generator is 15 hours per hour. Multiplying that with 168 hours (7 days), you get 2,520 gallons. Hoping that your genset can run continuously for 7 days without an engine issue, you'll need a fuel tank that can hold at least 2,520 gallons.

Date	Operation Hours	Gallons used
2/1/2017	3.5	52.7
2/18/2017	2	31
3/1/2017	4	59
3/11/2017	1.5	22.5

Let G be the fuel needed to operate for 7 days

Average consumption per hour = 15 gallons

7 days = 168 hours

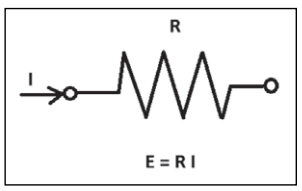
G = 168 x 15 = 2,520 gallons

Figure 5

Estimating fuel capacity needed to operate the genset continuously for 7 days.

Ohm's Law

One equation that came about from ratio and proportion is that ever popular Ohm's Law. George Simon Ohm published in 1827 that the current flow increases in proportion with increasing the voltage across a particular load. Since the ratio of Voltage "E" over Current "I" seems to be constant, he called that constant of proportionality Resistance "R." Thus the equation we all have come to love was born using ratio and proportion. The unit of resistance, as you well know, was named after George – the Ohm.



There are many applications of Ohm's Law, which became the building block of many other theorems and laws in electricity.

So understanding a simple concept and expressing it in numbers can provide an understanding that helps us solve problems and predict possible outcomes. One quote I remember so well is that of Lord Kelvin:

"When you can measure what you are speaking about, and express it in numbers, you know something about it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts advanced to the stage of science."

– Baron William Thomson (Lord Kelvin)

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

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Translator Topics

What the New AM Translator Rules Can Mean to You

by Jim Turvaville

With the recent change in February to the FCC rules for translators used by AM stations, there are some benefits from that, which can possibly help some current AM station operators. While not announced at the time of this writing, there will be a filing opportunity for AM stations who did not participate in the recent translator modification window; the new rule changes might mean a new game plan for them as well.

I usually play the armchair attorney, but the legal side of the new changes to the FM translator rules affecting AM stations is, for the most part, minimal. The changes are pretty much just a technical item which might bring a vast improvement for AM operators. Section 74.1203(g) was the FCC rule in question, which simply stated:

*"The coverage contour of an FM translator rebroadcasting an AM radio broadcast station as its primary station must be contained within the **lesser** of the 2 mV/m daytime contour of the AM station and a 25-mile (40 km) radius centered at the AM transmitter site. The protected contour for an FM translator station is its predicted 1 mV/m contour."*

And is now being amended to reflect the change as follows:

*"The coverage contour of an FM translator rebroadcasting an AM radio broadcast station as its primary station must be contained within the **greater** of either the 2 mV/m daytime contour of the AM station or a 25-mile (40 km) radius centered at the AM transmitter site. The protected contour for an FM translator station is its predicted 1 mV/m contour."*

Hey, wait ... what? Did you catch that?

Yeah, after literally years of proposals and comments and replies, not to mention the reams of paper used to do all of those, that is the only change being made to the rule – one single word. The word "lesser" in the first sentence becomes the word "greater." But what a change that can make for how a translator for an AM station can operate.

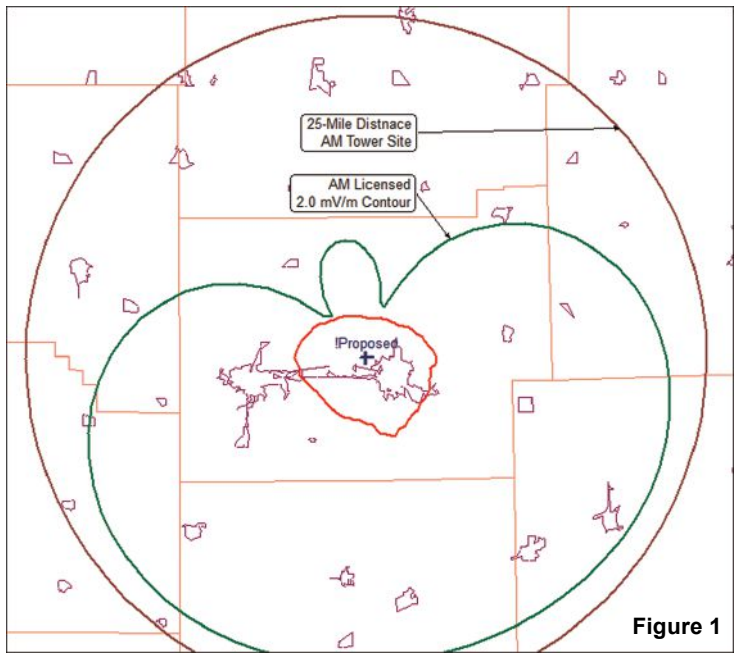

Figure 1

Let's look at a real world situation with a client of mine from a few years ago who wanted an FM translator for his AM station. Problem was, the station was a 4-tower directional, 5 kW operation daytime only. Since the FM contour had to fall inside that 2 mV AM contour, his situation looked like **(Figure 1)**:

See how horrible that makes your coverage over your service area? This installation was barely manageable with the directional antenna required on the FM translator in order to meet the AM contour restrictions.

Under the new rule change, this client can find a suitable tower site that permits a non-directional coverage at 250 Watts that looks like **(Figure 2)**:

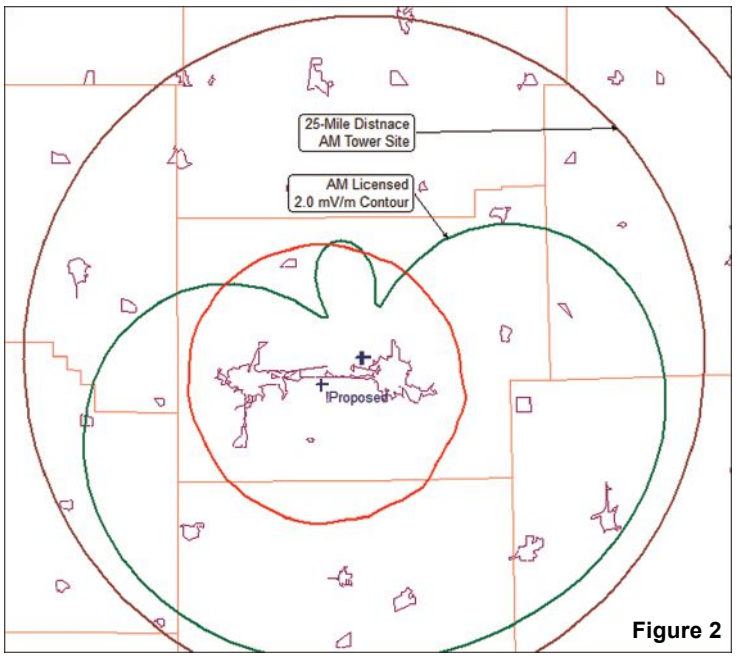

Figure 2

And, serves the entirety of the market currently being served by the AM signal; truly providing some relief as was originally intended in the "AM Revitalization Act."

Not only does the rule change permit an AM station to cover its local community more effectively, irrespective of the AM pattern, it can make a big difference in rural areas served by a single AM station.

Again, a real-world example of a client of mine who has a 25 kW Daytime AM station serving a large rural area with Farm and Agriculture programming – one of only 3 AM's in the entire area, and the only one serving all of it. This map shows the 3 communities in his primary service area of the AM, but only the 2 closest to the AM tower are permitted to have an AM translator, as it would exceed the 25-mile limit **(Figure 3)**:

Under the new rule, this station can also serve the adjacent community, which enjoys the daytime AM programming, with a translator signal. In this specific case, the irony was that the outlying community received the required 5 mV/m AM contour to have been the authorized City of License for the station, but was prohibited from having an FM translator serve it because of the proximity of the AM tower to it. Those who filed comments on this Proposed Rulemaking cited several examples of just this situation, and the Commission responded appropriately in consideration of these AM operators.

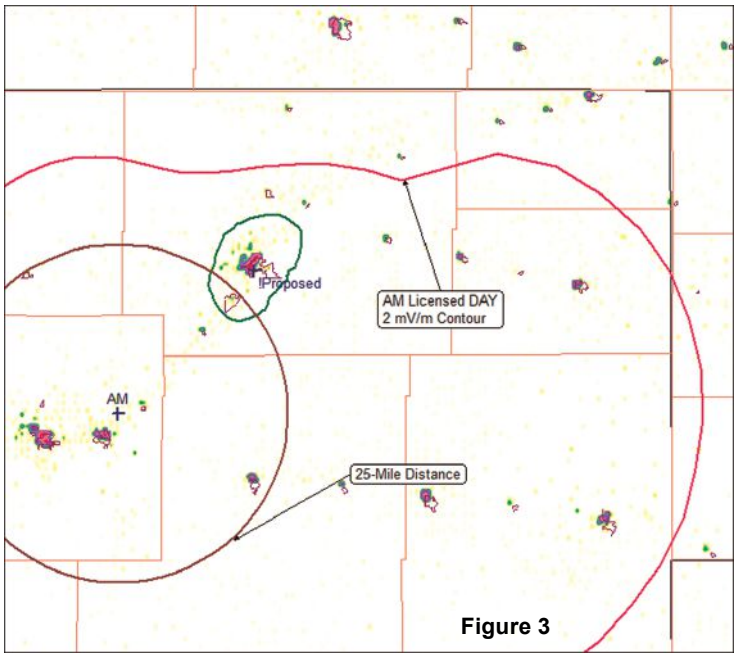

Figure 3

The new Administration has clearly been beneficial to the speed of functionality at the FCC, part of which is reflected in this rule change happening so soon and on such a fast track. I am hopeful that the other parts of the AM Revitalization Act as presented in 2015 can begin movement as well toward fruition, hopefully in as orderly and speedy a manner.

