Radio Guide

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Surviving Emergencies by Integrating IP Audio

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Radio Guide

Contents

January-February 2014

Radio Guide
Volume 22 – Issue 1

Cover Photo: John Lackness - V.P. Sales for Tieline

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In This Issue

Critical Content for Radio

Cover Story – *by John Lackness (page 6)*

"One of the reasons I am talking about how to survive emergencies by integrating IP audio, is the current push by Telcos to pull copper in many parts of the U.S. ..."

Transmitter Site – *by Mike Callaghan (page 10)*

"It's when you start digging a little that you discover finishing touches that never got finished. Interlocks, alarms, and remote control functions often get overlooked in the rush to get a new piece of equipment set up and running ..."

FCC Focus – *by Peter Gutmann (page 14)*

"Recently, the proverbial pendulum is swinging back. Many states have reversed course, legalizing marijuana for medical purposes and some even for purely recreational use. However, the federal ban remains in place. That imposes a burden on broadcasters who face conflicting legal standards ..."

Links and Lines – *by Chris Tarr (page 20)*

"With the Internet age comes a new breed of device, the IP Codec. These devices deliver audio over IP circuits – either private or public. Are these devices ready for prime time? Lets take a look ..."

Transmission Topics – *by Jim Turvavile (page 34)*

"For all stations, a knowledge of the FCC Community Contour coverage is an excellent starting place. The FCC has determined a minimum amount of signal that needs to be present from a station in order to properly serve the community to which it is licensed ..."

Phone
STAC VIP

Surviving Emergencies by Integrating IP Audio

by John Lackness – V.P. Sales, Tieline

Radio is critical in disaster management and there are numerous examples of how it can save lives. Whether it is fires in California, tornados throughout the midwest and wind from hurricanes, snow just about anywhere across the northern half of the U.S., or earthquakes or floods, radio becomes a key source of communicating with your community when a disaster strikes.

How Prepared Are You?

It was a little over a year ago that Hurricane Sandy hit the Northeast, and for those of you in this region, it's not something that any of you want to see again – especially after Hurricane Irene the previous year. However, it got me thinking about how many of us are really prepared for disasters, and how *well* are we prepared?

I used to be the Chief Engineer for several stations in Texas, so in writing this article it made me think of what I would do today to prepare for a disaster, and how to integrate AoIP in any form.

During Hurricane Irene, 44% of cell sites went down in Vermont and another 6,500 sites were down on the East Coast. During Hurricane Sandy, 8.6 million customers lost power and this affected nearly 50 million people. One week after the storm there were still 2.2 million without power! The cellular industry lost one quarter of the cell towers covering 10 States, and radio stations struggled to stay on the air or recover after the storm.

One of the reasons I am talking about how to survive emergencies by integrating IP audio, is the current push by Telcos to pull copper in many parts of the U.S. This affects the implementation and continued use of ISDN services. One of my sources told me that if a storm were to come through, and there is significant damage to copper infrastructure for ISDN services, there is a chance that it will be gone for good and not be reinstalled – especially in areas where the "zero ISDN installs" push is occurring.

We all know that technology and cost efficiencies are also driving more broadcast resources into IP and this will continue. As a result, IP backup strategies will become increasingly important in any radio network's disaster management strategy.

Diversification is the Key

In an emergency, diversification is the key. If you have a backup, have a backup to your backup – and a backup to that. Since we are talking about delivery of audio to your transmitter site, when an unexpected disaster strikes, here is what I, and others who I have polled, would suggest as inexpensive solutions.

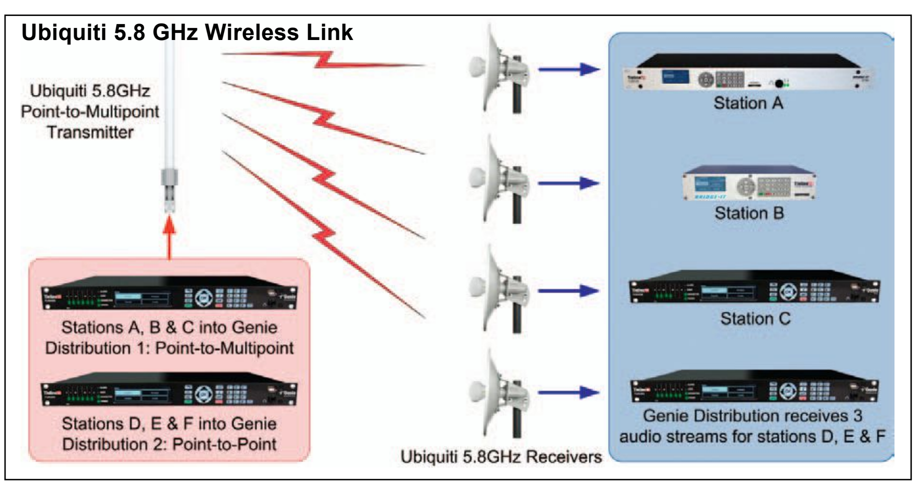
When selecting an audio codec to keep you on the air it is critical to assess its redundancy capabilities. The latest STL-grade IP audio codecs feature redundant internal power supplies and dual Gigabit Ethernet switches, which deliver redundancy at both power and network transport levels.

Tieline's Merlin and Genie families of IP codecs offer dual redundant IP streaming from different Ethernet ports. This is called SmartSteam PLUS, and it allows streaming of two identical IP packet streams using different ISPs. This can deliver seamless redundancy by switching back and forth, without loss of audio, from the primary IP data link to the backup link, if one fails and then subsequently recovers.

Using IP links from two different IP network providers delivers optimal redundancy over mission-critical STL connections. As an example, the first Ethernet port could connect to an AT&T Internet source, whereas the second port may use Verizon. Alternatively, one port could be connected to a wireless source.

And speaking of secondary sources, I also like 5.8 GHz wireless IP. Granted, it is not even a consideration, on a daily basis in a large or medium market, due to the proliferation of other 5.8 GHz devices, but in an emergency those interfering devices will be largely unusable due to a variety of power and/or Telco issues.

An idea was floated to me about making nice with a company in a large multistory building, where several radio stations could set up shop temporarily during a major disaster. Genie Distribution audio codecs could then route emergency information from each station into a Ubiquiti 5.8 GHz wireless link to each station's transmitter.



Alternatively, a single program signal could be configured for point-to-multipoint use. The idea here is to have one signal transmitted to all stations involved. Each station could install a low cost Ubiquiti unit at its transmitter site for about $120.00. Now if that does not float your boat …

Another source of redundancy is a wireless router like the popular CradlePoint Router series. Some of these will allow you to plug in as many as 4 USB wireless air cards simultaneously, so theoretically you could run all the major wireless companies as a wireless backup in case your main wired IP or ISDN circuits fail. You could even use a portable Wi-Fi hotspot via your cell-phone!

Power Considerations

We all agree that no matter what, we *must* have reliable power. Often we are so busy we can forget to ensure backup power supplies have been maintained correctly. Some points to ponder include: How long has it been since you have checked those UPS batteries? How old are they? Do you have any UPS units that are charged and ready for standby?

Do you have a backup generator at your transmitter? What is your fuel source, and do you have a good supply in case you will be down for a few days? Do you have a dual fuel generator? And lastly, when was the last time you full load cycled your generator? You should strive for once a week, or at a minimum once a month – but be sure to put a full load on it.

Bandwidth Restrictions

It's also important to think about conserving bandwidth over bandwidth constrained networks during a disaster. Algorithms like AAC-ELD, Tieline Music and Opus deliver high quality audio at low bit-rates.

You may not be familiar with Opus, which is an open source, royalty-free and highly versatile audio codec, ideally suited to disaster situations. Opus has been ratified by the Internet Engineering Task Force as RFC 6716 and validated by the EBU.

Let's say that we are in an emergency situation and have limited IP bandwidth due to damage to Telco infrastructure. Opus will deliver high quality voice at 9.6 kbps with low IP overheads. This is why we talk so much about the advantages of using Opus – like your mama wanting to introduce you to the nice girl down the street!

Once you get your audio to the transmitter successfully, you can use your preferred digital audio delivery system to run music and commercials and integrate any relevant safety information to the public in real-time.

Although what I have written is important as far as backups are concerned, one of the most important things to do is get to know the utility people in your community and keep in touch with them. These are human backups who can be your best friend in an emergency.

IP Network Security

It is important to be vigilant about IP network security. Hackers from around the world are active at this very moment trying to gain access to U.S. infrastructure, and we all know what the Stuxnet worm did in Iran. Should a hacker or an equally damaging worm or virus infiltrate any part of our broadcast infrastructure, what would we do? We already know of the instance of person(s) who got into poorly secured EAS encoders and put off "Zombie alerts," so we know that it can be done. Many of these attacks are delayed and if we were affected, how long would it take for our systems to return to normal operation?

In an emergency, remember that no matter what, people will want to tune in to your station for reliable disaster information updates. So to avoid a "perfect storm" of natural disaster impacts and related broadcast infrastructure failures – be vigilant in adapting your strategies and continually assess whether they are appropriate for your current requirements.

John Lackness began his broadcasting career as a DJ, then as a radio engineer in Texas. He then spent five years as sales manager for Marti Electronics and was in charge of the Southwest region for distributer SCMS. He is currently VP Sales for Tieline the Codec Company throughout the Americas.

Studio Site

The Un-Studio

When the Room That Makes Your Sound, Hurts Your Sound

by George Zahn

Take a moment soon and walk into your air studio. Turn down the monitor and the cans – and just listen.

Shhh ... do you hear it? Do you hear anything?

Ideally, you *shouldn't* be hearing much of anything, but as romantic as it might sound, many of us are broadcasting in creatively (and sometimes not so much) converted studios. These are often rooms that were never designed to be sound proof environments or ideal places for announcing in a quiet place. Those of us around long enough might remember carpet patches on walls to help keep a room from being too "live" or reverberant.

I know I am not alone, but I inventoried some of the air studio locations from which I've been fortunate to broadcast in my career. I count among them, downtown high rise studios that took most of a complete floor, to a converted small town law office, a hill top studio right under the tower, studios that were basically transformed university classrooms, a farm house complete with bay window, the second floor of an old office building where you could hear anyone tooting a horn outside, and even a gutted and renovated factory.

Antique collectors would call this provenance and it makes for some wonderful radio "war stories." Sometimes we simply made do with what we had, and wished for more. While that second floor studio overlooking River Street in a small Michigan town allowed us to do a bird's eye broadcast of the annual 4th of July parade, the giant windows that acted as sounding boards for everything else outside, more often detracted from what we were doing.

There are simple things we may be able to do as engineers and managers, and more importantly as a creative team from both camps, to help the acoustics of the rooms that shape our sound. In a perfect world, we'd have the perfect mix of sound absorption and nice reflective surfaces. We'd have walls that weren't at perfect right angles, to prevent standing waves. We'd have airlocks on the doorways, and nice double or triple pane windows and doors that Arnold Schwarzenegger would have a difficult time opening.

We don't often get dealt the hand that is the perfect studio, so we have to make the best of what I call the un-studio – the room that was loosely modified so someone could "make radio." I've worked with engineers, in this era of LMAs, that have literally had to build studios in hallway closets to add a new air studio for a broadcast group.

I hope we're not getting to the point where most of us don't care about what avoidable noise creeps into our air signal. It's easy to toss it off as something about which the competition doesn't care. We should be striving for the best sound for our listeners, and that means minimizing the noise in our studios. I understand no place is perfect. Even the gutted factory that was made to be state of the art broadcast facilities had a nasty skylight that ran the length of the building and, though baffled and stuffed with insulation, would still create a funky low frequency every time we had a really hard rain.

What noise can we control? There are three areas in which I think most stations can improve. If your studios front on a busy thoroughfare, or you're in a converted house near traffic, the cost of adding better windows, some wall soundproofing and heavier doors, or adding an airlock, can be a good investment. Odds are most of the changes have happened already.

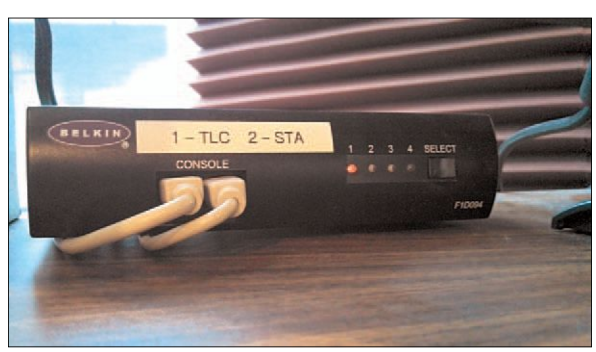
For the last few years, we've been battling a small, but knotty problem at my station, WMKV. Our studios were moved to a highly visible area of the company which owns us. We were moved into a converted, multi-purpose room with tons of windows and two heavy, but clunky doors. The windows are double pane, but the main walls with windows front onto a long hallway with plenty of foot traffic, including a Montessori pre-school group that happens past the studios daily.

It's not as bad as my first radio job in university studios, where we had to time our breaks so that when the lawnmower passed by our small basement window, we could shield our listeners from it. It is, however, something that we continue to try to improve so we can minimize the external noise around us.

Another area of concern is HVAC. If new studios in an old location are needed, it might be a good time to look into high volume, low pressure air handlers that will operate much more quietly in most cases. Some units also have special baffling to prevent air handling noise.

