Radio Guide

Radio Technology for Engineers and Managers

January 2005

IP-Audio Distribution Moves Into the Studio

Inside Radio Guide

IP-Audio Routing

Page 4

When we say "network" today, most folks immediately think of Ethernet. Devised in the 1970s at Xerox's PARC, this use of distributed packet switching to connect local computer networks has evolved into a high-speed universal connection method for sharing all sorts of digital information.

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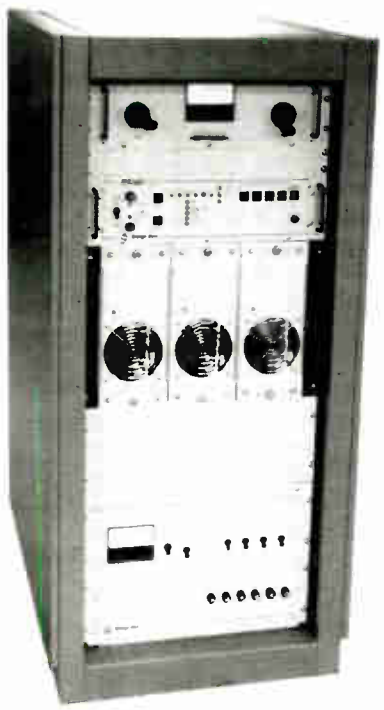

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Radio Guide

Contents

January 2005

IP-Audio Routing 4
The Technology Underlying Axia.

Audio Guide 8
Audio Processing from the Ground Up: Part 19 – Digital Audio

Security Guide 10
Good Fences (and Lights) Make Good Neighbors

FCC Focus 13
Why You Need a Washington Attorney

Radio Guide Road Trip 14
Peter Dahl: Transforming Broadcasters for Over Four Decades

Transmission Guide 18
Measuring AM Power

Tower Topics 22
The Truth About Towers: Part 4: Triggering the Specifications

Studio Guide 24
Streaming on a Budget

Pioneer Profiles 26
Thomas Convey: St. Louis Promoter and Radio Pioneer

Survival Guide 28
How Not to Get Eaten Alive in Radio's Food Chain

The Worst I've Ever Seen 28
A Periodic Display of Curious Solutions to Technical Problems

Tips From the Field 28
Tower Beacon Monitor Circuit

IT Guide 30
Effective and Safe E-mail Communication

Tech Tips 32
Optimod 8100A Low Output Fix

Gear Guide 34
AM/FM Transmitters and Exciters Showcase

Service Guide . . . . . 36 & 37
Products and Services for Radio

Final Stage 38
Date Book - Advertiser List - Industry Updates

Consultant Guide 39
Radio Consulting Engineers

Radio Guide

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Cover Photo: Axia SmartSurface™ installation at WEGL-FM, Auburn University, Auburn, AL.

Radio Waves

by Barry Mishkind – Editor

New Year, New Challenges

Have you gotten used to writing "-05" on your checks as yet? Or are you – like many of us – still writing "-04"?

Humans are naturally resistant to change, especially in those parts of our lives ruled by habit. Sure, there are many good habits we shouldn't change. Regularly expressing appreciation to friends and workmates, for example, or regularly looking your mate in the eye and saying "I love you!"

Other changes are necessary, even unavoidable; changes ranging from dietary "adjustments," commanded by a doctor, or changes in how we get to work, dictated by road construction – or consolidation.

The biggest change in the lives of broadcasters has to be the increasing prevalence of digital components in the station – from A/D inputs to IBOC transmission systems. Even the most change-resistant engineer must be ready to meet the digital challenge; there is a lot of work to do at many facilities.

Despite all those projects added to the regular duties making up your busy work schedule, our hope for you is that 2005 will bring you increased job satisfaction.

Getting there will require changes for some. Engineers constantly are pressured to do more with less, including less staff. Because engineers are basically "Can Do!" types of people, the tendency is to take a deep breath and just get the job done, no matter how many hours it takes.

That may be hard to change. Management attitudes toward workloads, as well as the some attitudes in the engineering community as a whole, need to be adjusted. No project or job is worth working yourself into an early grave.

Work hard. Enjoy your craft. But promise yourself and your family that in 2005 you will take time to "smell the roses," and enjoy real job satisfaction.

IP-Audio Routing

by Clark Novak, Axia Audio

The Technology Underlying Axia

As more and more stations transition to or plan for digital audio plants, it is important to understand the technologies that make it work. This month Clark Novak, from Axia Audio, explains how the IP-Audio Routing brings benefits to users.

[CLEVELAND, Ohio - January 2005] As long as there has been information, people have searched for efficient ways of sharing and distributing it. History credits the first "information system" to the French, who in 1791 developed an "Optical Telegraph Network" that used a system of cross-arms and pulleys to transmit messages at the blinding speed of 20 characters per minute.

A WHOLE DIFFERENT NETWORK

When we say "network" today, most folks immediately think of Ethernet. Devised in the 1970s at Xerox's PARC, this use of distributed packet switching to connect local computer networks has evolved into a high-speed universal connection method for sharing all sorts of digital information.