While yet unannounced, there will be an opportunity for AM station licensees to participate in a New FM Translator Auction filing window, probably this calendar year. Those who did not participate in the 2016 windows for modification of existing translators will be allowed to request available channels for their AM station to use; and this new rule change will be in effect before that time. Qualifying AM operators should begin now to examine the spectrum and see what channels could be requested in the coming Auction window. With the exception of most Top 50 markets, there remains some possibility for AM licensees to find usable operating channels in their location. Having been a supporter of local community radio my entire career, which began at a small 500W AM daytime station in rural West Texas, I look forward to seeing how the auction can bring relief to the local AM broadcast station which needs it the most.

As with any FCC rule, there is the potential for abuse; many of the rules we have in place now have been created only as a response from a few who took advantage of the old rules in a way to create an abusive situation. But the slight possibility that someone will create an unfair market position from an AM translator because of the rule change is extremely minor in comparison to the expanded ability of the vast majority of AM operators who are trying to serve their local communities.

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

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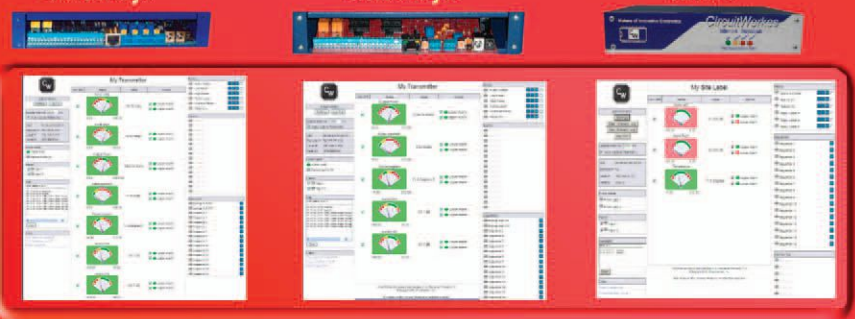

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State of the Art

What's in the Package?

25-Seven Systems, TVC-15 Broadcast Watermarking Monitor

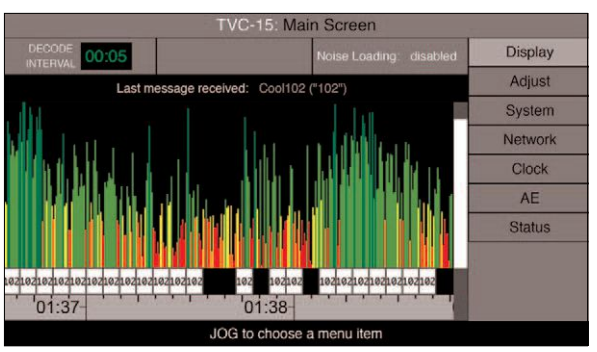
by Steve Callahan

While I was sitting at my desk the other day, there was a knock on the door, and in walked Geoff Steadman, the founder of 25-Seven Systems. No doubt you've heard a lot about Telos Alliance's Voltair, an extremely innovative watermark monitor and processor that has changed the way radio stations deal with watermarking their on-air signal. Well, Geoff had a package under his arm and it didn't take long for me to be very curious as to what was in that package.

Geoff Steadman

I was fortunate enough to have been interested in Geoff's development of the Voltair, even before it was known as the Voltair, and now he had a new device that I just had to see in operation.

Geoff's package contained the latest invention from 25-Seven Systems, the TVC-15 Broadcast Watermarking Monitor. It took just a couple of minutes to get the new device unwrapped and plugged in. The set up couldn't have been easier. The TVC-15 is not a Voltair, but is a watermark analyzer and monitor. It uses a different algorithm than the Voltair to analyze your station's watermarking every 400 milliseconds, or 150 times per minute. The TVC-15's display looked a lot like the Voltair's, but that's where the similarity ended.



The TVC-15 Display

The TVC-15 can be fed from any convenient off-air analog audio source, like an air monitor, an Internet radio or an HD receiver – or you could feed the TVC-15 recorded audio for analysis. A twist of the front panel jog wheel and the display comes alive with colored vertical strength bars that provide you with a wealth of knowledge on how well, or not, your watermarking is being broadcast and received. Dark green bars indicate 80% confidence, light green show 40% confidence, orange show at least 30% and red lines show less than 30% confidence, which means that there's a good chance that the monitoring meters won't be picking up your coding.

I first watched it analyze the off-air signal of a station that I knew was utilizing a Voltair, and the watermarking was robust and consistent. I then monitored a station that I knew didn't have a Voltair and the code watermarking was not very consistent. It's common knowledge that the codes are masked just under the existing station audio and that a heavily processed music format station has a more consistent watermarking that a station that broadcasts predominantly speech or talk programming.

The more you watch the display, the more comfortable you get with the information that the TVC-15 is presenting to you. When I plugged the TVC-15 into my station's off-air signal, I saw very adequate watermarking on spots and music that was heavily processed and continuous, but it dropped way off with talk show programming. That was not entirely unexpected but the information that was available to me via the TVC-15 was much more than just the red light on my encoding monitor.

Additionally, if your radio station is being listened to in a noisy environment, that's another hurdle for the watermarking to get over. With the TVC-15 monitoring your own audio, via a router output or patch bay in the privacy of your own station, you can equalize, or "noise load" the sample audio signal – or even distort it, to reflect how your watermarked signal is being received in real world conditions. You can also monitor your competitor's signals and see how well their watermarking is performing.

(Continued on Page 22)

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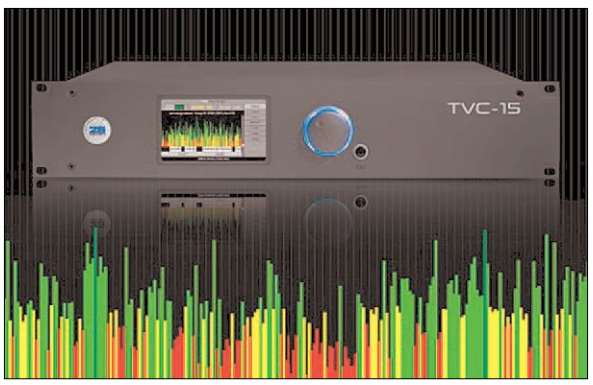
What's in the Package?

– Continued from Page 20 –

One feature that was extremely handy was the individual identification tags that change, when you change monitored stations. The watermark system uses arbitrary IDs that don't include station call letters or frequency, so the TVC-15 assigns a simple letter code to each new encoded signal it recognizes and then displays that code whenever it sees codes from that specific encoder. Those tags can also be customized with encoder nicknames for even better clarity. The TVC-15 display has a front panel timer that updates every time a complete watermark message is received. Normally it takes 4.8 seconds for the watermark signal to assemble enough code symbols for a full station identification, so it's a good thing if the timer resets often because that means that you are broadcasting a complete watermarked message more often. During periods of silence or speech, the timer will not reset as often and it changes color to alert you.

Of course, you can access the information in the TVC-15 on-line and even over the web. The TVC supports three different kinds of access, starting with the front panel. You can also get full web access which is a remote version of the front panel. Finally, you can get view-only web access which allows just monitoring. Of course, remote access is password protected and the confidence display can also be monitored on tablets or smart phones. You can get daily reports of minute-by-minute actual code reliability, so you'll know at all times how well your programming is supporting the watermarking codes.



25-Seven System's TVC-15

One thing that I believe the TVC-15 is absolutely necessary for is when your station "double encodes" a piece of audio. More frequently that you know, your morning show uses some audio off of the Internet, network audio, or another station, without knowing that it is already watermark encoded. Then when you encode it and broadcast it, you have "double encoded" it and that is not a good thing. The TVC-15 can alert you to that condition much faster, and much more efficiently, than your existing watermarking monitor, which provides only a simple "no code" warning and basic error messages on it's LCD. It won't alert you to a program stream that is only marginally supporting the watermarks.

You wouldn't judge the quality of your station's signal without an off-air receiver or monitor at your station, so it's also absolutely vital to know how well you are encoding the watermarking. As Geoff says, "Broadcasting is a numbers business. Broadcasters' success depends on what kind of audience they attract and hold, and we all know there's a direct link between ratings and a station's revenue in electronically measured markets."

One huge benefit of the TVC-15 is that it can work hand-in-hand via its Intelligent Adaptive Enhancement feedback loop, to dynamically control your Voltair in real time based on the minute-by-minute analysis of your actual air signal by the TVC-15.

The Voltair doesn't create "phantom panelists" in the ratings system but it helps make sure that stations get credit for the listeners they really have. The TVC-15's Intelligent Adaptive Enhancement acts like a trained operator who is on duty 24 hours a day, 7 days a week, constantly monitoring your signal – who knows when and how to incorporate watermark enhancement based on the program material.