But there's another insidious noise that's been encroaching on many studios from small to large markets, and the cost to fix it may not be all that high for the end benefit. It may have started with one computer for the on-air control or for checking traffic reports. Soon there were two computers in the room, then maybe three. The fan noise from these conveniences might not seem like much, but with on-air processing, those fans add up and start to hinder our sound.

Our station tackled this long ago, and now we have many Keyboard/Video/Mouse (KVM) switches/extenders to keep the computers elsewhere, while the KVM controls stay in the studio. Radio operations specialist Dave Schram says, "The KVM allows us to extend a single computer to another room or studio, via either CAT5 or other proprietary cable. A reliable one for broadcast purposes will cost $200 to $450."



A Belkin KVM Extender

The modest equipment outlay (some KVMs can run as little as $40 to $100, if you wish to experiment with one) has helped reduce the noise in many studios. In fact, at our small station alone, we use a KVM to access different computers that control our air studio, access to Internet and traffic info, our communication with the front desk for on-air caller info, and our recording interface. Another KVM is used for our Wide Orbit on-air control. That equates to the fan noise of at least three computers eliminated from our studio and placed in rooms where the din isn't a significant issue for broadcast.

Schram reports that, while a KVM with CAT5 cable can run up to 1,000 feet, it's not recommended to run them that far, to ensure a solid KVM signal. He adds, "Running 500 feet or less is better, and some may even be limited to as little as 100 feet."

In addition to keeping out noise, stations using KVM switches and/or extenders in each studio allow for all the CPUs to be placed in one air controlled closet. Our relatively small operation has five workstations, and all the actual computers are in a single small room which has its own climate control. While we couldn't control the design of the outer wall of our air studio (pictured), we could at least eliminate the computer fan noise and better preserve our computers.

The WMKV Air Studio

Sound absorption is important if you have too many hard or reflective surfaces, and that's where products such as Sonex and SoundTex to deaden part of the studio (some on a budget have even used carpet remnants with limited success). Our WMKV-FM air studio is about half Sonex and half glass/metal drywall – a happy medium.

I once worked a station which had some extra Sonex, and literally covered every inch of the walls in one studio with the absorbent covering. That didn't last long. In effect, we created an anechoic chamber in which there was so little "live" effect that it was disturbing to go into the room, much less try to broadcast from there.

Creating irregular surfaces through adding a small bookcase or plant, can help deaden sound. Curtains (over windows or just along walls) can also replace or complement the permanently mounted wall coverings. You can retract or extend curtains to adjust the desired "liveness" of the room. Just a little bit of improvement can make a major difference in sound.

If you have a fun story about a studio you've built or been a part of, please share your radio war stories with me at: gzahn@mkcommunities.org

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

Putting the Finishing Touches on Transmitter Plants

by Mike Callaghan (KIIS Radio - Retired)

It doesn't take a whole lot to put a new transmitter on the air. You hook up the power, the audio, and the antenna, and you're pretty much good to go. What gets overlooked way too often are the finishing touches that provide protection for the transmitter and the other parts of the plant.

I've seen way too many happily operating facilities, where everything seems just fine given a casual glance. It's when you start digging a little that you discover finishing touches that never got finished. Interlocks, alarms, and remote control functions often get overlooked in the rush to get a new piece of equipment set up and running. Once the new gear is perking away and the tools are stored, it's easy to decide it's Miller Time and to leave the little details for another day – a day that never seems to arrive.

Power Control

With automatic power control built into many new transmitters, why not skip the raise and lower functions and let the transmitter set its own power? Well, for one thing, the Rules say you have to be able to adjust this from the studio. For another, FM stations that share sites can be asked to drop power when someone is climbing up an adjacent tower, and passing right through the aperture of antennas that belong to someone else. In that case, a number of stations are required to drop power to protect the riggers. This happens all the time at Mt. Wilson, and gets inconvenient when there's no way to adjust the power remotely. Finally, something might go wrong with the antenna system and, depending on the age of the transmitter, you might need to reduce power just to keep the station on the air.

Transmitter Grounds

A good earth ground for the transmitter often gets overlooked, the philosophy being that the transmitter is grounded through the antenna lead. Remember that there's a lot more going on with that antenna connection than providing a transmitter ground. The box needs a good, solid strap to the station ground regardless of the antenna. This is true for both AM and FM operations. During the Station Fire, when Mt. Wilson was in peril, we had a solid-state FM transmitter in the back of a cargo truck. It was supposed to run from a generator in a towed trailer. We tried running it without a good solid ground, and it wouldn't even turn on. Only after we "borrowed" a ground from an electrical panel on an adjacent building could we get power out of it. It was a lesson well learned.

Coaxial Transfer Relays

If your facility uses coaxial transfer switches, there are a bunch of interlock connections that are supposed to do two things. First, they're supposed to turn off the RF when the switches are in operation. This basically means the transmitter interlocks should be opened whenever the coaxial switch carrying the transmitter output starts to change from one position to another.

Fine in theory, but the fact is that transmitters don't stop producing RF the instant the interlock opens. There are tank circuits inside, and there's still going to be some output there, even after the relay starts to break the antenna connection. It's much better to turn off the transmitter first, and then after things have had a chance to die, command the transfer switch to start changing the connection. Just a second or so of delay should be enough.

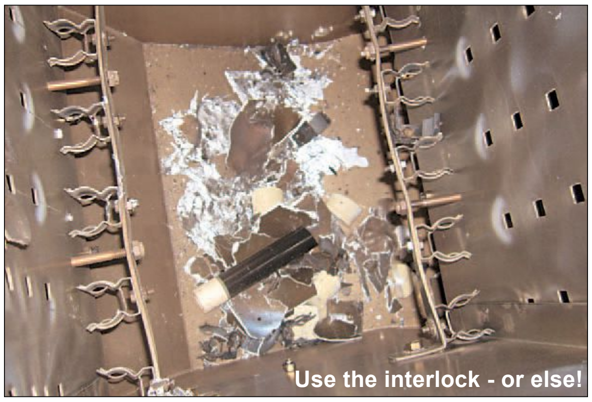
The second function for the interlocks is to provide tallies so the control circuitry knows what position the switches are in. This helps make sure the right transmitter comes on, and that the connections all got seated correctly. I've had these switches "hang up" halfway through a switching sequence, and then nothing's connected to *anything.* You don't want the transmitter to come on at full throttle when this happens.

To be honest, I abhor coaxial antenna relays. I've never known anyone that's used them and not lived to regret it. To me, the best coaxial transfer relay is the one that doesn't exist. There are plenty of ways to avoid using them, and these are the ways I'm most comfortable with.

Dummy Loads

If the station uses an air-cooled dummy load, this brings about another set of connections that are easily overlooked. Dummy loads like this have two connections to the rest of the plant. First, they require power to drive the internal fan that keeps them cool when they're operating. This is readily obvious and is rarely overlooked. Secondly, they have a thermal switch inside that activates when the load gets too hot. This can happen if the fan fails, or the fan power gets interrupted.

This switch is supposed to get tied into the plant's control circuitry, so that whatever transmitter is running the load will get shut down when the load overheats. And this connection seems to be at the top of the list of the "Connections-That-Never-Seem-To-Get-Connected." Ignore this connection at your own peril!



Use the interlock - or else!

KSRF, a Class "A" station that had a transmitter plant on top of a high-rise at the beach in Santa Monica, left this disconnected. A novice operator, confused about what did what on the remote control, turned on the auxiliary transmitter into the dummy load and left it running. The fan seized, and the resulting inferno burned down the top floor of the building and completely destroyed the transmitter plant. The station was off over a week until something temporary was rigged up somewhere else.

The results of lost dummy load cooling.

More recently, we had a station on Mt. Wilson do the same thing, but the dummy load disintegrated before it could set fire to anything else. The resistors fractured and fell apart.

Sleet Melters

Another seasonal feature that might get skipped is hooking up the sleet melters, or deicers. Even in sunny Southern California we get snow and sleet on Mt. Wilson, and bad things happen when the antenna freezes up. We had one station with bad deicers that was very philosophical about the problem; when the antenna froze in the winter, the tower couldn't be climbed to fix the problem, so the station used a backup antenna, with reduced coverage. In the summertime, there wasn't any ice, so the antenna worked fine and didn't need fixing! This went on for five years before a new antenna was installed and the problem fortuitously went away.

If you have a thermostat that switches the deicers on automatically, be sure and meter the current so you know they're working right when they do come on.

Statuses and Resets

Depending on the size and complexity of the transmitter, there are likely to be a number of status alarms and reset functions that are meant to tie into the remote control. These can be valuable in just keeping an overview on the way things are running. The status flags can show if there was an antenna VSWR overload or other anomaly. The reset will get things going again if the transmitter shuts down. All of these are important.

It goes without saying to hook up as many of the remote control metering channels as you can; the more you know about what's happening at the transmitter, the better advised you'll be.

Another connection that's important is the one between the remote control at the transmitter and the outside world. Historically, there's been a remote control chassis at the transmitter, and another one at the studio. They've been linked together using two-way connections so you can control the transmitter using the studio unit.

Recently, a trend seems to be becoming established that does away with the studio unit, and allows the transmitter to be operated using a Graphic Computer Interface (GCI) and the Internet. This allows control from anywhere, with a computer and an Internet connection. While the FCC still wants a formal control point, this is certainly more flexible and allows advanced control functions from a variety of locations.

And if all else fails, many remote controls still have the dial-up and touch-tone access that allows control from just about any telephone.

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

Gear Guide

A Very "Cool" Transmitter

The Rohde & Schwarz THR9

by Steve Callahan

While I was at the 2013 NAB Radio Show in Orlando, I had the opportunity to see a product which I had only just heard about. Over the years, I've visited quite a few FM transmitter sites which were co-located with TV transmitters. I had always been fascinated with the liquid cooling systems which these UHF transmitters used, and it seemed to me that liquid cooling could also be efficient for higher power FM transmitters. Imagine not having to build and maintain expensive HVAC systems just to remove transmitter waste heat.

In the vendor exhibit area, I saw a crowd of people surrounding a booth, and naturally I was curious to see what was so interesting. The folks at Rohde & Schwarz had a demonstration model of their THR9 on the floor and it looked very impressive. They call it the "Future-Proof" transmitter, with a high efficiency and small footprint. It's a true liquid cooled FM transmitter, and by doing so it is 75% energy efficient.

You've probably heard of the Munich-based Rohde & Schwarz through their high quality line of fine German-engineered test equipment. With a history spanning 75 years, they are the largest manufacturer of electronic test and measurement equipment in Europe and their newest offering, the THR9 transmitter, looks just as impressive as their spectrum analyzers – with a clean, totally functional look.

A closer view at the THR9 revealed a lot of transmitter in just one rack. Their 5 kW power modules are physically small because they utilize direct heat sink liquid cooling, and this allows for up to 40 kW of RF output per rack. The liquid cooling by direct heat sink coupling assures that all of the output transistors are operated at the same temperature, which eliminates the uneven cooling in a fan-cooled unit. Imagine the space savings when you remove the exhaust fans and internal plenum spaces in a convention FM transmitter. Now you get the idea of how Rohde & Schwarz can achieve that space-to-power density. THR9 can also be configured using their MultiTX system to have up to four 10 kW individual transmitters in just one rack, and this configuration can be easily modified in the field if future needs dictate change. Up to an 80% space savings in some transmitter sites, by having the ability to locate up to four 10 kW transmitters in one rack, is pretty amazing.

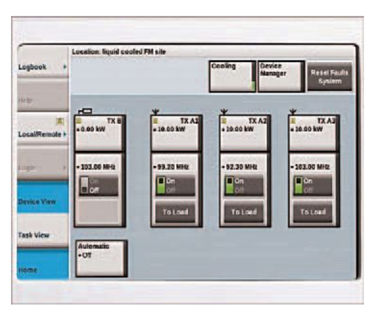
Power Amplifier Module

Since the concept of liquid cooling for UHF transmitters has been around for a long time, the cooling for the THR9 is achieved by circulating liquid coolant using an outdoor heat exchanger and two indoor pump modules that operate in active standby mode. The coolant pumps are also normally mounted inside the transmitter rack and are connected to the outdoor heat exchanger with just two coolant lines. The pump modules can also be located outside of the transmitter rack if site restrictions require a floor or wall mount.

Coolant Pumps in the Rack

Their innovative liquid cooling system saves lots of energy by optimally adjusting the coolant flow and also adjusting the outdoor heat exchanger fan speed accordingly, depending on coolant temperature.

One feature that wasn't immediately obvious is a low noise operation. Without the need for any high RPM indoor exhaust fans or blowers, the THR9 is an amazingly quiet transmitter. We've all had to work at transmitter sites that had deafening blowers, and a quieter transmitter site would be a welcome relief. With redundancy in mind, each of the RF power amplifiers, which can operate at 5.2 kW in analog mode, have three power supplies which helps to insure that the amplifier remains on the air with two-thirds power even if one power supply fails.



Retractable Touch Screen

One obviously cool feature is a retractable touch screen that automatically slides out of the transmitter and allows for local control and monitoring of the THR9. There is also the obligatory LAN interface which allows for remote operation via a web interface. The transmitter has a front panel status display and controls, that make it easy and quick to select from remote to local mode – and switch the transmitter on and off locally.

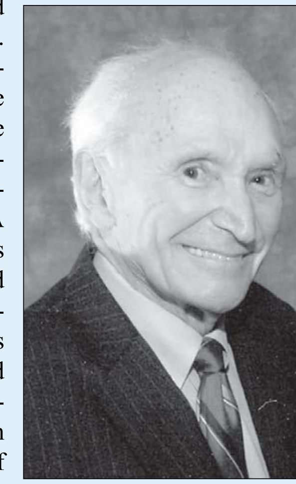
Ever increasing electricity costs and crowded transmitter rooms mean we have to rethink the concept of exactly what a higher power FM transmitter needs to be. The folks at Rohde & Schwarz have done a lot of thinking and have come up with a very innovative product. Of course, they also provide a 24/7 transmitter support telephone number. You can reach the Rohde & Schwarz in North America in Columbia, Maryland at info@rsa.rohde-schwarz.com or 1-888-837-8772.

Remembering Bernie Wise

Founder and President – Energy-Onix

Bernie Wise, a pioneer in the grounded grid design for broadcast transmitters, passed away on December 13, 2013.

I would be remiss if I didn't write about my experiences with Bernie over the years. I would see Bernie at various NAB shows, and to say that he was a real character would be an understatement. Before founding Energy Onix in upstate New York, in 1987, he had a fascinating history in transmitter design with RCA, CCA and CSI. Bernie was very outspoken and never let an opportunity pass to express his opinion. I once asked him just how important filament regulation was in the operation of a tube transmitter. He just shrugged and said in his opinion it really wasn't all that important and that he suggested that the filament voltage control on his transmitters be left at their minimum setting.



Bernard Wise (1926-2013)

One time I had a vexing problem with one of his FM transmitters that I had installed in Erving, Massachusetts. One call to Bernie and a factory technician was on the way. When he arrived later that day we found that the output filter had been jarred out of internal adjustment during shipping.

Bernie's tech and I then disassembled the filter, made a few adjustments, reassembled the filter, and it was soon "problem solved." I returned the favor to Bernie shortly after, when he called and asked me to visit another of his Energy Onix FM transmitters on Cape Cod, which wouldn't turn back on. That station's regular engineer couldn't be found and they needed help so they called the factory. When I got to the station's tower site, I found a lot of lightning damage and the best I could do was relay back to Bernie a list of all of the obviously burned and charred components, while I connected their exciter, which was still operational, directly into their antenna.

My lasting memory of Bernie Wise will be when I was installing one of his transmitters at a new FM station in Dudley, Massachusetts on top of a hill, accessed only by a very steep and muddy road. I was in the transmitter building working on the transmitter when I looked out of the door and down the muddy hill, only to see Bernie slogging up the hill in knee-high boots. I hadn't asked him to be present but he knew I would be there and he thought I might appreciate his help. That transmitter installation was one of the most rewarding and entertaining I have ever done thanks to Bernie's presence.

I have never heard of another owner of a broadcast transmitter company who showed up unannounced at a tower site just to assist a local engineer install his product. I'm confident that the good folks at Energy Onix will continue the personalized, hands-on attention that I will always remember Bernie Wise for.

– Steve Callahan

FCC Focus

A New Era of Ad Content

E-Cigarette and Cannabis Considerations

by Peter Gutmann

Cigarette ads on radio? That's an easy one – you can't – ever!

Yet two recent developments soon may test the federal ban that's been in effect since 1971.

The first involves so-called "e-cigarettes" – electronic devices shaped like a cigarette but containing a battery-driven nicotine vaporizer. The second involves the desire of dispensaries to advertise their wares in states where marijuana has been legalized.

Here's the crux of the issue – the statute banning broadcast cigarette ads defines a cigarette as "any roll of tobacco" that is wrapped in certain substances or offered for sale in certain ways, and neither e-cigarettes nor marijuana products contain tobacco. (The law has been extended to smokeless and chewing tobacco, but that seems a logical extension of the basic definition.)

As you might expect with evolving developments, so far this is a gray area that broadcasters may be tempted to confront. Let's take e-cigarettes first, which are being marketed as satisfying a craving for nicotine and weaning smokers away from the toxins of tobacco.

The Department of Justice has issued a letter advising that since e-cigarettes do not contain tobacco they are not within the scope of the advertising ban. Yet, that letter came from the DoJ's Consumer Protection Branch, rather than its Criminal Division that is apt to enforce the federal ban (which is a criminal statute). Indeed, the letter cautioned that it did not represent the views of any other governmental office, thus leaving unaddressed the positions to be taken not only by the DoJ's own Criminal Division but by the Food and Drug Administration and the Federal Trade Commission, as well as the FCC, all of which could assert jurisdiction over e-cigarette ads.

The FDA in particular has challenged unsubstantiated safety claims by e-cigarette manufacturers and has issued health warnings about their products containing known carcinogens. It further indicated that it intends to regulate e-cigarettes consistent with its mission of protecting public health. So any advertising might be short-lived. In the meantime, it is conceivable that broadcasters airing e-cigarette ads could confront consumer protection agencies or be held liable to listeners claiming injuries from purchase decisions influenced by the station.

While e-cigarettes are a relatively recent development, marijuana has a long and largely favorable history. In fact, it was not all that long ago that marijuana was entirely legal throughout the U.S. Until 1937, it was prescribed as effective treatment for a wide range of afflictions and bore the authority of being included in the *United States Pharmacopeia,* the official medical reference manual. Indeed, the American Medical Association opposed the Marijuana Tax Act of 1937, which outlawed the distribution of cannabis. Although the federal ban had exceptions for medical or industrial use, state laws arose to foreclose them. Finally, the Narcotics Control Act of 1956 made even simple possession a crime with heavy sentences and fines. Even so, the drug retained a wide spectrum of users, from musicians to college students, and continued to be touted for its medicinal value.

Recently, the proverbial pendulum is swinging back. Many states have reversed course, legalizing marijuana for medical purposes and some even for purely recreational use. However, the federal ban remains in place. That imposes a burden on broadcasters who face conflicting legal standards.

This goes beyond personal opinion or approval. Like it or not, the clear trend is toward the legalization of cannabis, if not on a national level, then certainly in a majority of the states and municipalities. Public opinion already favors legalization by a growing margin, law enforcement officials generally resent the drain on their resources to pursue minor violators who merely possess or use marijuana, legislators decry the drain on scarce funds of tracking down, prosecuting and jailing offenders for relatively trivial incidents, and politicians crave the dollars that taxes would produce.

The moral considerations, fortunately, are well beyond the scope of this article. On the one hand, marijuana is often cited as an entry-level drug that can lead to reduced productivity and addictive dependence on more powerful and ruinous substances. Yet, proponents of decriminalization point out that it can stimulate artistic productivity, that it is far safer than alcohol (how many traffic fatalities are caused by stoned drivers, as opposed to drunk ones?), that decriminalizing it will shift profits out of underworld markets into legitimate commerce, and that failing to tax it squanders an opportunity to provide a much-needed source of revenue.

The most immediate issue for broadcasters is how to deal with requests for marijuana advertising. Of course, above any legal consideration is your near-absolute editorial discretion to determine what types of ads to accept. As a general matter, you are free to accept or reject any ads you wish. The exceptions are few – mandatory federal political access, equal opportunities and avoiding "no urban/no Spanish" dictates. Otherwise, if you want to decline certain categories of ads, that is your right, both morally and legally.

If your state has not legalized marijuana for the purpose stated in a proposed marijuana ad, then there seems little question that the ad should be declined. But what if you're tempted by lucrative ad opportunities for marijuana-related products and services that have been made legal in your state? Broadcasters still face the realization that they hold a federal license, and so it is possible that federal standards would be applied to a license challenge based on encouraging use of a federally-banned substance. In that context, it's worth considering that the Supreme Court has upheld the right of the federal government to prosecute medical marijuana patients in states with compassionate use laws, and that marijuana dispensaries in California have been subject to drug enforcement raids. So state legalization may not provide a refuge against federal prosecution.

In that regard, it is important to note that the federal Controlled Substances Act (which holds marijuana to be an illegal drug) does not apply only to advertisers. Rather, it specifically provides that it extends to anyone who aids or abets the commission of a drug-related crime. Indeed, it further provides that the aider or abettor can be charged with the illegal acts even if the perpetrator itself is not charged. While First Amendment considerations might eventually be raised as a successful defense, it is conceivable that a broadcaster could be swept up on a drug prosecution for having "aided and abetted" the ostensibly illegal activity of an advertiser.

A degree of clarification of the conflict between federal and state laws came this past summer when the Department of Justice issued a memorandum directing law enforcement to focus on certain priorities, including distribution to minors, trafficking to states where possession is still illegal, adversely impacting public health and other offenses that went beyond mere possession and use. Of particular concern to broadcasters is DOJ concern when marijuana or marijuana-infused products are marketed in a manner that might appeal to minors. The memorandum further advised states to implement a "strong and effective" regulatory scheme and instructed prosecutors to review marijuana cases on an individual basis to determine whether the state regulatory scheme had been violated or if federal priorities were implicated.

An interesting and perhaps significant indication of how these conflicting considerations might be balanced comes from Colorado, one of two states where recreational use is now legal. In September, in addition to proposing a stiff tax on retail sales, the Marijuana Enforcement Division of its Department of Revenue issued a set of rules that may serve as a model for other states that will have to confront similar issues.

The primary regulation bars marijuana advertising unless the advertiser "has reliable evidence that no more than 30% of the audience for the program … is reasonably expected to be under the age of 21." This would seem to effectively serve as a ban for most programming during most hours of operation. (A similar restriction applies to TV, print media and the Internet.) Ads targeting out-of-state persons, ads on mobile devices that could be accessed by minors, most outdoor ads and pop-up ads are all prohibited outright. Content restrictions extend to most safety claims and the use of cartoon characters or other means of appealing to minors. Even signage and advertising promoting event sponsorship are strictly controlled where 30% or more of the viewers might be minors.

In response, the on-line *Marijuana Business Daily* conceded that the only vehicle left in Colorado for cannabis ads might be email specifically targeted to adults, although it left unaddressed how to ensure the effectiveness of "over 21" barriers or certifications to comply with the Colorado age restriction. It further noted that branded apparel, such as tee shirts, or other types of displays, while currently not addressed by the Colorado rules, could be nixed in the future should exposure to youth become prevalent. In the meantime, it cautioned that "Colorado retailers need to place ads very carefully."

In light of these considerations, it seems impossible to predict the outcome of a test case in which a broadcaster would be called upon to defend itself against an accusation of violating the federal marijuana laws. While it might be hoped that a mature, fact-based spot would pass muster, there is no "safe harbor" or other reliable basis for assurance. In addition, broadcasters have no way to control the reception of their signals by youngsters, whose protection clearly is the focus of both federal and emerging state laws. A related complication may arise with signals that penetrate less tolerant states. So perhaps the best that can be said at this time is that each broadcaster must weigh the moral, legal and business factors to arrive at a decision.

No one said broadcasting was easy.

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Science of Sound

Acoustics and Radio – *Part 2*

by Jeff Johnson, CPBE

"Standby – 3, 2, 1"

We are about to open the mic. Will our listeners hear the air conditioning, the traffic, the rattle of CD cases, the WC?

We are about to broadcast an in-house musical group. Will our listeners hear too much of the piano and too little of the vocalist – not to mention the violinist off tempo because he cannot hear the others?

Our ears and brains can reconstruct "right sound" focus and rationalization, in-person in such circumstances; that is called the "cocktail party effect." In a room of music and conversations, we can focus on the person with us or eavesdrop on a more interesting conversation nearby. But when heard remotely, via technology, our brain lack tools to sort distractions, and recreate the nature and focus of the source. Our task is to deliver sound faithful to the purpose and character of the original – that used to be called "hi-fi."

As radio broadcasters, we realize that our listeners may be hearing us on a $29.95 clock radio, in a noisy truck, or in an audiophile listening room. Let's try to satisfy the audiophile first. With best-quality source audio, we can later devolve that into a satisfactory form for other listening environments. We broadcasters know that as "processing."

First, what is best-quality audio? Let us consider that to be the audio closest to the original. Should the original acoustic environment be included or not? It is obvious that a program host – a DJ – should appear as isolated from the environment. Simple radio broadcast studios for voice are intended to be "dead," or anechoic. The most recent article in this series described various sophisticated means of absorbing reflected sound with acoustic panels and traps. No, carpet or egg crates are *not* ideal.

An experienced producer and broadcaster, Chuck Miller has the following observations and recommendations:

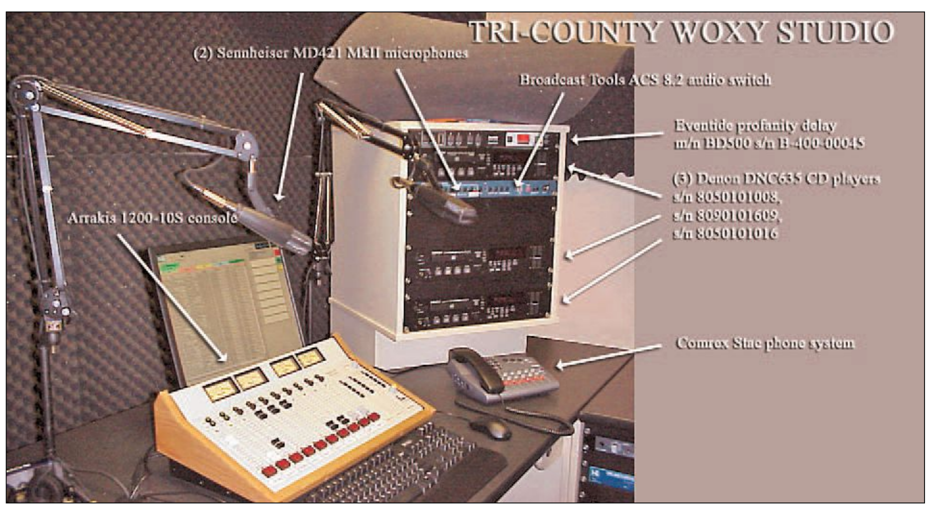
Thinking about facilities and spaces for sound will require a lot more research on your part than I have room to write. Consider this a basic and very glossy start in what I hope will be the right direction for you and your spaces.