Still another feature of the TVC-15 is the ability to monitor the time stamping of the each successfully broadcast code – you can see if an encoder clock isn't accurate. For real time monitoring, it should be within one minute of real world time, which is a situation that can interfere with reliable ratings.

Geoff was right ... broadcasting today *is* a numbers game and you need all the tools that are available to you to maximize those numbers. Do you know right now if your station's encoder is properly encoding and how do you know your codes are being efficiently received? If you don't know the answers o these two questions, then the TVC-15 is what's needed to monitor and analyze a crucial portion of your station's off-air signal.

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

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FCC Focus

2017 – Year of the Towers

by Gregg P. Skall
Womble Carlyle Sandridge & Rice, LLP

A number of factors are converging to make 2017 an especially eventful year for communications engineering and construction. While there are many changes afoot, they are converging is a way that may make the year remembered as "The Year of the Towers."

Nearly every area of communications technology is in some state of transition that will have an effect on new and existing communications towers. FM radio is experiencing a convulsion of spectrum assignment issues caused by the widespread use of FM translators by AM stations and wireless broadband is involved in an explosion of new spectrum implementation.

The Re-Pack

The FCC has now concluded the reverse and forward 600 MHz spectrum auction. All phases of the channel reassignment process for stations that are to relocate are about to begin with the impending release of the Closing and Channel Reassignment Public Notice (the "CCR-PN"). Although we cannot now estimate the number, it is believed that a considerable number of repack stations will involve a change of or modification to their tower.

ATSC-3.0

With new generations of viewers increasingly moving to personal devices for news and video entertainment, many television broadcasters believe there is an urgent need for a broadcast standard capable of reaching those devices. To hit that target, and other new media opportunities, One Media, a joint venture of Sinclair Broadcasting Group and Coherent Logix, has advocated an ATSC 3.0 standard and the Commission appears ready to accommodate. Recently, the Commission proposed to authorize its use on a voluntary, market-driven basis, provided that licensees continue to deliver the current-generation "ATSC 1.0 digital" to their viewers. One Media's goal is to have the rules adopted in time to be implemented in the repack schedule without negatively affecting the post-incentive auction transition process.

Under the Commission's proposal, each television station choosing to broadcast its signal in both ATSC 1.0 and ATSC 3.0 would arrange for another station in its local market to act as a "host" and "simulcast" one of the two signals. In turn, it will broadcast the "host" ATSC 1.0 program stream in ATSC 3.0. Yet to be decided is how the Commission will handle ATSC 1.0 simulcast hosting of stations with different service contours or communities of license, or even class of service, i.e., full-power and Class A stations.

ATSC 3.0 also offers the ability to create single frequency networks, allowing a station to extend its signal to distant parts of the DMA that may have been lost in the digital transition, or even new areas without the need for satellite stations. It can also use a fill-in transmitter for high interference areas, as well as mobile service, hyper-local zoning and programmatic advertising opportunities with in-contour transmitters offering zonal service capability. Importantly, for smaller markets where build-out has been neglected by the large ISPs, ATSC 3.0 will offer broadcasters the data capacity for diverse traffic delivery, enabling TV to expand its service offerings to one-way over-the-air ISP traffic. One Media estimates this could bring as much as $12.2 billion in new revenue to broadcasters.

The implications are clear. ATSC 3.0 is going to involve a lot of transmitter and tower modifications to accomplish even a partial transition, and that has implications for co-located radio stations.

FM Translators

Just when it seemed that most of the issues presented by FM translator expansion under the AM Revitalization 250 mile waiver were close to being resolved, the Commission released its Second Report and Order in AM Revitalization that again changes the ground rules. Many AM stations found it difficult to place their relocated translator at a useful location, so the Commission acted on a "leftover" item from the 2015 First Report & Order to allow siting of a new translator within the greater, rather than the lesser of the 2 m/Vm daytime contour of the AM station, or a 25 mile radius from the AM transmitter site. It also eliminated the 40 mile limit. This change may also result in new demands for tower space. Moreover, the Commission has pledged to open two new windows for AM stations that were unable to take advantage of the 250 mile waiver windows to apply for new translators, with the first supposed to come in 2017.

With the influx of relocated and new translators, the potential for, and complaints of, interference conflicts with licensed full-power FM stations will accelerate.

(Continued on Page 28)

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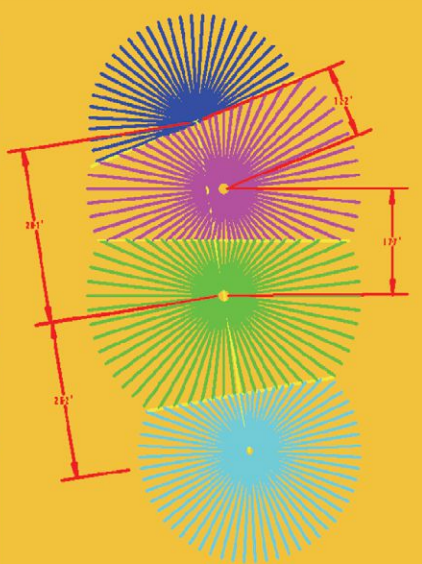

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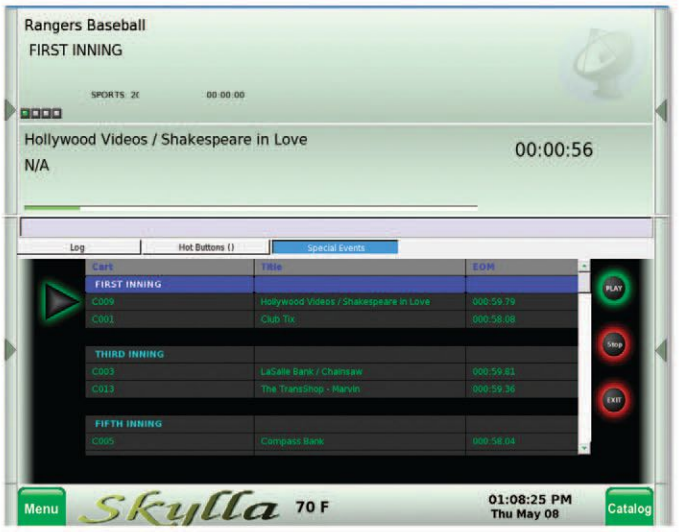

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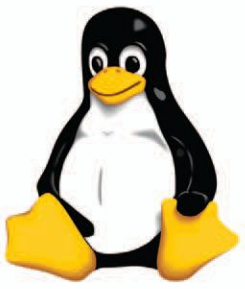

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- Roger Utnehmer, Nicolet Broadcasting, Sturgeon Bay, WI

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2017 – Year of the Towers

– Continued from Page 26 –

While the secondary status of FM translators would seem to be an easy response to such interference complaints, in practice resolution has not been so easy, with "pleading wars" breaking out among translator and full-power licensees. The resolution of these conflicts often results in the relocation of the translator – even after construction – resulting in a new tower location requirement.

Wireless Broadband

The mobile broadband industry is also queued up to need additional tower space as it plans to implement AWS-3 Band 66 and the 600 MHz band made available by the forward TV auction along with the anticipated rollout of 5G and micro-cell technology.

ANSI/TIA-222-G (and H) - The Complicating Factor

Rev G: Just when the need for new towers and tower reloading becomes a critical factor, along comes a new structural standard for communications towers. TIA 222 Rev G provides the requirements for the structural design and fabrication of new, and the modification of existing support structures. This is important as ANSI/TIA 222 and its revisions are specifically tracked in many state building codes.

As explained by Rohn Towers, Rev G changes the calculation for wind from the fastest-mile wind speed, to a 3-second gust wind speed. "For a given location, the 3-second gust wind speed represents the peak gust wind speed whereas the fastest-mile wind speed represents the average wind speed over the time required for one mile of wind to pass the site."

Rev G also added other factors for the design or modification of structures. These include classification of structures into three classes and the ability to adjust wind speed based on the type of surrounding terrain. The three reliability classes are based on the type of service and the structure's potential hazard to human life and property. An excellent description and PDF file is available at http://www.rohnnet.com/revg

Rev G also adopted a performance specification for grounding systems greater than the Rev F prescriptive requirements. It also made significant additions addressing climber safety, categorizing climbers with each category having different requirements and limitations, and requiring tower safety climb systems.

The critical issue is that many exiting towers were not constructed under Rev G, but will be required to comply with it when reloading the tower with new or additional antennas and transmission lines required for the repack and ATSC 3.0 conversion. Furthermore, structural issues may be presented in the process of moving antenna locations and reloading towers in accomplishing the repack, adding new FM translators, or seeking to share or expand return on tower real estate by offering space for new mobile broadband expansion.

Rev H: Further complicating the picture is Rev ANSI/TIA-222-H looming on the horizon. Rev H, expected to be adopted sometime in late 2017, would make changes regarding loading and design strength requirements to comply with changes in national standards; and could add several new annexes for Wind Induced Structural Oscillations (Annex M), New Tower Construction (Annex N), Existing Tower Modification Inspection (Annex O) and Tubular Pole Weld Toe Crack Evaluation (Annex P).