We work with sound waves, so this analogy may help. If you drop a stone into the middle of a 6' x 6' box filled with water, you see the generated waves quickly reflect back towards the center. This is what we deal with in control studio situations, interview booths, even a drum booth in a recording studio. If you drop the same stone into the middle of a large pond the generated waves have natural space to decay. This is your performance or theater space.

Induced and External Noise

In my non-engineering opinion, requirements for control and interview booths are very similar, in that you have to manage internal reflections, induced noise, and external noise. When looking over a space, survey the exterior from the inside and outside of the structure. Take into consideration vehicle and pedestrian traffic, flight patterns, parking, power, roof structure, windows, doors, and security. Is your space insulated from said issues? Besides protecting your business, will the roof amplify the pelting rain or hail? Is the facility "sound" enough to prevent thunder from invading an open mic? If in a multi-story building, can you hear the click of a high heeled shoe or boot upstairs? What about elevator noise, or better yet plumbing noise? Finally, be sure everything is in local code and ADA compliance.

Items to assist in keeping your studio's noise floor down are very basic. Avoid fluorescent lighting at all costs and you avoid their constant buzz. Be keenly aware of HVAC needs and low-flow vents, to avoid low frequency rumbling and fan noise. Well-grounded power to your room should have all circuits on isolation transformers. Lighting, computers, HVAC, humidifier, and audio gear should each be on separate circuits. There should not be a parallel wall in your studios, which helps to reduce standing waves (the 6' x 6' box of water). Entry ways into your room should feature airlocks, or a chamber dividing the hall way and the studio with a couple of heavy doors. Those doors will want to be professionally made sound killers, filled with insulation, and have gaskets around them with minimal glass. Quality carpeting, sonic wall treatments, carpet on tables, bass traps, and high-grade silent chairs all help keep things quiet.



10-15 Degree Downward Angle

If you are building a space that needs eye contact with an interview booth of some sort, you'll need glass and a thick, soundproof wall with a lot of insulation. Avoid placing power in this wall, as those openings will allow sound to bleed through. Glass is very reflective, so make a sound investment by installing triple pane glass. The center pane is permanently mounted in the center of the wall pocket. Have a carpenter build the outer glass mounts with a 10 to 15 degree downward angle.

Once designed, install the outer glass on hinges with gaskets so you can easily clean the surfaces as needed. Mic inputs between the control room and your booth should have isolation transformers wired into them as well. An eight output headphone feed, backed by a good set of monitors, wired to mute with mics open, and an off-air talk-back system, should satisfy your studio guests' need for on-air monitoring and communications.

As you plan your booths, it is critical to make sure you place gear within your lines of sight. For this on-air space, a simple broadcast console will suffice. A broadcast console differs from an outright production console in many ways. However today's line of digital gear should have all you need to get started. Be sure you have upwards of four mic inputs – one for master control, the others for your booth.

Your console will have functions like cue, audition, program, and aux outputs. Each input should carry a minimum of two functions, say: CD-1 and NET, for example. Wire your console for redundant service – in case a channel drops, you can have the control mic or CD-1 on another with the touch of a button. Some broadcast consoles will feature a fade with upwards of seven inputs for example. This is very useful for remote lines, news feeds, satellite, and automation.

Clear Sightlines

Where you place your outboard gear (CDs, EAS, network gear, computer gear, etc.) is a matter of taste. Computer towers have cooling fans, and CD decks have mechanical noise, and so on. Be sure your cardioid pattern control room mic is 180 degrees off axis from all that gear so it won't pick up the noise as well. Be sure your operator has clear sightlines to the VU meters of the console, even when talking with guests. Similarly, off-air monitoring and a good weather warning system should be line of sight as well.

Back to the 6' x 6' box. Now your installation is almost done. Your control mic is probably in the middle of things. A sound treated room should be kind to that mic. Do you need a big pop filter? I say no, and that comes from experience and experiments. If you look at a Sennheiser 421 (I love them) cross eyed, it will pop a "P."

Do this to your air talent. Have them all in a room, then ask them to put a hand in front of their mouth and say, "Please pass the peanut butter, Kim and Tom." They will quickly learn about "plosives." Place a cardioid mic 45 degrees off and 6" away from their voice box. Then have them talk straight ahead, repeat that phrase again, and viola – plosives are a thing of the past.

Based on the construction needs above, next time we'll dive into a production studio, studio performance spaces and front-of-house needs.

– Chuck Miller

Successful anechoic studios employ not only acoustic surface treatment, such as discussed in depth in the last installment *(Radio Guide Jan/Feb 2014),* but also non-parallel walls, windows and ceiling.

Recording and broadcasting music requires a reverberant space – much different than a solo mic in a "dead" space. The author's research has uncovered many fascinating facts concerning acoustics of performance spaces, which will be the subject of the next article. Understanding these will enable us to improve our broadcast sound. After all, our business is entertaining and pleasing our listeners.

Jeff Johnson can be contacted at: jeff@rfproof.com

Tower Topics

The Truth of Towers

Part 2 – Developing Tower Specifications

by Leonard Weenou, P.E.

In Part-1 (Nov/Dec-13), our effort to develop a better understanding about the towers in our stations began with a tabulation of "tower facts" concerning the design and construction of towers. This time we will actually start the process of designing a tower for a typical broadcast application as a sort of case study to demonstrate several of those critical points.

A Learning Project

Our setting is the legendary Mt. Alexander, where we are planning to construct a facility for our new FM Construction Permit (CP). According to the Application for CP, to achieve proper height above average terrain (HAAT) for infamous W-QRM (FM) our center of radiation (COR) needs to be 420 feet above ground level (AGL).

Meanwhile, another study has indicated that the STL receive antenna needs to be at an optimal AGL of 420 ft (coincidence) to provide proper Fresnel zone clearance and make the STL 99.99% reliable.

As we had mentioned, all tower design is a function of the *loads and location*. Since the loads come first in line, let us begin by accumulating and annotating the projected loads on our study structure.

Gathering Specifications

With that height up here on the bluff, we only need an effective radiated power (ERP) of something like 40 kW for a full Class C, which we can achieve easily with a 25 kW transmitter and a four bay antenna (a circular pattern with a gain of 2). The four bay antenna will minimize aperture problems in the community of license, and the transmitter will still have sufficient reserve for IBOC operations.

W-QRM has one of the best engineering staffs in the country (Why not? This is all imaginary – they even are *paid really well* in this fantasy!). Their total cost study has indicated that 3-1/8 inch flexible air line is the best choice to feed this antenna. The STL antenna system can operate more than adequately with 7/8 inch line. A similar total cost study indicates that air line should be used for this installation as well.

Since two antennas cannot share the same space and they both need to be pointed at the main market, a decision has been made to place the STL *above* the FM main antenna. The heat flutes from a pesky ridge on the mountain nearby that the signal needs to pass over (and similarly a bothersome building rooftop close to the studio) are worrisome. To obtain proper clearance, this exalted tower elevation is needed.

The Mighty Fine FM Antenna Company (MFFMAC), founded in 1947 by a truly inspired engineer, has made several suggestions based on their experience of over 7,500 extraordinary FM antennas, used in 126 countries. The first is that the antenna should be their proprietary full wave spaced big element, wide band model which uses a special coating to resist icing. This antenna does not have deicers.

A quarter wave stub will bring the antenna's total length beyond its COR to 20 ft.

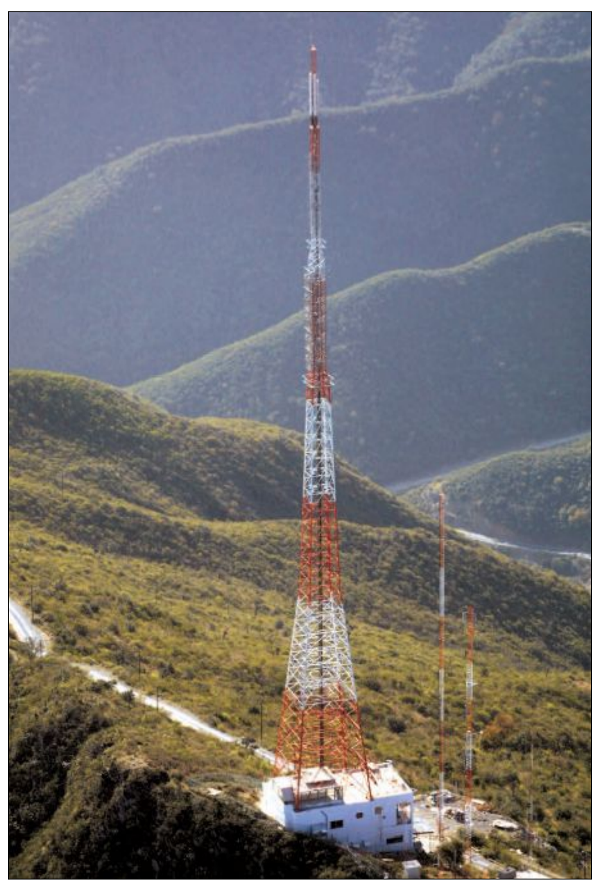
As mentioned, the greatest force that has to be dealt with on a tower is the wind resistance of the loads. This antenna is *big* and even though its elements are rounded and elegantly simple, there is still more than 700 foot-pounds of wind load to be dealt with.

MFFMAC has also provided some initial counsel on tower face widths and orientation to minimize the interaction of the antenna and tower in signal dispersal.

Tower Size Considerations

Concerning the tower structure size itself, the station has deferred to the judgment of their consultant engineer on this part of the project. After running some preliminary numbers dealing just with the big antenna, the consultant determines that the tower face will need to be 36 inches or greater on a guyed tower. MFFMAC does not like 36 inches in this application; their initial studies indicate that 42 inches will have the least deleterious effects on the signal in this face range.

Probably you have just noticed something important in this last paragraph. The design process for towers is interactive rather than linear. Each piece of information gathered requires a review of all previous decisions filtered through the overall goals of the project and the experience of the people involved in the process. We have just come upon the first of many times in this process that we will see this effect.



Very subtly, we have also seen how the experience of the principle parties involved appears in the initial decision to focus on a guyed tower of slightly wider than initially intended size.

It is worth noting that there are vague boundaries where, on just a cost basis, as the structure height increases, it is most prudent to move from a consideration of towers that are self-supporting and guyed, to only-guyed.

Only when land is extraordinarily expensive, or site restrictions demand it, does a self-supporting tower stay in the equation for FM after about 350 feet AGL.

MFFMAC has sent us some range studies done for others on a similar combination of antenna and tower face. We feel confident enough with our decision to proceed, by specifying a 42-inch face guyed triangular tower.

Tower Loading

The remaining loads include a 450 MHz remote pickup (RPU) whip antenna at the tower top with preamp and 1/2 inch line, and a single bay standby FM antenna at 250 feet AGL. The latter is a full power, one bay version of the new main antenna.

The old tower was 199 feet high (to avoid lighting requirements). Therefore we wanted this standby to be higher to attenuate interaction with the nearby old tower. Not only will this standby antenna be a great backup for a main failure but will also allow easy maintenance of both structures while the station stays on the air. By judiciously toggling between antennas, towers and power levels, we can avoid exceeding RF level maximums in the latest FCC OET bulletin, and keep any maintenance climbers within "safe" levels.

A tower at this 450 foot (or so) height will need to be lighted. The consensus from pilots and the land owner (Spruce Goose Land and Lumber) is that medium intensity strobes by day, and reds by night, are best. This is what was requested, and now approved, by the FAA and the FCC.

With this information, we can now tabulate our loads, expressing and delineating the point loads in both windload and dead weight. Similarly, we can begin to consolidate the distributed loads such as the tower's own sectional wind loading, coax and conduit as well.

Location Considerations

At this point we need to consider our location, the second half of *loads and location*, to identify the peak wind design (the maximum that we expect to encounter and allow for) and how much of the tower is exposed to that wind.

Furthermore, we must tentatively position the tower, which will dictate the deployment of the guys and the address of the tower, and the loads into the peak prevailing winds. All of this is critically important so that what we finally erect has the greatest chance of survival under duress.

The top of Mt. Alexander is like many mountains, in that the amount of flat space is very limited and already occupied by several other towers. Guying, without endangering other structures, will be a problem.

The industry perception is that the "ideal" guy length is where the anchors are located out at 60% or more of the vertical height of the guypoint on the tower along the horizontal. In an effort to equalize the forces on a guyed tower at the guy landing, all guys in that level should have not only equal spacing around the circumference of the tower (120 degrees for a three guy tower) but also the same angular address from the tower face. If the desired angle address for a particular guy is 45 degrees from the tower face, then they should all be 45 degrees at this guy landing.

Because the ground is so uneven in elevation on Mt. Alexander, it will take some careful positioning of these anchors to achieve this even angle. If a guy is called for at 200 feet AGL and we want exact "60% guys" then the anchor needs to be horizontally, out 120 feet from the base of the tower.

On the tower, this would achieve a 37-degree angle. If the ground near one anchor is higher than the base, then the anchor will need to be closer to the tower to maintain that angle. Similarly, if the ground is lower (which it usually is on the face of a mountain), then the anchor will need to be placed further away. As you can imagine, if the ground really drops off, then the anchor guy line can be very, very long to achieve that 60% and so, quite often, some compromises in percent of guying has to be made and the strength and stability desired made up in other ways.

We will break here until next our episode, where we will do our final pass on loads, determine our final height and make a final pass on calculations to determine not only the tower fabrication dimensions, but also the foundations for the base and anchors. *– Radio Guide –*

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INOVONICS BROADCAST

Links and Lines

IP Codecs – Ready for Prime Time

by Chris Tarr

When it comes to delivering audio from your studio to your remote transmitter site, you typically can't get more reliable and inexpensive to run, than a traditional 950 MHz studio-to-transmitter (STL) link. Once they're installed and tuned, they generally perform for years without incident.

However, what if you're putting together a new station, or perhaps relocating your studio? Perhaps the ideal location doesn't have a clear path for the signal, or an ideal location for an STL transmit antenna. Maybe you're in a crowded area where coordination might be difficult. In the past, you had two relatively expensive options – equalized phone lines from the phone company, or a point-to-point T1 or DSL circuit. Those often carried high monthly tariffs and required expensive equipment.

With the Internet age comes a new breed of device, the IP Codec. These devices deliver audio over IP circuits – either private or public. Are these devices ready for prime time? Lets take a look.

In the past few months I've been involved in three new studio projects. In each case, it was determined that an IP STL solution would be used. As I will detail, each solution was very much different from the others.

As we dive into the discussion, let's talk about the basics of IP delivery. All of the IP codecs on the market today are "appliances" that are basically stand-alone boxes. The theory of operation is pretty simple. Plug in your audio cables, plug it into a network connection, tell the box where it needs to connect to ... and go. With some boxes that setup is pretty easy – with others, there's a bit of a learning curve.

There are some things you need to consider when looking into an IP based STL system:

What types of circuits are you going to use? Obviously IP networks (outside of point-to-point connections) can be fragile. Once the packets leave your network, you lose control of them. Internet routing is mostly "best effort" which means that there's no guarantee that all of your packets will arrive on the other end in a timely manner (or at all for that matter). Any congestion along the route can create problems for you.

The best solution is a private, direct network. This would mean a point-to-point T1, or a direct spread-spectrum type of link. The setup and configuration details are a bit outside the scope of this column, but I offer them as an option.

The other option (which two of the three stations I set up used) is the public Internet. Going this route has it's challenges and compromises. Even business class DSL and Cable don't carry an uptime or QoS guarantee – however, in many places those connections are reliable enough to put together a workable, inexpensive solution.

When using the public Internet, there are a few things you can do to increase the odds of success. When possible, use the same provider for both ends of the connection. For example, if you use DSL, use the same DSL provider on both ends. When possible, go with the incumbent provider (ILEC) rather than a competitive provider (CLEC). CLEC's often ride on the ILEC's equipment, and if there's a problem you're at the mercy of the CLEC who is at the mercy of the ILEC – it's never fun. At any rate, by using the same provider on both ends, you have a much better chance of having your traffic run entirely on the providers network, never actually going out on to the public network.

If that's not an option, start looking at ways to keep packet loss to a minimum. For example, even though all codecs today have very good algorithms to dynamically adjust buffers to deal with congestion, they can result in noticeable artifacts as they ramp up and down. I generally set a generous fixed buffer on these circuits, in the order of seconds. This can all but eliminate the little burps and blips in the audio. When possible, use the circuit only for the codecs, and try to plug them directly into the modem. This takes away any potential local congestion issues or router failures.

Take advantage of the advancement in codecs and choose the codec that uses the least amount of bandwidth for the job. Another bonus tip: If you don't need two-way audio, save yourself some bandwidth and configure the connection for one-way only. If you don't, you'll use bandwidth in both directions which is entirely unnecessary.

Even with all of those preparations, the circuit will go down at some point. That's where the tolerance for pain comes in.

(Continued on Page 22)

IP Codecs

– Continued from Page 20 –

You absolutely need to have a backup plan for how to deal with the situation. Some of the codecs available have built-in audio players that will play backup audio from a USB drive or Compact Flash card upon loss of connection. You could also have some sort of device connected to a silence sensor to take care of the job as well. However, keep in mind that you are at the mercy of your provider – you could be down for several hours! If this is a problem, you'll want to have some other way to deliver your studio audio. A dial-up ISDN or POTS line may fit the bill in a pinch.

Another configuration that is gaining traction is connection diversity. For example you can bring in connections from two separate providers and fail over between them. Some people have used special routers that detect WAN failures and automatically switch to the working connection, giving them redundancy. Some manufacturers are now selling codecs that have two WAN connections built-in that will receive the two streams at the same time and use the info from both to recreate the audio. If one connection gets congested or fails, it can get the data from the other connection.

So let's talk about implementation. As I mentioned earlier, I've recently done three IP STL's and each one was different, based on the budget, needs, and type of facility.

The first is my station, Radio Milwaukee. When we decided to move to the new building, I looked into STL systems. We already had a traditional link from our studios at the Milwaukee Public Schools office to the transmitter site. That site also has an auxiliary facility which was hard wired to the studio there. I decided that the easiest thing to do was to leave the link from that building to the transmitter site intact, and create a new hop from our new building. Trying to get a 950 MHz link from our new site to the old site was looking to be problematic, so it was time to look into an IP STL.

Now this is a station in a major market, and any kind of audio degradation or loss of audio would be unacceptable. In the past, the solution would be a point-to-point T1 connection paired with some very expensive multiplexing gear. I decided that we would go with a point-to-point T1, but set it up as its own IP network, using IP codecs on both sides. This provides QoS and uptime guarantees, plus plenty of uncontested bandwidth for our audio. There is a possibility that the T1 circuit could go down – in that case I do have Barix codecs on each side connected via the public Internet as a backup, as well as dial-up ISDN circuits on both sides. The system works exceptionally well.

The second is a Catholic radio broadcaster. This is a non-comm FM station that primarily runs long-form, spoken word programming. For them, location and budget were an issue. It's a new station, and trying to get a traditional STL coordinated and installed would be difficult. However, there is a pubic Internet connection in the building that they had access to for free, and a very robust Internet connection at their studio.

In their case, they were not as concerned about the possibility of the studio being off for some time, as long as they could air "evergreen" programming from the transmitter site. In their case, it was as simple as putting a codec on the public Internet on each side, and loading up some programming on a CF card at the transmitter that would automatically play audio if the connection went down.

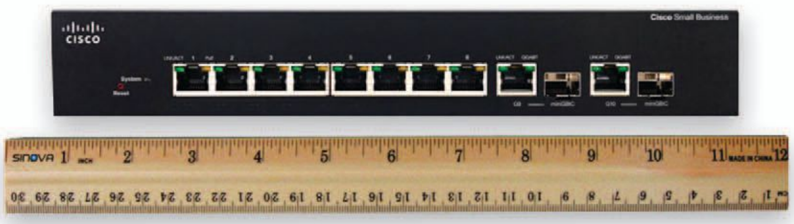
The third case is an AM daytimer. This station was running an equalized line to the transmitter site at considerable expense. In addition, it only provided about 8 kHz in frequency response, so the audio didn't sound so hot on the air.

Being a small AM station, cost was a major factor. We determined that we could get a business DSL connection at the transmitter site, and use their current business class cable service at their studio for connectivity. Knowing that, for several months of the year, a daytime station in this area isn't even on 12 hours a day, we knew that the odds were good that it would be "reliable enough." At this site, however, we took a novel approach to backup programming. We took an old "retired" iPod and loaded it up with programming. We hooked it up to a power supply and a Broadcast Tools silence sensor – and hit "repeat." It's run like that for a long time, and the few times we had an outage, it faithfully popped up on the air keeping things going.

Obviously, some of these cases wouldn't be acceptable enough some some owners and operators. For those who can afford it, having a bullet-proof solution is the only answer. However, with radio budgets being what they are, some creativity can give you really good performance while saving you some money. There are also many combinations of the examples I gave you, that you could employ to give you that perfect solution.

IP STL codecs have come a long way. While they're probably not appropriate for the "big dog" station in the market (unless you can provide solid connectivity), with the right configurations, you can remove the barriers that cost and location can throw up when you're looking to deliver programming to your transmitter site.

Christopher Tarr CSRE, CBNE, DRB is the Director of Radio Operations/Engineering for 88Nine, Radio Milwaukee. He can be reached at chris@radiomilwaukee.org



Sizing the Ethernet Switch Can Save BIG!

You might have been told in the past to go with the biggest switch you can afford for your audio over IP network. But you might not have to...

...so why spend extra for something you don't need? A lot of older AoIP system designs don't manage the multicast streams, and actually keep the pathway open for them, which takes up valuable, expensive resources in the switch. But because the WheatNet-IP system continually responds to IGMP queries checking for usable source groupings on the network, any unneeded multicast streams are pruned as a result.

Read the rest of the story here: INN7.wheatstone.com

Processing for PPM

Does audio processing have an affect on PPM ratings? You bet it does...

...according to Wheatstone audio engineer Mike Erickson. "The biggest issue is making sure that audio levels don't fall below a certain threshold," he said. PPM encoders will stop encoding audio, as many have found out, if they are not fed a steady diet of audio. "When the encoder stops, the PPM (encoded) signals can no longer be 'heard' and detected by PPM devices that track listenership," he explained.

An easy out is to put an AGC in front of the encoder, and any Wheatstone audio processor will be able handle that with ease (our stuff can actually adapt to external processors without any user adjustment). For other processors that are not self-adjusting or even for ours that are, Mike suggests broadcasters establish a standard set of reference levels for audio sources as a guideline for board operators who load music, imaging and spots into the automation system.

Read the rest of the story here: INN7.wheatstone.com

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Introducing the Audioarts IP-16

Audioarts' WheatNet-IP console gets a bigger sibling with a brand new 16-fader version

We just added four channels to our popular IP-12 console frame to give our broadcast customers a bigger, 16-channel console at a price they can afford. Each of its 16 input modules is equipped with an LED source name display and an A/B source selector; sources can be set via a rotary encoder in the master section. Each input module has access to four program busses and has cue and talkback switches. A 100mm long-throw fader and lighted channel ON/OFF switches round out the module. Best of all, the IP-16 has access to all your sources wherever they live on your WheatNet-IP network.

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We've been thinking about your studio options for some time, and we can pretty much guarantee that the studio you build today will be better and more affordable than the one you might have sketched out on a yellow legal pad back in the early '00s. It all starts with a plan, so give our sales engineers a call to go over your options.

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BLADE HONING 101

What's Inside A BLADE...part 1

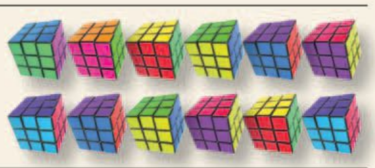
Each BLADE on the Intelligent Network is exceptionally powerful... but do you know about the incredible functionality inside EVERY BLADE?

By now, it's a good bet you're aware of the WheatNet-IP Intelligent Network. You know about its advantages - how it's obsessively compulsive about redundancy. How it can repair itself, configure itself, run rings around the competition while still having much greater bandwidth (due to the WheatNet-IP system's Gigabit Ethernet throughput) - enough, in fact, to not only handle our increased functionality today, but well into the future.

So we figured it's time to let you know a little more about those boxes you plug into the Intelligent Network. The ones that contribute to its intelligence. They're called BLADES and from inception have been far more advanced than any boxes on any other networks out there. Take a look and consider how you'd put all that to work in YOUR WheatNet-IP system.

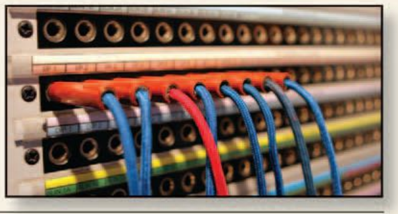
Two 8x2 Stereo Virtual Utility Mixers
These can be used for a wide range of applications; for example, using Wheatstone's ACI Automation Control Interface, your automation system can control the mix for satellite or local insertion switching.

Flexible GPI Logic
12 universal logic ports, programmable as inputs or outputs, routable throughout the entire system



Silent — No Fans
Can safely be located in a studio with live mics

Front Panel Routing Control
Any system source to any destination on that BLADE



ACI
(Automation Control Interface)
An embedded interface for complete external control over IP for both the BLADE itself and its Utility Mixers

There's a LOT more in each BLADE and next month we'll continue the tour. In the meantime, visit us on the web to learn more! INN7.wheatstone.com

A Little Bit of This – A Little Bit of That

by Scott Schmeling


HT-10 Filament Control **Pitted Wiper Contact**

Before we get started with this issue's article, I hope you had a great Christmas. We're a full month into 2014, but this is my first chance to wish all of you a very Happy and Prosperous New Year!

In this issue, I'd like to share a few bits and pieces, a little potpourri if you will, of engineering "stuff."

First, regarding the November/December 2013 issue of *Radio Guide,* when I shared with you my experiences installing a brand new transmitter (in particular, getting the transmitter *inside* the building), Bill Ruck from San Francisco e-mailed me, and I hope he won't mind if I share that e-mail with you.

Bill said:

A long time ago I learned that moving companies know how to move stuff without either hurting themselves or breaking something. Consider this:

Have the new transmitter delivered to a local moving company. Delivery trucks only operate on their schedule; never on yours.

The moving company can accept something big and heavy, and temporarily store it for you.

When you are ready for the installation, the local moving company will deliver it on your schedule and move it into place for you.