Protection: The Tower Lease

Among the first questions likely to be addressed, once tower space and structural issues are identified, are who will be responsible for the inspection, cost, relocation and construction and how are these responsibilities and liabilities to be allocated?

Ultimately, whether asked by tower owner or the tower tenant, the answer will lie in the tower lease. A well prepared tower lease provides for the allocation of responsibility when interference occurs, priorities between pre-existing and newer tenants when any of them is required to change their location on the tower or leaving the tower, or otherwise modify their transmission parameters.

This is particularly important with respect to the repack. *The FCC staff has indicated that impositions on other tower occupants by a television station's required move may only be eligible as a reimbursable expense if legally required by the terms of the tower lease or other binding contractual commitment.* Accordingly, it will serve every broadcaster, tower owner, or other FCC licensed transmitting service to begin an immediate review of its tower leases and related contracts. After all, 2017 will be the "Year of the Towers."

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

Gregg Skall is a partner of the law firm Womble 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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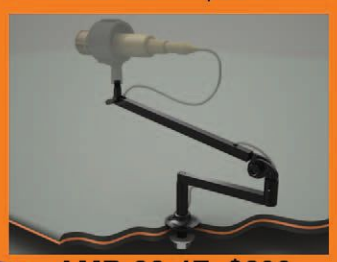
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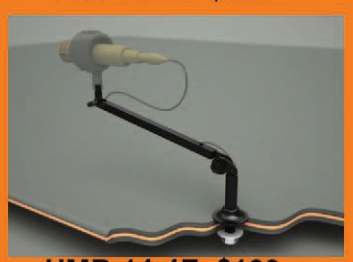
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Test and Measure

Weights and Measures

by Mike Hendrickson

What do Air Canada Flight 143, the Mars Climate Orbiter, and the French Revolution have in common? Continue reading and you will find the answer!

This time I thought that I would write an article about something that we don't think much about, but is vitally important to engineering and to the population at large. This is the system of weights and measures. When you stop and think about it, it is the standardization of units of length, volume, and mass that enabled us to develop our modern manufacturing. Can you imagine changing the unit of length every time a local government or ruler changed? Or that the length of a foot in one location is 10% different then the length of a foot in another location? Or how about basing an inch on the size of your thumb? This would eliminate all mass production because there would no longer be interchangeable parts.

This article came as the result of reading a series of science fiction novels about a planet called Safehold by author David Weber. This series has, as one of its themes, the lack of a weight and measures standard. This lack of a standard was done to prevent the Safehold society from progressing into the industrial age. This theme caused me to start looking at our standards and it became an interesting subject for an article. In the process I learned a number of interesting things about standards.

On a historical basis, weights and measures were based entirely on local standards. This meant that each community defined the length of a foot and the weight or mass of a pound. It is estimated that, prior to the revolution in France in the 1790s, there were over 100,000 different standards in France. There had been calls for uniform standards of measurement since the 1600's from the scientific community, but now with the increasing trade over ever longer distances, France recognized the need for a uniform standard. Thus, in 1799, during the French Revolution, the metric system of measurement was first adopted for use. After the revolution, the system was abandoned, but in 1837 it was readopted.

In the United States we have two legal systems of measurement. There is the U.S. Customary System that uses feet and pounds, then there is the SI system (International System or French: Système International d'unités) that has meters and kilograms among its standards.

What I didn't realize, until I starting reading about weights and measures, is the way they affect the customary system used in the United States. In the early part of the 1800's the U.S. Coast and Geodetic Survey used meter and kilogram standards brought from France. In 1866 the U.S. Congress authorized the use of the metric system. In 1893 the U.S. customary units, such as the yard and pound, were redefined in terms of metric units. The yard was defined as exactly 3600/3937 meters – that is, 1 yard is approximately equal to 0.91440183 meters. In 1959, the yard was redefined as exactly equal to 0.9144 meters. This means that the foot is defined as 0.3048 meters, exactly. There is no standard for a foot other then the definition that it is 0.3048 meters. This foot is referred to as the "International Foot." What's interesting is that the United States and India also have another foot that is used, as well as the International Foot. This other foot is the "Survey Foot." The U.S. Survey Foot is defined as exactly 1200/3937 meters or 0.30480061 meters. (India's survey foot is a slightly different value.)

I mentioned that the foot is defined as being exactly 0.3048 meters, but how is the meter defined? Originally the meter was defined as being 1/10,000,000 of the distance from the North Pole to the equator. This distance was determined in the 1790s. The measurement was used to construct an iron bar that was the primary standard. A number of copies were made of the iron bar. Later, a 90% platinum-10% iridium bar was used to replace the iron bar. Since the original standard was made, there have been concerns about the stability of the standard. For example, the temperature of the standard will affect its length. Another concern is that, over the years, just the cleaning of the standard may slightly shorten it. This resulted in the requirement that the meter standard be based on something that is more stable.

In 1960 the meter was defined in terms of a certain number of wavelengths of a certain emission line of Krypton-86. This new definition meant that any well equipped lab could reproduce an exact meter length standard. In 1983, the current definition of a meter was made. This definition is the distance that light will travel

(Continued on Page 32)

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Weights and Measures

– Continued from Page 30 –

in a vacuum in 1/299,792,458 of a second. This time based definition is interesting because the original proposal in the 1600s was to use a definition based on a pendulum with a half period of one second. This was rejected because it was discovered that the force of gravity varies slightly over the surface of the earth, thus affecting the swing of the pendulum.

The whole point of redefining the meter was to develop a standard that was independent of arbitrary local rules. The length of a meter could be reproduced independently, instead of using the original meter bar that was preserved in Paris.

Why is there such emphasis on the meter? The meter is used, in part, in many other measurement standards. When you buy a liter of soda you are actually buying a volume of soda that is exactly (0.1 meter)x(0.1 meter)x(0.1 meter). Even when you buy a 12 ounce can of soda it is actually defined in terms of a meter. An ounce is 1/8 of a cup which is 1/16 of a gallon. A gallon is defined as 231 cubic inches. And guess what ... an inch is defined as exactly 0.0254 meters.

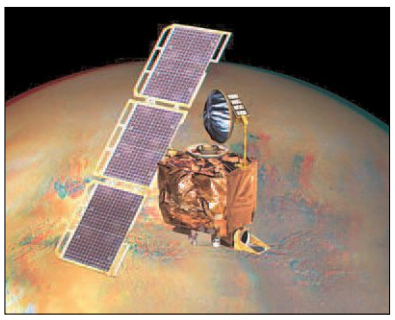
A meter is used in the definition of a kilogram. A kilogram was originally defined as the mass of one liter of water at the melting point of ice. It was later defined as the mass of one liter of water at the point of water's maximum density, which occurs at a temperature of 4 degrees C. This resulted in an object called the "prototype Kilogram." The prototype kilogram is still used as the standard for the kilogram. This will change in 2018 when the kilogram will be redefined in terms of the "Planck Constant."

Another item of interest about weights and measurement in the U.S. is that there are two different "pounds." There is the pound of mass, known as the avoirdupois pound or commonly called the "pound" and is in use in the U.S., and the pound of force also known as the "pound (force)." The pound of mass is defined as exactly 0.45359237 kilograms. The pound (force) is the gravitational force exerted on a mass of one avoirdupois pound on the surface of Earth.

When you weight yourself on a spring scale you are weighing yourself in terms of pound (force). When you "weigh" yourself on a balance scale you are weighing yourself in terms of avoirdupois pounds or just standard pounds. The pound (force) unit can be used on the surface of the earth when the slight variations in gravity can be ignored.

How does this tie into broadcast engineering? The majority of our job involves the use of metric or SI units of measurement. The FCC specifies and uses the metric system of measurement. The frequency is specified in SI units. The measurement of electricity is in SI units. The use of "kilo," "Mega," "micro," and others, are all metric and used as multipliers or dividers of basic measurements by units of ten, one hundred, and so on.

Now to answer the questions at the beginning of the article: The Mars Climate Orbiter was a $135 million dollar space probe that was lost because of the use of both Metric and U.S. Customary units of measurement. NASA engineers specified the thrust of the rocket's required by the probe in terms of Newtons-seconds while Lockheed engineers defined the rockets thrust by specifying the thrust in terms of pounds (force)-Seconds. The result was the space probe entered the atmosphere of Mars and broke up. The pound (force) is approximately equal to 4.45 Newtons.



Mars Climate Orbiter

In 1983, Air Canada flight 143, a Boeing 767 airliner, was forced to make a "dead stick" emergency landing after it ran out of fuel midway through a flight between Montreal and Edmonton. The ground crew failed to make the proper conversion between pounds of fuel and kilograms of fuel. The result was that the pilots had to land the plane on former RCAF Gimli air base. The airplane was repaired and returned to service. The airplane has since been known as the Gimli Glider. In 2008, the Gimli Glider was retired.