Yes, they are not free, but their cost is a whole lot less than the hassle of getting a delivery truck to cooperate.

He's absolutely right! And thank you, Bill, for the e-mail. In addition to having the right tools and the know-how, moving companies also usually have a warehouse. We have, in fact, done this a couple times in the past. As Bill says, when we were ready for it, all we had to do was call and they brought it out – and put it exactly where we wanted it. And I didn't even break a sweat!

While we're talking transmitters, I had a few little things I had to deal with. On a Harris HT-10, I had no filament control. I could turn the knob fully clockwise or counter-clockwise and my filament voltage stayed the same. My first suspicion was the rheostat's wiper contact might have "fallen" out of its holder – this has happened to me before. When the wiper contact is out of place you have no "variable" resistance, and therefore the voltage stays the same.

But when I opened it up, the wiper was just where it should be. An end-to-end resistance check indicated the correct value, but if I checked from either end to the wiper, it showed a very high resistance. Upon closer inspection, the wiper contact had been overheated and was not conducting. I tried to file it down, but to no avail. So I replaced the rheostat with a new one and now there's plenty of adjustment. Being able to adjust your filament voltage to that "sweet spot" has a dramatic affect on tube life (for more on adjusting filament voltage, see my article in the January/February 2013 issue of *Radio Guide*)

I had an interesting problem with a CCA 10 kW transmitter. It had blown its main breaker a couple of times but would always come right back up to full power with normal readings after the breaker was reset – we attributed it to a "power line issue." But the last time it tripped, I drove out and reset it as usual (all the reading were right where they should be). As I was driving away, the transmitter dropped off again – yup, the breaker had tripped. But this time I could feel the breaker was *very* warm – you could almost call it hot.

This was a *bolt-in* Siemans breaker (not a snap-in Square D) so I couldn't just *push* on it. But I carefully checked the bolts and they were both good and tight. I talked with an electrician friend and we both felt the breaker itself was going bad. He had one overnighted and we scheduled a service call for the next day.

In the meantime, I checked the current draw on both legs of the 220 Volt line at the breaker, to verify the transmitter wasn't drawing too much current. The numbers were right were they should be, so I let the transmitter run at low power until the breaker could be replaced.

(Continued on Page 28)

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- All products include onboard temperature sensor
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SiteSentry4 SiteSentry2 WAM-2

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- SUB-03 Subaudible tone decoder and SEN-6 Subaudible encoder.
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- DTMF-16 and DS-8 DTMF tone decoders.

Find Full product info & downloadable manuals online at www.circuitwerkes.com. 352-335-6555

Chief Engineer

A Little Bit of This...

– Continued from Page 26 –

When we (and by "we," I mean the electricians) removed the faulty breaker, we expected we might see signs of overheating on the bottom side of the contact, but they were both nice and clean. But since changing the breaker, the transmitter has stayed on, telling me the breaker *was* definitely the problem.

I have one last transmitter story. We had a Continental 816R-3 that had started showing a PA Driver Screen overload. Tuning also seemed a little bit "different." At one point, I just happened to notice C-60 (a doorknob capacitor) on the underside of the PA tube socket looked like it had a small crack. I had one in the parts bin, so I replaced it (which is *not* the easiest thing to do, by any means). Tuning changed – closer to normal – and I could almost get to full power before it hit a driver screen overload again.

I went back out one night and started taking a good close look. This time I notice C-59 (another doorknob) was also cracked. But this time, thanks to a few more overloads, it was *really* cracked. In fact, it sort of fell apart in my hand as I was removing it (definitely a bad sign). After installing the replacement capacitor, the transmitter tuned up normally, and made full power with ease.

In hindsight (which is *always* 20/20), I really should have taken a closer look at C-59, after finding the initial crack in C-60. These capacitors are in parallel, and it stands to reason, if one went bad, the other was probably damaged as well. Lesson learned!

Now let's go to the studio. I'm guessing most of you have at least one XDS receiver in the rack. Like its predecessor, the Starguide receivers, the fan in the XDS can fail – and one of ours did. This receiver is in the studio and when the fan started to go, the bearings were grinding loudly. So much so, that the noise was being picked up by the studio microphones. I did not have a spare fan in stock, so the first thing I did was take the receiver cover off, then unplug and remove the fan. At least now it was quiet. I also blew out any dust and left the top cover off so any heat would not be trapped inside the chassis.

The fan is 80 mm square by 25 mm thick. It has a 3-pin power connector (DC plus tach) so the system can monitor fan speed. The networks don't stock parts for the receivers, but I have found three sources for replacement fans.

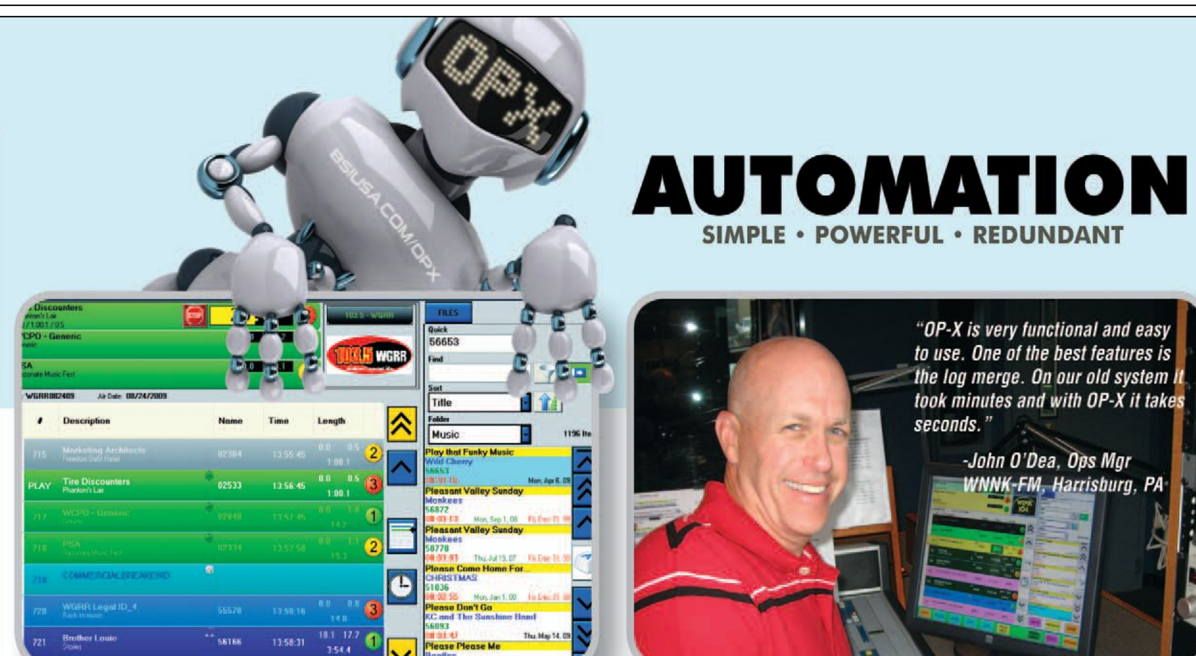
One broadcast equipment supplier (Broadcasters General Store) has a very nice fan replacement kit for about $35. It includes the fan (with 3-pin power connector installed), four plastic rivets to hold the fan in place, and step-by-step instructions. I believe it also includes a replacement "Warranty Void if Removed" adhesive label, to replace the one you have to sacrifice to remove the top.

I've also found the fan, connectors and pins available from Newark and Mouser. The fan is a Sanyo Denki (part #109R081254011) and the connector is a Molex (part #22-01-3037), which uses contacts (part #08-50-0114). You'll have to crimp the contacts on and insert them into the connector housing. And, you'll have to carefully remove and reuse those plastic rivets. Total cost, if you order these parts separately, is under $13.00. Doing it yourself will save some money, if you want to go that way.

I also just happened to see a replacement computer fan – the *exact* size – with the 3-pin connector installed, for only $8.99 plus tax, at a local computer sales and service retailer. I bought it, installed it, and it works like a charm. I'll admit, I lucked out on that find.

That will do it for now. Again, I hope you all have a very happy, productive, and prosperous 2014. And until next time ... keep it between 90 and 105!

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



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From the Ground Up

Air Studio Ergonomics

Designing the Optimum Control Room

by Mike Callaghan (KIIS-FM - Retired)

Call it what you will: Master Control, On-Air, the Main Studio – or anything else – there's no doubt the "air" studio is the most important one that you have. Literally "on the air" the vast majority of the time, it's important that this room be easy to use, efficient, and that it not impede the air personalities while they get creative and strive for higher ratings.

Building this room and getting it ready for operation involves much more than just opening boxes and stacking equipment on some furniture. The size and shape of the room will affect the size and shape of the cabinetry, and that will determine where things will ultimately fit. So really, the amount of equipment and the form factors it brings should determine the furniture design. And it's while that is being designed, that you'll have to make it work inside the room.

Remembering that times and station formats change, it's best to allow plenty of flexibility down the road; don't piece together a setup that works in just one way without room to expand and renovate in the future. One reality is that new broadcast gear will always be added into a room – while it's much more rare to see equipment getting removed, mini-disc recorders and players notwithstanding.

The workspace you will have behind the console should be a major factor when you choose one. If the input and output connectors are on a rear panel, putting it up against a wall will cause multitudes of grief when you need to work back there.

If that space is confined, you'll be much better off with a console using I/O ports that are reached through the top cover, or under a meter bridge.

If you do use a console with top access, try to avoid having massive amounts of gear on the overbridge. This will likely have to be moved out of the way when you want to get inside. It can be especially daunting when someone's trying to do a show, and the video monitors get shoved to where the operator can't see them anymore.

Bigger is better, as well, when buying the console; having a few unassigned inputs will make adding more features and sources less of a trauma later. Granted, while the "B" inputs are always available, the less they're needed, the happier the talent will be.

The size of the console will have a lot to do with the furniture design. There has to be room at the right and left ends of it for other equipment. This can include CD players that back up the automation, or pods for rack-mounted gear. You need to allow some flat space for the computer mice. With so many different computers, each mouse should each be a different color to avoid confusion. There also needs to be a flat space – at least 8 inches or so – immediately in front of the talent to write on logs and make notes. There's usually room under the console for a couple of keyboards on pull-out drawers. If need be, an additional one or two can also be on top of the console if you use a keyboard trolley. This moves up and down the face of the console and rolls up out of the way when it's not needed.


A Keyboard Trolly

As I've said before, wireless and mice and keyboards are best avoided in studio operations.

The height of the console table is a matter of personal preference. I've always preferred to make it high enough that the operators usually stand while they do a show. This has to do with the quality of their voices. People project better when they're standing up. It *does* make a difference.

On the floor, include a rectangular sheet of linoleum or special pad for the talent to stand on. A low chair will be close for them to rest on, and it should be able to roll freely. Also, if the pad can be conductive and tied to the ground system, it will avoid static buildup and the excitement that creates when a discharge accidentally fires off an event!

(Continued on Page 32)

From the Ground Up

Air Studio Ergonomics

Designing the Optimum Control Room

– Continued from Page 30 –

Provide a Floor Pad for the Air Talent

Video Monitors can be in a row or on poles. If they're arranged in a row in front of the talent, they can get in the way when someone is being interviewed. To fix this, try putting the less-critical monitors – like the one for the phone screener – on a swivel so it can be rotated out of the way. The row configuration is more common; many automation systems, like NextGen, are meant to have the monitors side by side. Having them one above the other on a pole is more awkward.

The number of monitors has certainly proliferated recently. It's not unusual to have them for the call screener, the Voxpro phone call editor, two for the automation, one for the Internet, and maybe even a TV set to keep track of the news. If you choose to use poles, plan on more than one just to hold what's needed.

The size of the monitors will vary depending on function. Typically, the ones for the automation are the most important.

When you're wiring the monitors up, make the automation monitor cabling long enough to reach at least some of the other screens if need be. This can keep things operational if one of the critical monitors dies.

Immediately adjacent to the talent, you will likely want the profanity delay, CD players – and within reach, a Zephyr for remotes, a routing switcher control head, the EAS package, and the other peripherals. A simple facility might have just a few; yours might have CD recorders for airchecks, studio switchers, effects boxes, and other gear. These are typically located in a rack cabinet of some sort, extending up above the counter surface. The gear should be well-spaced out to make it easy to reach and use, and to keep the equipment cool. A small rack shelf can hold blank CD's and other supplies, but there should always be an empty rack space between the different devices.

When new gear is added and space runs out, try to put passive panels that produce no heat, like power strips and switch boxes, between the active gear to keep things as cool as you can. The same rule applies for the equipment that mounts in the racks below the tabletop. This includes the redundant console power supplies. (If you need redundant supplies anywhere, you need them here.) This is also the place for the monitor speaker and the jock and guest headphone amplifiers. Put the really heavy components one rack space above the bottom. This saves strain when they need to be replaced, and lowers the center of gravity. Using perforated filler panels between these ersatz electric heaters will help them cool, happy, and reliable. If you use security covers over the front of the gear, it will keep chairs and feet from hitting and erasing knobs or changing adjustments.

Leave space on the table top for the telephone, logs, pens, pencils, and other supplies. Some air talent will bring a laptop or tablet to work with them – table space for these, an Internet connection (or Wi-Fi) and a power outlet is always appreciated.

Don't skimp when you choose the chairs for the air studio. You can spend as little as $29 or so for a cheap chair, and then keep buying them every few months, or you can get well-built, heavy-duty chairs rated for 24/7 usage. They will cost a few hundred dollars, they'll have additional adjustments for the seat tilt and the back, and they'll last years – in contrast to the cheap offerings, they are a sound and comfortable investment.

If you want an idea of how a studio will work out and flow before you commit to anything, take some masking tape and lay out where the cabinetry will be placed in a vacant office or even the parking lot. Put a chair in the center, and try the reaches, turns and chair navigation. You can learn a lot from this exercise.

Taking the time to try it out first, followed by carefully placing and working with the equipment, will provide a good ergonomic layout for the most important studio in your station, and one that will be enjoyed and appreciated for years to come.

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


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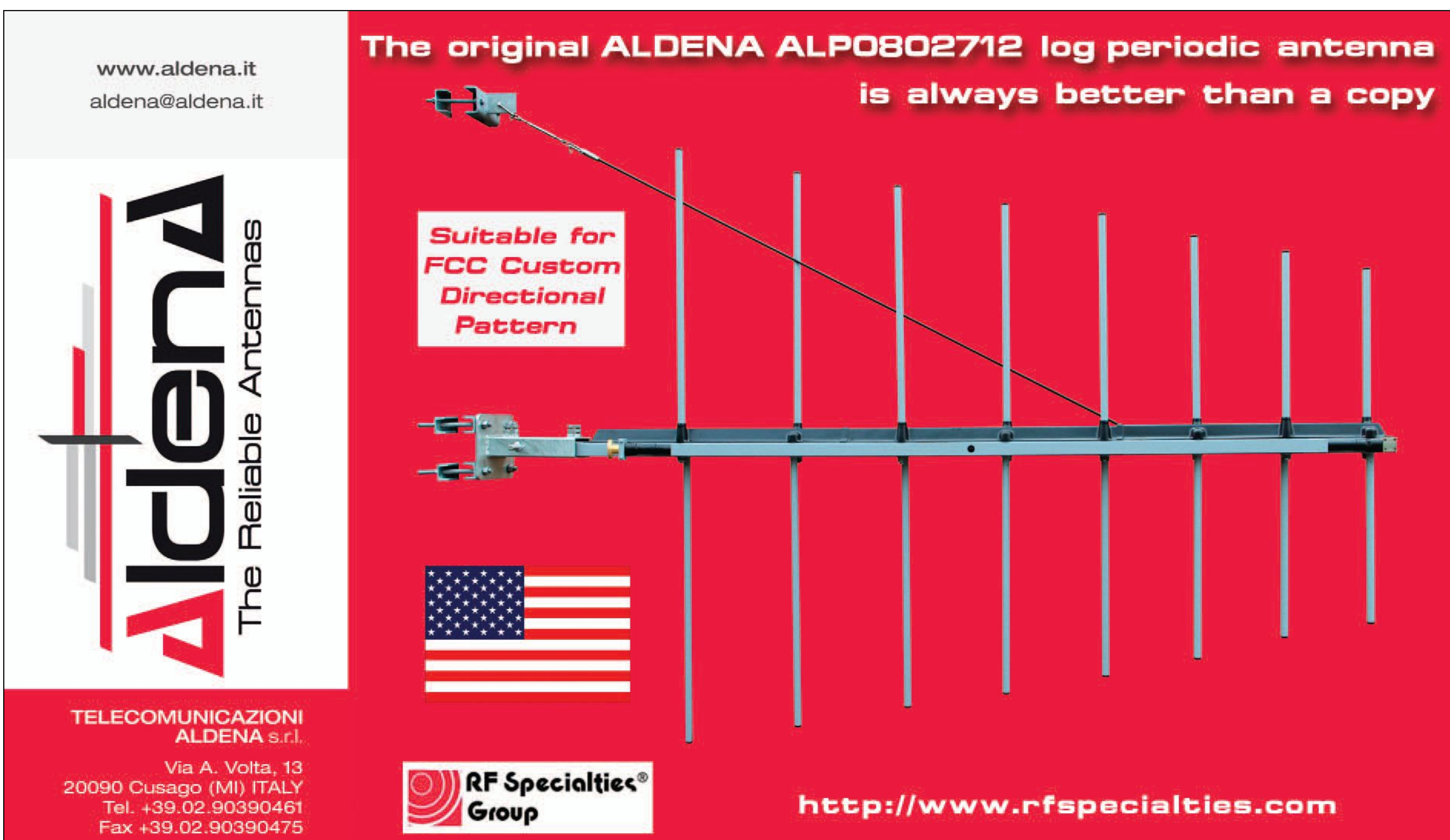
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What Those Circles Really Mean

by Jim Turvaville

Whether looking at your or a competitor's FCC application, or at a station coverage map, the circles being drawn should represent some form of reality. In decades gone by, stations would take commercially available maps and estimate coverage contours with a ruler and call it a coverage map. I've even seen state road maps or gas station issue maps used for sales material at small town stations. With the advent of, and ready availability of, proper FCC contour maps draw by software, I trust that none of these methods are still in use. Beside gross inaccuracy, there is now the issue of copyright infringement which may arise from using a commercially available map for reproduction in your sales material.

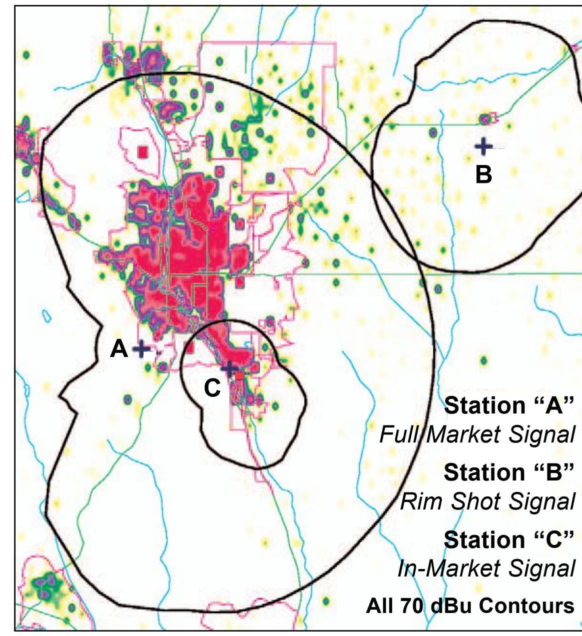
Those of us who work with station allocations and signals on a daily basis are often guilty of taking for granted our knowledge of the contours on the map and forget the need to be sure our station staff understand what they are representing to our clients and listeners. Using some of the available on-line resources like Radio-Locator are extremely good for a general idea of a station footprint, but labeling contours as "local," "distant," and "fringe" do not really tell an accurate story for most stations. While these on-line resources offer a good representation of AM directional patterns, some FM stations which operate with complex directional antennas are often not reflected with any reality.

For all stations, a knowledge of the FCC Community Contour coverage is an excellent starting place. The FCC has determined a minimum amount of signal that needs to be present from a station in order to properly serve the community to which it is licensed.

For AM stations that is defined as the 5 mV/m signal level – meaning if a field monitor is set up with a receiver tuned to the AM station at a specific location, the amount of actual RF in the air is 5 millivolts. For FM stations, that community coverage contour is defined as a 70 dBu (3.16 mV/m) for commercial stations and 60 dBu (1 mV/m) for non-commercial stations.

These references are important to understand, as they relate almost directly to the potential for the public to hear your radio station, so drawing these on a map will help to correlate the size of a potential audience. This is often a critical limitation to the "rim shot" stations in larger markets – while they may represent some signal coverage over a great portion of a metro area, many of these stations lack real signal penetration into large numbers of the population.

For a practical example of these differences, consider this map of the 70 dBu contour coverage of three real stations in a real market. Station "A" is full-market signal coverage with solid mobile listening and would have good home, and probably very good office, signal penetration in the entire metro area.



Station "B" is a rim shot signal from an adjacent community and would likely have a reasonably good mobile signal in much of the metro area, but lack any home or office signal capabilities.

Station "C" is an in-market signal but much lower in power; it would have a reasonably good mobile signal in much of the metro area, but lack any home or office signal capabilities outside the immediate area of the tower – certainly not in the farther extremities of the metro area.

(Continued on Page 36)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Transmission Topics

– Continued from Page 34 –

It is also important to understand the minimum radio signals and their usefulness. The FCC uses the 1 mV/m signal level to assure “interference free” reception of the station by the public. For all AM and FM stations, this contour is considered the station’s protected service area, and all co and adjacent channel signals must keep their corresponding interference contour out of this area. The definitions of co and adjacent channel interfering contour ratios are designed to assure that the protected service area of all stations remains viable for the listening public; and is the basis for those colorful contour maps which are always included in FCC applications. A signal of 0.1 mV/m (40 dBu) is generally considered the minimum strength at which most commercially available radios are able to maintain a reliable lock on the radio station and reproduce an acceptable quality audio sound. The FCC has also set a policy that an FM translator cannot be licensed if the primary station does not have a predicted signal level of 20 dBu (0.01 mV/m) at the translator location.

Besides those signal levels, there are a few points used to estimate the minimum signal for reliable reception in a moving environment (automobiles) and for building penetration for homes and offices. The automobile receiver is an amazing device – it is designed to have maximum signal sensitivity, maximum signal selectivity, and maximum audio fidelity, while working with the minimum of a receive antenna in a moving environment. In the absence of other co or adjacent channel station interference, most automobile radios can sound really good at signal levels as low as 34 dBu (0.05 mV/m) on FM and 0.025 mV/m on AM. This is, of course, more true in rural areas than an urban environment, where signals are often jammed into each other on the dial.

Buildings present a huge challenge in setting a reference signal for reliable radio reception; especially with the noise factor present in commercial building environments, which can often destroy even the most robust AM signal. While FM is not immune to environmental noises like computers, UPS units, florescent lighting, computer monitors, etc. in our work environments, there is usually a good chance that FM signals of sufficient strength can be received in an office building. In many years of unofficial research, I have found an FM signal of 74 dBu (5 mV/m) tends to be able to overcome most of the noise in a commercial environment and has been often used as a “rule of thumb” when considering the potential for the at-work audience. As always, circumstances will determine how accurately a specific FM signal is able to be received at a specific location, so that 74 dBu number is a generalization.

Since the dB scale on which FM signals are measured is a logarithmic calculation, the contours are related to each other in a non-linear manner; which means signals degrade differently than the numbers represent. For example, an FM signal of 60 dBu (1.0 mV/m) in one location is 10 times stronger than another signal of 40 dBu (0.1 mV/m) That 20 dB in signal change represents a 10 fold change in signal level over the distance; while the 10 dBu difference between a 70 dBu community coverage contour for a commercial FM station and its 60 dBu protected interference free contour is a signal difference of only 3.16 times. All of that is to say, don’t let the numbers themselves become a point of confusion when comparing signals; it usually takes a minimum of 6 dB of signal change for a radio receiver – or your listening ear – to discern a difference.

With that in mind, a properly constructed contour map might look like **Figure-1** – a real licensed station in a rural area.

This shows all of the relevant signal contours for a commercial FM station: the 70 dBu community contour, the interference free 60 dBu contour, the 54 dBu adjacent channel interfering contour, and the 40 dBu co-channel interfering contour. Of those, we can understand that the most building penetration and home reception will happen in most all of the 70 dBu and much of the 60 dBu contour, while the mobile audience will be viable as far out as the 40 dBu contour.

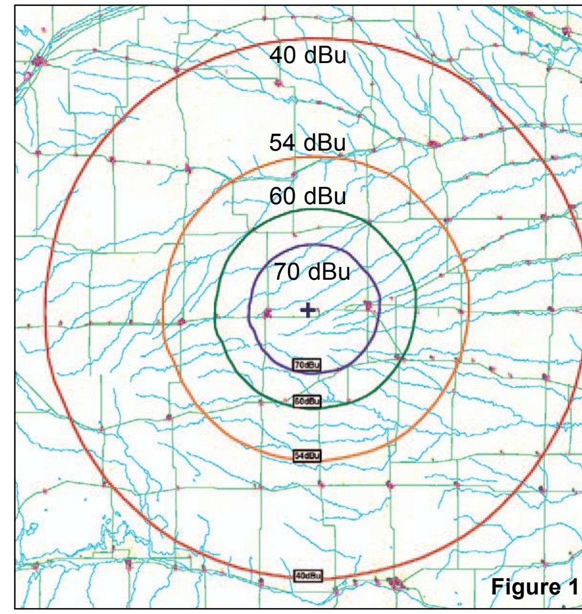

Figure 1

The same software which produces these contours most often has Census Block Data underlays which permit an accurate population analysis of each of those contours as well. This is useful in a station understanding a maximum possible listening audience in each of the signal contours.

By understanding these contours and how they affect a station’s listening audience, you can more accurately compare between station signals in a market and realize who may have a competitive edge, and why.

Jim “Turbo” Turvaville has been Director of Engineering and I.T. for WAY Media (www.wayfm.com) since 1999 and currently works in their Corporate Office in Colorado Springs, CO. He also 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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LPFM Guide

LPFM Radio – Here They Come!

by Leo Ashcraft

With nearly 3,000 LPFM applications filed at the end of 2013, the FCC has begun granting the construction permits. So far in January, nearly 200 have been granted. The Commission expects to grant about a thousand of the singleton applications within the next few months. So now it's time to build these stations!

Many of the applicants are new to the broadcasting business, so we are providing a breakdown of a basic LPFM Radio station's equipment needs, and how various pieces of equipment are utilized. Some items are optional, while others, such as the EAS/CAP system, are required. Some elements of the installation, handled improperly, can cost the new station thousands of dollars in fines, sanctions – or even loss of the license itself. Be careful, build smart, and build it correctly.