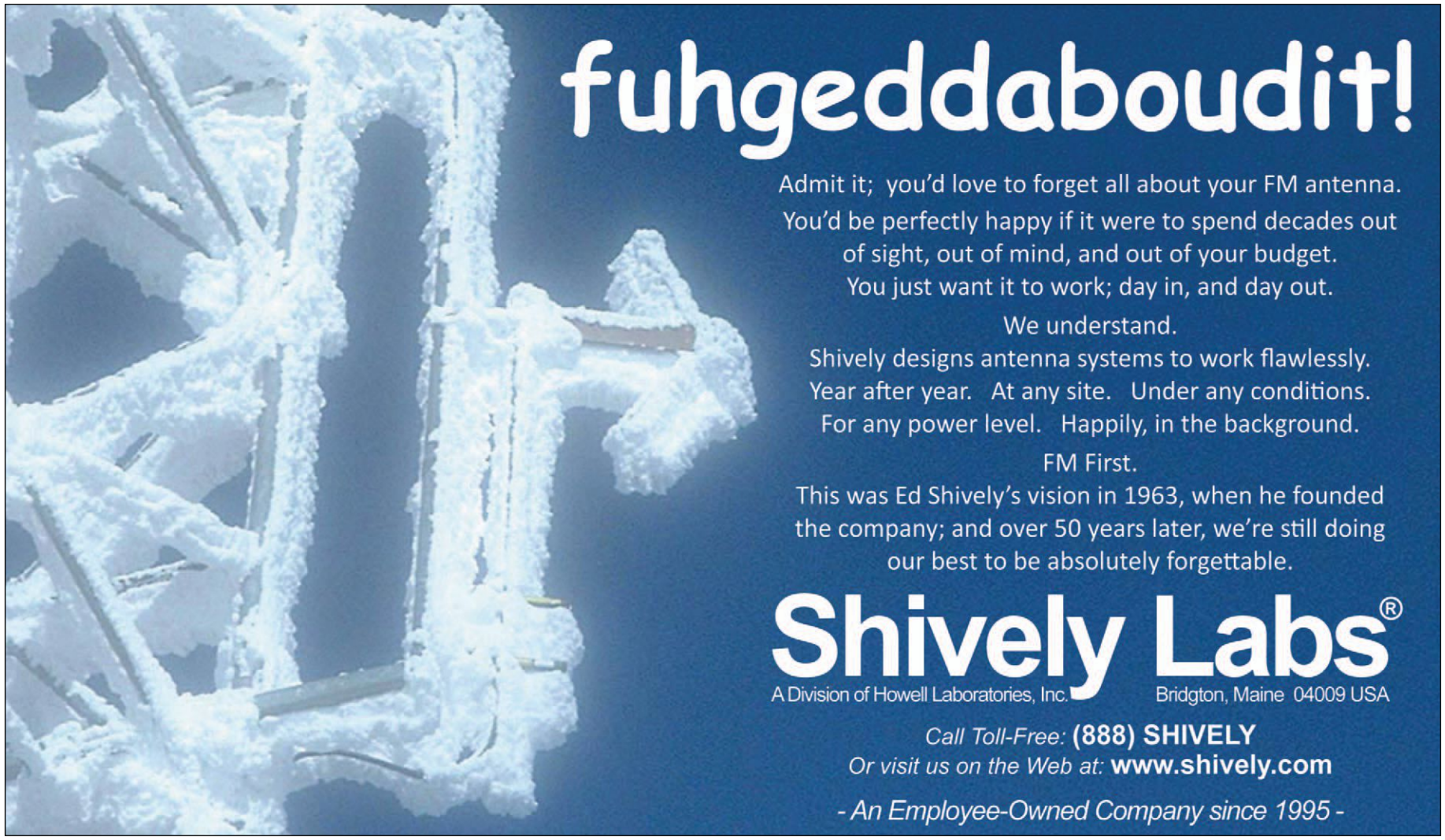
Air Canada Flight 143

And we know the results of the French Revolution!

Until next time, happy engineering!

Artist concept of Mars Climate Orbiter that failed due to a conversion error.

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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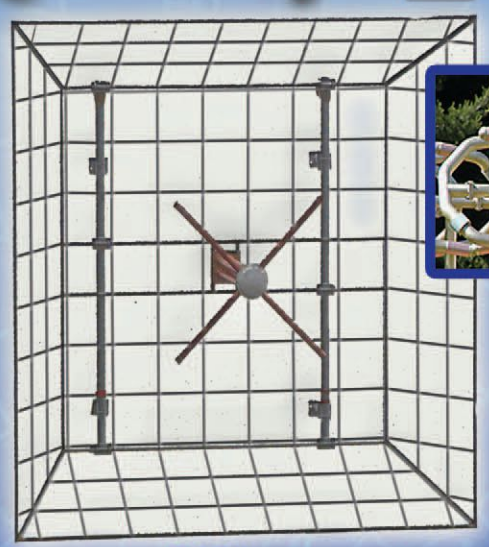

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Rules and Regs

Inspection Time

by Christopher Tarr – CSRE, CBNE, AMD, and DRB

It used to be that you could almost count on an FCC inspection at least once during a license term. A lot of the older generation of Engineers can even tell you the names of the inspectors paying them a visit!

Of course now with budget cuts, and a host of new technologies that the FCC is responsible for, you may never see an inspector. While the FCC is still very much active and willing to "educate" broadcasters when they are not following the rules, they very much rely on self-regulation in order to manage the workload. Fortunately, with today's technology, staying in compliance is much easier than it used to be, so the need for continual inspections has decreased.

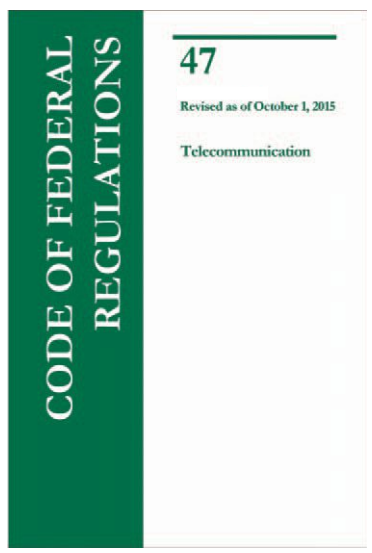
However, there are some that look at this as a relaxation of the rules and may take a lackadaisical approach to keeping things in order. That can be, and often is, a costly mistake. Make no mistake – the FCC is still very serious about compliance, and will not hesitate to investigate any issues that arise. Additionally, unless you can prove otherwise with good record keeping, things that appear like they could have been out of compliance for some time will increase the potential penalty due to the infraction being "willful and repeated." It's simply not worth the gamble, since you will eventually lose.

The great thing about the FCC rules is that there's nothing at all secret about them. There are many places you can find them, and they're easily available on-line. You certainly can't cite a lack of access to the rules as a reason for not following them, and they've stated many times that ignorance about a rule is no excuse. The FCC expects every licensee, and in turn you, to know the applicable rules for your facility. Every radio station should have a copy of CFR 47 parts 0-19 and 70-79 on the "bookshelf" in the shop. CFR 47 may be accessed at: **https://www.fcc.gov/general/rules-regulations-title-47**. You can order them from the U.S. Government publishing office for $67.00 each and, in a bit, I'll tell you how you can easily carry the rules with you!

All the stations I'm involved with have a very strict policy regarding compliance – we do self-inspections twice a year (once by myself, and once with another Engineer) and we also take part in our state's ABIP (Alternate Broadcast Inspection Program) every three years. This insures that we stay in compliance and that if we were to get a visit that there would be no surprises.

I understand that this sounds like a lot of work and hassle. However, it's really not. As long as you're willing to "open up the books" to someone who wants to work with you, then it's a winning situation.