Consoles and Audio Mixers

A mixer is aptly named, it mixes your studio sources to become the final product your audience hears. There are many flavors of mixing consoles and audio mixers. The lowest cost method is by utilizing what's known as a band mixer. These generally have several audio inputs controlled by sliders. They also allow equalization for treble and bass of each input. While that may sound like a great idea, in reality – in the on air studio – it is not. You don't want your on air staff tweaking everything, and trust me they will – it can be a never ending battle. However, it is a cheap entry method for mixing audio with pricing as low as $100. Generally a radio station will use what's called a mixing console, as pictured here. These are preferable because they do not have all the equalization and other knobs to play with. They simply have the leveler slides, channel mute and channel activation and relay buttons for each slider. These are much higher in cost with these coming in as low as a thousand dollars and up.

Arrakis ARC-10up

Studio Sources

- Broadcast Automation
- Microphones
- CD Players
- Telephone Interface

These days, most radio stations use a computer-based automation system. Even when you are running a live program, these are very useful, as they serve as a storage source for all your audio. Additionally, they provide a quick and easy way to access and play this audio on the air. And when you need to take a break, you simply switch to automation mode and walk away. These systems are usually hooked up to a channel on the mixing console.

Tune Tracker Command One

Emergency Alert System (CAP Capable)

The Emergency Alert System (EAS) is a national public warning system that is required for legal operation of your LPFM station. This device allows the President the communications capability to address the American public during a national emergency or for state officials to pass vital information to residents.

This is the first thing the FCC checks in an inspection, so make sure it's perfect. Old EBS, EAS units, or units that are not CAP capable are not usable. LPFMs are not required to generate required weekly tests (RWT), but must receive weekly tests from the Local Primary 1 and Local Primary 2, stations, and must pass the Required Monthly

(Continued on Page 40)

LPFM Guide

– Continued from Page 38 –

Tests (RMT). Additional CAP monitoring and logging rules apply. This is a large investment for the station with units starting around $2,000. Unfortunately you do not have the option to skip this. Operating without an operational EAS CAP system could result in multi-thousand dollar fines and possible revocation of the station license.

Broadcast Audio Processor/Stereo Generator

This device sculpts the sound that your listeners hear, and acts as your stereo generator. Most new processors are DSP-based and are delivered with many internal presets. Precise alignment may require technical expertise and previous knowledge of stereo generator fundamentals.

Inovonics Model 718

The basic functions are generally ready to go, out of the box. While it costs a bit more, its best to use an external unit opposed to a transmitter built-in system. Keep in mind, if these built-in systems fail, you could be off the air until the transmitter is repaired. It's always best to use separate components for the highest redundancy and reliability.

Studio Transmitter Link (STL)

If your studio is co-located with your transmitter this is not needed. But if your transmitter and studio are located at separate locations, you must have a way to deliver your audio to the transmitter. Some may wish to use the highly reliable and high quality legacy method of a one-way 950 MHz link. This requires prior coordination and licensing that can cost between $500-1,000, plus the cost of equipment, antennas and transmission lines. There are no ongoing costs to operate the equipment. Another method is to use equipment that uses the public Internet to deliver your program audio to the transmitter. Since you are relying on the public Internet, this method is less reliable, as you will be at the mercy of you Internet provider. Less expensive license-free, point-to-point systems in the 5 GHz band also work well if you have a line of site shot between your studio and transmitter site.

Barix Model 110

Transmitter

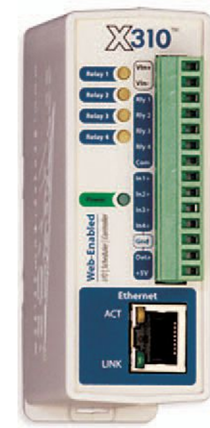
73.1660(a)(2) of the FCC Rules stipulate that you may only use transmitters that have been granted FCC certification on an LPFM station. Certified transmitters will have a permanently attached label bearing an FCC identifier.

Nexus Model NX-250718

Fortunately there are several FCC certified transmitters on the market. Be forewarned however, some distributors and manufacturers will tell you their transmitter is FCC certified when it is under Part 73 Verification. This is not the same. A properly FCC certified transmitter is required to have a label on the back. This label will use the term FCC certified and list the FCC certification number. Operating with a non-certified transmitter may result in severe fines and possible license forfeiture.

Remote Control

For controlling and monitoring your transmitter, a remote control system is required. In the event of an out of tolerance condition you must be able turn your transmitter on and off. The FCC may ask you to demonstrate this during an inspection. While there are many systems on the market built for this specific purpose, there are also methods to handle this on the cheap, such as the **Controlbyweb.com Model X310** pictured here. This interfaces to your Internet router and allows you to toggle up to four relays. These can control various things at your transmitter site, such as turning off the transmitter. You can find similar devices that hook to a standard telephone line for those worried about the stability of the Internet.



By year's end there will likely be hundreds of new Low Power FM Radio Stations on the air. For those of you who have recently received their new construction permits, congratulations! And for those that are still waiting, the best of luck to you. The hardest part about this process is the waiting.

Leo Ashcraft is former CEO of Nexus Broadcast "Broadcast Outside The Box!" He is a broadcast consultant with over 29 years engineering experience and an avid LPFM advocate for over 15 years. More information at LPFMStore.com or 888-732-3599

Small Market Guide

Another Lesson Learned

50 & 75 Ohm Connectors – Different Dimensions

by Roger Paskvan

In small marketville, this past September brought the construction of an FM translator. We had ordered two FM beams from a reputable manufacturer to aim at the city, since the tower was outside of town. My engineer, working with the tower crew, constructed a phasing harness out of 75 Ohm coax and sent it up for the tower hands to assemble. When it was all said and done, the antenna measurements indicated a very high reflected power – now, back up the tower again to trouble shoot. The crew finally brought the beams down with the explanation: "Both connectors on the beams have been ruined! We don't know how that happened?"

After studying the problem, some not-so-well-known facts about 75 Ohm connectors emerged. My engineer had utilized a 75 Ohm phasing harness, but attached 50 Ohm "N" connectors since that was what we had on hand. The mismatch of 50/75 Ohms in the connector is not worth worrying about – that was not the problem. The problem was that the physical dimensions of a true 75 Ohm connector are very different from a 50 Ohm connector. These physical differences are not readily visible, but can cause a lot of problems.

The center pin of a 50 Ohm connector is 0.108 inches in diameter. The center pin for a 75 Ohm connector is only 0.066 inches in diameter – this is where the problem surfaces. A 75 Ohm connector's center pin is almost half the size of its 50 Ohm cousin. Inserting a 50 Ohm male "N" connector into a 75 Ohm female "N" connector does a lot of damage. The larger 50 Ohm center pin spreads apart the tines of the 50 Ohm female center pin, and they either break off or short to the outer shield. Now the connector is ruined, and many engineers may not even realize this as they tighten the connectors.

So the ultimate solution is to find true 75 Ohm connectors and make up a phasing harness the proper way. The problem is that 75 Ohm connectors are hard to find and very expensive. So many engineers use 50 Ohm connectors on 75 Ohm cable. The problem occurs with the interface to the manufacture's 75 Ohm connector. The simplest solution is to cut off the 75 Ohm connector and replace it with a 50 Ohm connector, on the 75 Ohm antenna cable pigtail.

Another solution is to purchase a true 75 Ohm connector for the ends of your phasing harness that face the 75 Ohm antenna pigtail. (Remember, if you're putting 50 Ohm connectors on RG-11 coax, you will have to solder the 50 Ohm center pins onto RG-11 coax. (This is because the center pin of the 50 Ohm connector is too large for the smaller center conductor of 75 Ohm coax.)

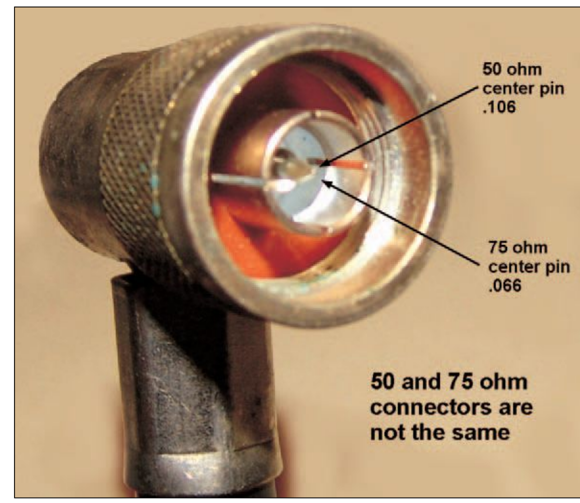
The solution that worked for us was to purchase two 75 Ohm connectors from Pasternack (PE-4510) and put them on the antenna ends of our phasing line. These are crimp connectors – remember, do it right once, since they are over $16.00 each. The fix worked. Everything was re-assembled, installed on the tower, and it all worked with a 1:1 SWR.

The Lesson:

If you push a 50 Ohm male "N" connector into a 75 Ohm female connector, the larger center pin of the 50 Ohm connector will spread apart the smaller female center pin of the 75 Ohm connector and damage it permanently. The tines will usually break off and short to the shield. The converse: If you push a 75 Ohm "N" connector into a female 50 Ohm connector, the center pin will be loose, causing intermittent problems from that day on.

Knowing this information about the minor differences in 75 and 50 Ohm connectors could save you a lot of money and time in your next install involving commercial antennas that come with factory installed 75 Ohm connectors.

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



50 and 75 ohm connectors are not the same

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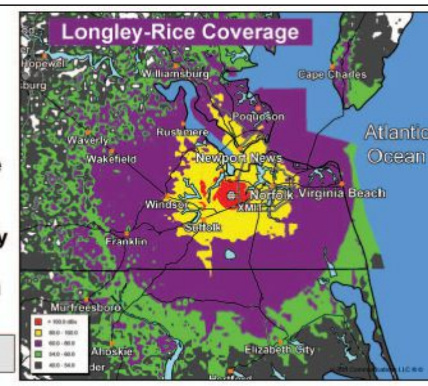

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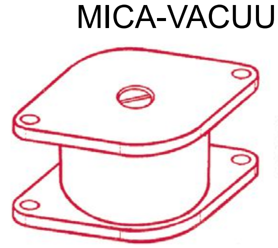

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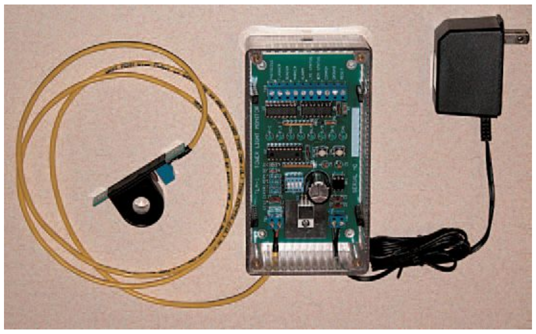

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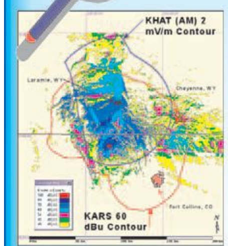

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AM Ground Systems - 32	www.amgroundsystems.com	Michael Patton - 47	www.michaelpatton.com
Arrakis - 17	www.arrakis-systems.com	Micro Communications - 43	www.mcibroadcast.com
Bay Country - 43	www.baycountry.com	Mooretronix - 45	www.mooretronix.com
BEXT - 43	www.bext.com	Myat - 37	www.myat.com
Broadcasters General Store - 21	www.bgs.cc	NAB Spring Show - 23	www.nabshow.com
Broadcast Devices - 36	www.broadcast-devices.com	Nautel - 7	www.nautel.com
Broadcast Software Intl. - 28	www.bsiusa.com	Nexus - 4	www.lpfmstore.com
BW Broadcast - 29	www.bwbroadcast.com	NTI - 39	www.minstruments.com
CircuitWerkes - 27	www.circuitwerkes.com	Orban - 37	www.orban.com
Coaxial Dynamics - 31	www.coaxial.com	Phasetek - 47	www.phasetekinc.com
Comrex - 5	www.comrex.com	ProAudio.com - 31	www.proaudio.com
Davicom - 41	www.davicom.com	PSI (Propagation Systems) - 30	www.psibroadcast.com
Delta Meccanica - 43	www.deltameccanica.com	Radio Systems - 26	www.radiosystems.com
Deva - 20	www.devabroadcast.com	RAM - 38	www.ramsystemsonline.com
DM Engineering - 47	www.dmengineering.com	Samco Antennas - 46	www.samcoantennas.net
Econco Tubes - 42	www.econco.com	SAS (Sierra Automated Sys) - 13	www.sasaudio.com
Elenos - 15	www.elenos.com	SCMS - 11	www.scmsinc.com
ESE - 46	www.ese-web.com	Shively - 22	www.shively.com
Graham Studios - 46	www.graham-studios.com	Sparta Broadcast - 41	www.ebsradio.com
Henry Engineering - 2	www.henryeng.com	Stackley Devices - 46	www.stackleydevices.com
Inovonics - 1, 19	www.inovon.com	Superior - 39	www.sbp-tv.com
Jampro - 35	www.jampro.com	Tieline - 9	www.tieline.com
Kay Indistries - 47	www.kayind.com	Transcom - 41	www.fmamtv.com
Kintronic Labs - 42	www.kintronic.com	V-Soft Communications- 44	www.v-soft.com
LBA - 35	www.lbagroup.com	Wheatstone - 3, 24, 25, 48	www.wheatstone.com