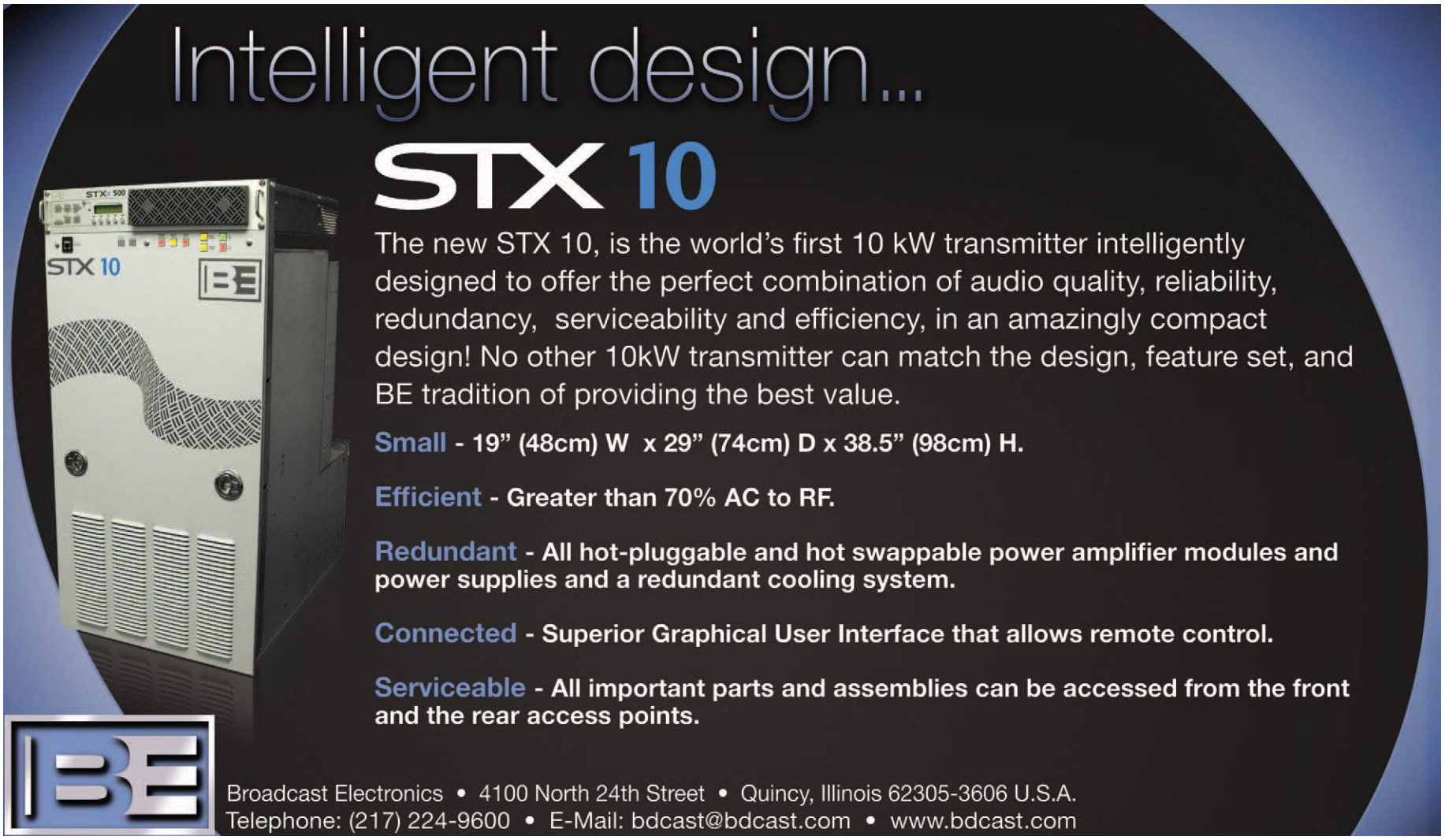
Let's start with the self-inspections. The FCC provides a self-inspection checklist for broadcast facilities at **https://www.fcc.gov/general/broadcast-self-inspection-checklists.** While the items covered in the checklists are not necessarily all-inclusive, they cover many of the things that an inspector would look at, and definitely cover good Broadcast Engineering practices. One of the things I always like to point out is that the checklists do not allow a "No" answer when it comes to compliance, only "P" for pending. They expect that anything you find that isn't correct will be corrected in short order.



Even if you don't know the rules chapter and verse, the checklists are a great learning and compliance tool. Each question references the related rule for review so that you can easily look it up. I recommend having someone else go through your facility with the checklist once a year just to have another set of eyes on things. Of course, there are some things that they don't cover on the checklists that are just good practice.

Take the time to be thorough. Go through the Public File and check for completeness. Remove any unneces-

(Continued on Page 36)



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– Continued from Page 34 –

sary paperwork (you'd be surprised by how much unneeded clutter can be in there!) and take some time to organize it. Anyone inspecting the files will appreciate the time you've invested to make it thorough and easy to navigate.

Take a look at your EAS and station logs. Make sure those records are organized and that you have all the handbooks posted.

After that, it's a matter of organization. Make sure the necessary documents are posted at control points and transmitter sites. Don't just rush through each question. Go slowly and give everything a good look.

Really, it's a matter of not only being compliant, but being organized. Nothing is worse than having to scramble to find needed forms and documents when trying to do inspections. Plus, the more time you spend organizing and familiarizing yourself with these things, the more confident you'll be that everything is in order.

In addition to the self-inspection checklists, be sure to participate in your state's ABIP program. The FCC realized that it was a tall order to try and routinely inspect every station across the country. So they teamed up with several state's broadcaster's associations to create a self-inspection program that insures compliance, lightens the workload of the FCC, and prevents surprise FCC visits. Here's how it works:

When a station signs up for the program, the FCC is notified. That will exempt you from routine inspection for a set amount of time (in Wisconsin it's 150 days) in order to get the inspection completed. The association's inspector, a person contracted by the association, will then come through and do the same sort of routine inspection that the FCC would do. The difference is that the inspector will *not* report non-compliance to the FCC, rather he or she will give you a report of any problems, and will give you the opportunity to correct it either on the spot or later with a re-inspection.

Once you pass the inspection, the FCC field office is notified, and you are then exempt from routine FCC inspections for a period of three years. Note that you are *not* exempted from inspections resulting from complaints or tower-related safety matters, or EEO and political broadcasting rules compliance. When the three years is up, you have the opportunity to once again have the inspections done and start the clock over again.

The additional benefits of the ABIP program are the same as having someone else go through the FCC checklist once a year – you'd much rather have a "friend" find a problem, giving you a "free" opportunity to correct it, rather than receive an NOV! Plus, nobody wants their name and reputation attached to an FCC fine.

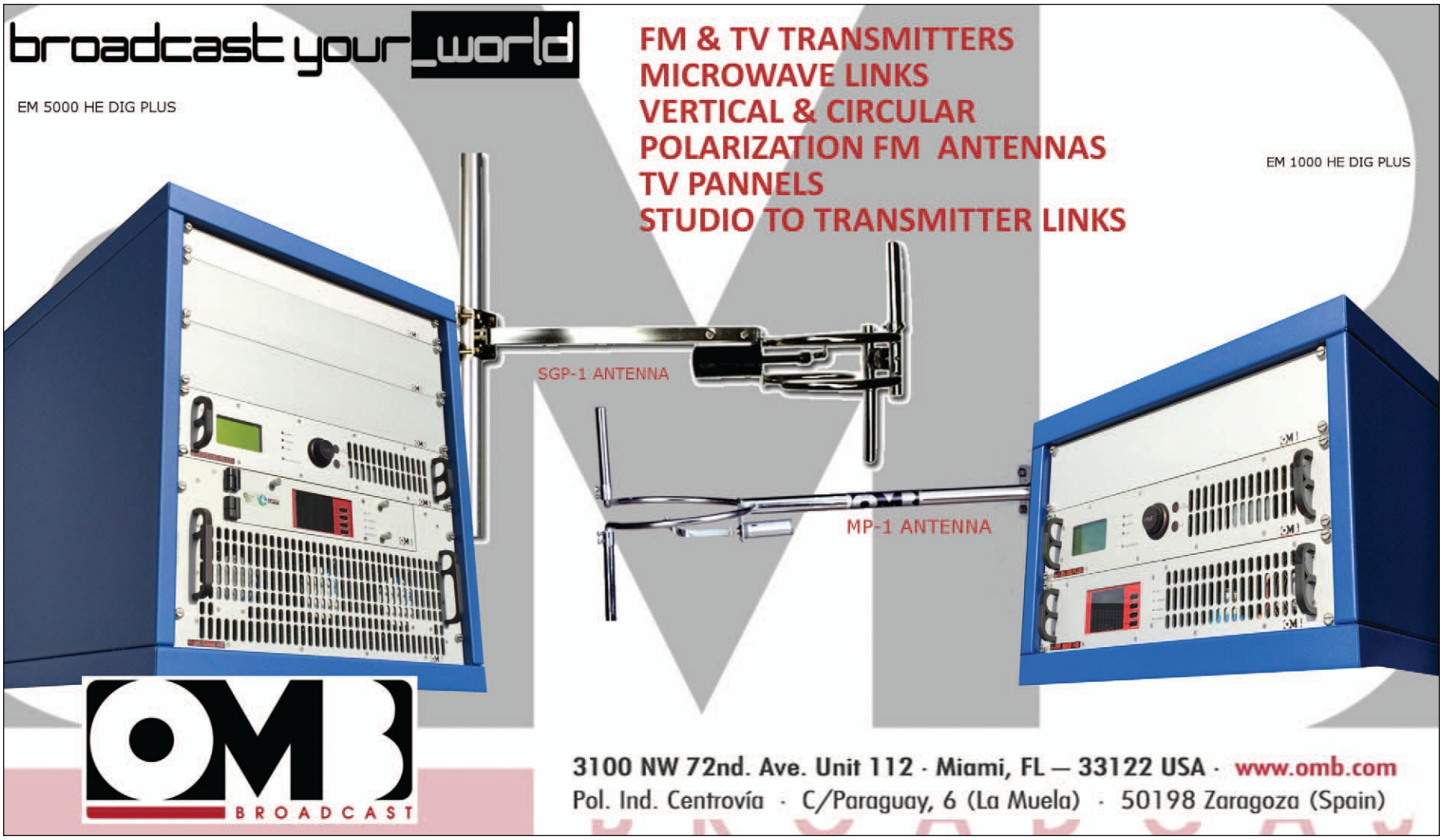
I realize that it's hard on the ego sometimes to "open the books" like that, but I find that for some people that's a great motivator to keep things in shape! I often look at it as a challenge to see if I can get through the inspections and checklists without finding any issues. Nobody is perfect, and we're all busier than ever these days, so it's not unreasonable to think that something may slip through the cracks. Frequent checkups can go a long way to preventing those things from coming back to haunt you later on.

That leads me to the tip I mentioned earlier. It's really handy to have a reference with you when you need it, when out in the field. So how can you keep the rules with you all the time? If you have a smartphone, I have some recommendations. For iOS devices, LawStack offers an app ($30/year subscription) that gives you a searchable copy of the rules that you can carry with you all the time. Android users can check out "DroidLaw" which has an "add-on" for CFR 47 which gives you the same benefits. I also have PDF copies of CFR 47 on my computer, along with the NAB's Engineering Handbook. Having all of these resources at my fingertips is exceptionally handy when a question comes up.

I find that the combination of having the rules with me all the time and going through the process of self-inspections have really increased my awareness of the FCC rules governing our industry. This, in turn, has made it easier for me to make sure my facilities are in compliance, since I now have many of those rules memorized from having gone over them so many times!

Once you get into that "positive spiral," keeping your facilities in order becomes very easy. You learn to spot potential problems right away and can respond to the issues swiftly and correctly. It also forces you to spend some time giving your facility a hard look – often you'll find non-related problems that may prevent costly repairs down the road. I use "inspection time" as an opportunity to look not just at regulatory and compliance items, but maintenance items as well. It's a great feeling when the ABIP inspector comes through and notes that it's obvious that I take great pride in my work and in my compliance with the rules. It becomes an easy process once you take the time to get it done.

Christopher Tarr holds the CSRE, CBNE, AMD, and DRB certifications from the Society of Broadcast Engineers, and is the Director of Techincal Operations for Entercom's Wisconsin stations. He can be reached at chris@tarr.cc



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Maintenance Guide

Just Log It!

by Tommy Gray – CPBE CBNE

Years ago this was a common practice – transmitter logging that is. We would not think about failing to log our operating parameters. Then deregulation stepped in and logging went out the window! When I first got into the Engineering profession, I had the example of a great engineer who logged everything. Studio and transmitter sites were profusely covered with documentation of everything that was done there, for the entire time he was Chief Engineer. When I took over it was an easy matter to continue to maintain the gear, as just about everything that was ever done to it was written down.

This really helped a fledging Chief Engineer to, not only easily maintain the equipment, but it helped to be able to cover things legally. Logging was not just a good engineering practice, it was a legal requirement! Some might say that logging is not necessary, and especially so, since it is not a legal requirement these days. Well allow me to remind you that there are still certain things you must log to be legal *now!*

For example, there is a legal requirement to maintain your operating frequency within legal tolerances. These tolerances vary between services (AM, FM, and TV). Didn't think you needed to measure your frequency? Well, let's see what the rules say:

§ 73.1540 Carrier Frequency Measurements.

(a) The carrier frequency of each AM and FM station and the visual carrier frequency and the difference between the visual carrier and the aural carrier or center frequency of each TV and Class A TV station shall be measured or determined as often as necessary to ensure that they are maintained within the prescribed tolerances.

Well it looks like to me that you need to at least check your frequency from time to time to assure that your operating frequency has not drifted. How often is determined by the stability of your equipment. You may go for years without the frequency being out of tolerance. But what if you get inspected and you are out? When was the last time you checked and logged your operating frequency? Now I realize that with the current state of the FCC and with all the cutbacks we have seen in staffing, that the likelihood of you seeing an inspector on just a routine visit may be rare. But you should still maintain your operating parameters within legal limits to prevent interference, and to assure that your station is performing well for the sake of your listeners and other broadcasters.

How far can I drift without being illegal? Well here you go, straight from the regs:

§ 73.1545 Carrier Frequency Departure Tolerances.

(a)AM stations. The departure of the carrier frequency for monophonic transmissions or center frequency for stereophonic transmissions may not exceed ±20 Hz from the assigned frequency.

(b)FM stations.

(1) The departure of the carrier or center frequency of an FM station with an authorized transmitter output power more than 10 Watts may not exceed ±2000 Hz from the assigned frequency.

(2) The departure of the carrier or center frequency of an FM station with an authorized transmitter output power of 10 Watts or less may not exceed ±3000 Hz from the assigned frequency.

In the last couple of years I have had personal dealings with a similar situation. A college station that was on the fringe of one of our major stations had an exciter that was prone to putting out spurs all over the dial and it would require a reboot to stop it. Now the engineering for the offending station was just about non-existent and all they had was a contract engineer that they did not call unless they were, for the most part, off the air. We would start getting calls from the market telling us that they were covering us up. We immediately knew what the problem was. We would then have to initiate a process of contacting the station manager who would tell us that they "didn't have a problem."

Well we would argue and explain to them that, "Yes you do have a problem, and you are interfering with us!" This rarely brought an immediate response, even though all that was necessary was to reboot their exciter and things were good to go again until the next time. Early on, they had an on-staff engineer who understood the problem and would work with us. However budget cuts forced him out and they no longer had staffers in charge of the technical operation. They became more and more difficult to deal with and I finally had to resort to calling the FCC. Finally, months later, they were inspected and the agent convinced them that they needed to replace the exciter, "or else!" During this time, had someone been checking the signal periodically, the interference could have been detected and dealt with promptly and to everyone's satisfaction. Oh and by the way, I heard that when the field agent asked for their logs, they had none!

Bottom line: Just because you have a modern transmitter that is known for stability does not mean that it could not have

(Continued on Page 40)

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Maintenance Guide

– Continued from Page 38 –

problems. The aforementioned transmitter causing all the problems was a modern solid-state HD transmitter and not some antique box!

Checking your operating frequency periodically is just one of many remaining technical regulations that are still in force that many may think no longer exist.

Another one is tower lighting inspection. The rules are changing frequently, it seems, with regards to technical monitoring and logging, but remember that you still have responsibilities as a tower owner to properly light, maintain and monitor your sites. Recent changes have somewhat relieved the quarterly inspection requirements for certain tower owners (i.e. Those who monitor all their towers from a Network Operations Center, "NOC" for instance). However, you are still required to maintain monitoring capabilities, which most of us in our trade do through our remote control systems, etc. There is also a requirement for tower/antenna structure owners to maintain records of observed or otherwise known outages or improper functioning of structure lights, for two years, and to provide such records to the Commission upon request. How do you do that? With your log book.

Don't Have a Log Book? No Problem!

I have traditionally kept a log book with profuse details as to the condition of the transmitter sites I maintain. Many of these are in the form of a nice notebook with specially made forms to log each and every parameter of the transmitter and every other piece of equipment vital to the performance and operation of the site. I first include in these forms, every legally required parameter that must be logged. Next, I include normal operating parameters for the transmitter so I can tell if anything is drifting or to alert me to anything that may indicate an impending problem (tube failure, etc.).

CCA FM 35000G FM Transmitter — Station: _____

Overall Meter Readings

Function	Date	Date	Date	date	Date
Multimeter					
IPA Ig					
IPA Isg					
IPA Ik					
IPA Eb					
IPA Esg					
PA					
Grid					
Volts (Ep)					
Current (Ip)					
Filament					
IPA					
PA					
Reflectometer					
Fwd					
Ref					
Watt Meter					
Fwd					
Ref					
Exciter					
Fwd					
Ref					
PA V					
PA I					
AFC					
Line					
Phase 1					
Phase 2					
Phase 3					
Hours					
Notes:					

Figure 1

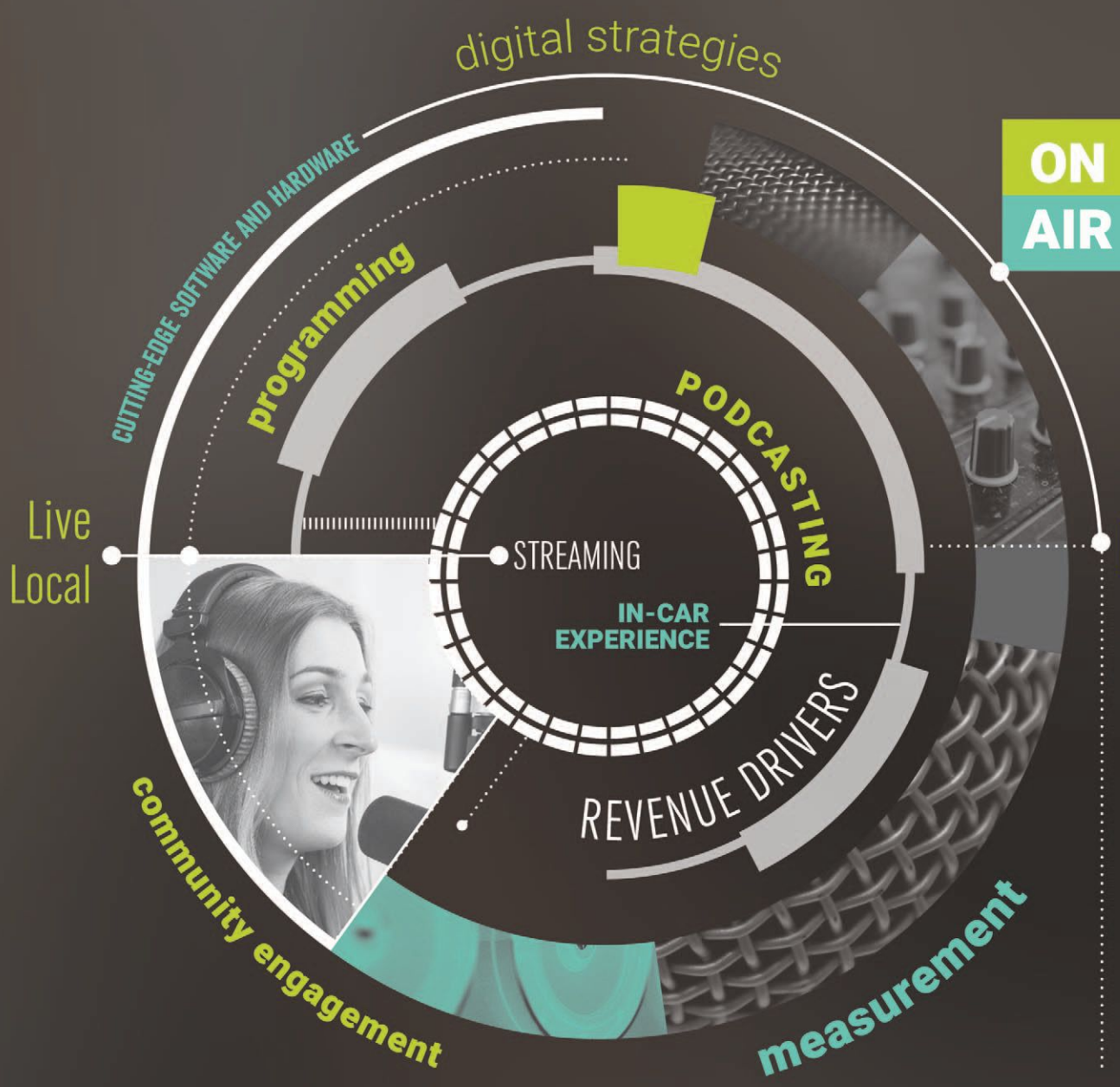
Most of the logging I do is for my own benefit and for the benefit of anyone who has to follow behind me to make repairs to the site. Following a premise from an an old GM, I operate on the "City Bus theory." What happens if you go out and get run over by a city bus? Who knows how to keep things going and what has been going on at the site? Well the simple answer is, "Your Log Book Does."

I didn't mention that the engineer who helped me so much when I first got into the business is one I never met, because he had passed away before I ever came on board. I felt I knew him, however, from reading the logs and maintenance records he kept. I could not have made it without them!

I said no log book, no problem. Well, what I meant was, not that you should not have one. What I meant is that you do not have to be fancy or elaborate to still meet the need. At some sites, simply because of budgets or time constraints, I had a simple spiral notebook. It is easier if you have only a few stations and are on staff, but if you have a scad of sites to maintain, and are a contractor, it is not as easy to keep a great looking book. I personally like to keep a decent book, because to me it shows that you care and are trying to do a great job! You may not ever meet your replacement, but I can tell you that he will think more of you if you help him out with great documentation. The FCC Field agent will also think more of you too, FWIW.

Figure 1 is a sample copy of a transmitter log to use for one station for weekly logging. You probably would want to add a few more things to it, but you can get the idea of a simple but comprehensive log from what I have shown here. Include things in a second section such as Tower Lighting Inspection, Frequency Measurements, Remote Control Calibration, etc., and you have a great book that will serve you and anyone who has to follow after you very well.

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



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LET'S THRIVE.

Small Market Guide

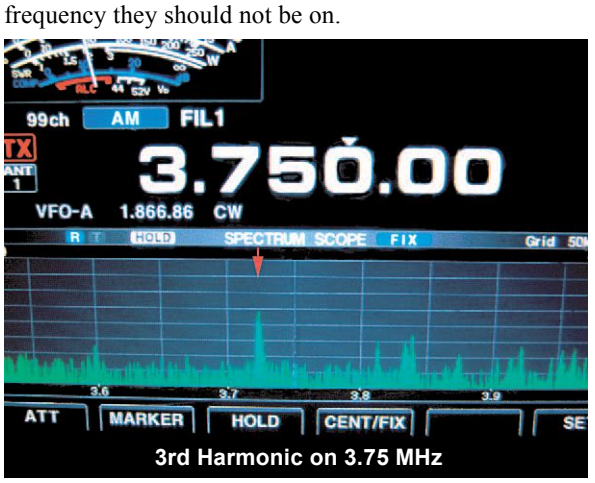
Transmitter Housekeeping in Small Marketville

by Roger Paskvan

Most small market owners are good honest operators and do their best to comply with the FCC regulations. Sometimes our aging RF generators unintentionally begin to fail and give no indication. This is where the "FCC Mock Inspection" plan shines, since it forces your engineer to check things that don't always show up on the meters. The following story is an account of what happened to one small market radio station.

It was on a cold winter day this past December, that I received a call from a station I consult, requesting help with an unusual problem. They claimed that a local Ham (Amateur Radio Operator) operator was saying that she listens to their AM station over her 80 meter Ham radio on a regular basis. I kind of blew it off as front end overload since she was about 5 miles from the station. I assumed the Ham had a standard 120 ft. dipole antenna that could gather quite a bit of signal. Hams are nice people, but occasionally exaggerate the situation. Just kidding, right?

A few days later, I contacted this Ham operator and we had a pleasant conversation about why this was happening. It seems that she wanted to check into a net on 3.75 MHz and our AM was coming in on top of that channel. Some quick math showed that the third harmonic of the 1250 kHz AM transmitter was ending up on 3.75 MHz. Well, we agreed to meet the very next day. I went to her house and got the free home demonstration of her $1,200 amateur radio transceiver. Yes, the AM station's signal was coming in S8 – loud and clear – five miles from their tower, on a frequency they should not be on.



3rd Harmonic on 3.75 MHz

Over the next week, I checked their AM transmitter. All seemed very normal and in good running condition. A field inspection of the tower indicated nothing unusual. Using a Potomac FIM 41 (field strength meter), I could hear a signal on 3.75 but it was in the microvolt area, just exceeding the noise

In order to do justice to this measurement, I drove out half a mile from the tower and took measurements on 1250 kHz and 3.75 MHz – a quick calculation showed the 3rd harmonic to be down only 57 dB. Wow! They had a serious problem and some of this radiation was causing problems in another radio service.

Over the next few nights, I checked out their old Gates transmitter, finding everything normal in the RF chain. It is not easy to locate harmonic problems. Eventually the problem was traced to a defective mica capacitor that was across the harmonic trap inductor. The capacitor measured open, thus providing no attenuation from the trap. A replacement was installed and the trap was tuned to stop 3.75 MHz with a network analyzer. There was a small minimal effect on the transmitter resonance but a touch up of the loading and tuning brought things back into perspective.

The next morning, I brought the FIM 41 out to the same spot and measured the third harmonic. It was a small rise in the hiss that I could hardly make out, but the ratio became 97 dB down. Now that's more like it.

A quick call to our Ham friend indicated the signal had dropped from S8 to S1. She could barely make it out in the noise. Victory in small marketville again.

The FCC rules (Part 73.44) indicate: Emissions removed by more than 75 kHz from the main carrier must be down 80 dB below the unmodulated carrier level.

The moral of this story is that not all transmitter problems show up on the meters or in daily operational checks. It might be a good idea to measure your out-of-band products one or more times a year just to be safe, and keep the FCC from having to make a house call.

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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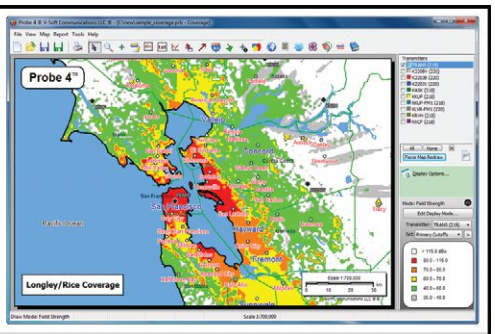

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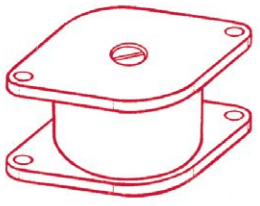

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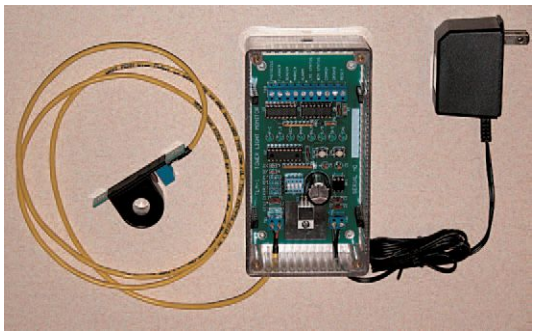

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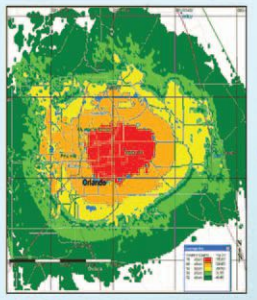

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Notable new features include a five-inch capacitive touch screen that doesn't require a stylus, which simplifies set up and operation. ACCESS NX includes a dedicated stereo line input, in addition to a pair of XLR switchable audio inputs. ACCESS NX will also be compatible with an ACCESS clip-on channel mixer, a new accessory which adds four mic/line inputs and headphone outputs.

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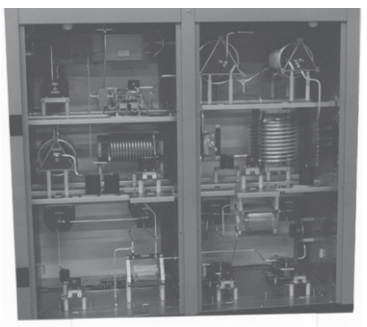

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