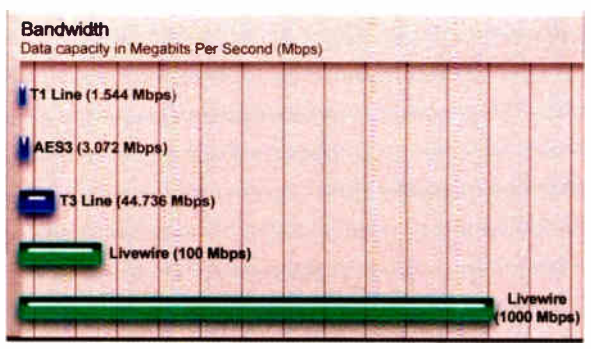
You may or may not have thought about it, but Ethernet is actually the most common digital audio transmission method in today's broadcast facilities, connecting audio delivery servers with studio computers. A natural extension of the technology would be to use Ethernet as a low-cost, universal way to connect audio and data for *everything* – including real-time audio – in broadcast studios.

Of course, it is not just the connection that is needed, but a connection with a pipe big enough and reliable enough to handle low-delay, high-reliability uncompressed audio over switched Ethernet. Axia Audio's solution for professional audio delivery is called "Livewire™."

Livewire is the core technology in all Axia products. It allows transport of real-time, "live" audio, plus Program Associated Data (PAD) and machine remote control over a network of switched Ethernet, a technique called "IP-Audio." This network can also carry file transfers, messaging and other routine traffic, resulting in a true "converged" network for the broadcast plant.

NO MORE PATCH BAYS

"Ethernet connects everything," says Axia President Michael "Catfish" Dosch. "Two devices connect with a length of CAT-6 cable; multiple devices connect through an Ethernet switch. The same wire conveys audio, logic and control messaging, program-associated data – even general IP traffic. Very clean, simple and elegant."



Ethernet has more than enough bandwidth for uncompressed digital audio.

The Axia Livewire network replaces the need for a cross-point audio switcher, since every source is available to every destination on the network. The network is designed to be naturally scalable, and can effectively cross-connect either a few studios, or a few dozen. This way a single Ethernet switch will support hundreds of cross-points.

Ethernet's enormous data capacity makes it possible for a 100Base-T segment to carry 25 stereo channels of 48 kHz, 24-bit linear PCM audio in both directions. A 1000Base-T or Gigabit fiber link can handle ten times that amount – up to 32,000 stereo channels per system.

HOW IT ALL WORKS

Livewire networks have three parts: the **Ethernet backbone**, the **software layer**, and the **user layer**.

Why Ethernet? According to Telos founder Steve Church, "Low-cost mass-market Ethernet switches offer us something very interesting. Since their function is to direct packets from port-to-port, we can use them to move our audio signals from whatever source to whatever destinations we want. This means we get a simple, flexible, facility-wide audio routing system for almost free."

Livewire has an audio advertising system based on the familiar concept of IP addressing, Church continues. "Every source has a text name and numeric ID. These are transmitted from source devices to the network. Receivers can build lists of all available sources from which users can select. With hardware nodes, you enter the names, numbers, and other configuration information via an attached PC with a web browser. With PC nodes, you open a configuration window."

In this manner, Livewire networks are constructed using a "building block" approach: determine the location and number of your audio inputs, then place Axia Audio Nodes next to them. There is an Analog Node for line-level sources, an AES/EBU Node to handle digital streams, a Microphone Node (with internal preamps) for microphone inputs, a General Purpose I/O (GPIO) Node for logic-follows-source machine control, and a Router Selector Node, a unique hybrid X-Y controller with its own AES and analog I/O ports.

Users like the fact that routing systems built using Livewire typically cost about half that of a hardwired TDM router. "With a traditional router, you spend something in the neighborhood of $100,000 just to put one console on the air, plus you need the special links to get audio into the frame, and adding another room means you have to invest in even more proprietary gear," explains Jim Hibbard of Pacific Mobile Recorders.

Hibbard, who installed Axia for Univision's Austin, Texas cluster notes, "Adding another studio with Axia is real simple, not a break-the-bank proposition. All we have to do is plug it in."

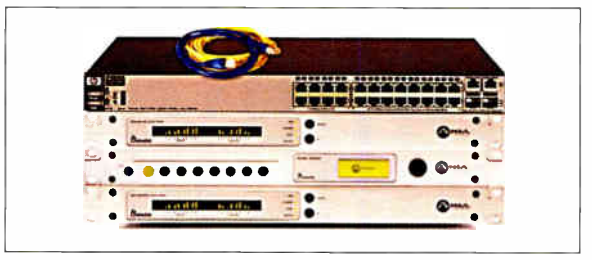
AVOIDING TRAFFIC DELAYS

In the "software layer," audio is sent in two ways: **livestreams**, which use small, fast packets to send uncompressed 48 kHz/24-bit PCM audio to network destinations in real time, and **standard streams**, whose larger, slower packets use the Internet's RTP/IP protocol to transfer pre-recorded audio. All Axia hardware transmits and receives both stream types; path selection happens transparently, without user intervention.

Whichever path is used, Livewire audio overcomes typical network issues such as the delay that plagues Internet audio. Such delay is often multiple seconds because of the long buffers needed to ride out network problems and the delays inherent in multiple-hop router paths.

On the other hand, without the limitations of the public Internet, and with 100% control over all parts of the system, live audio can be transported without delay or dropouts at full quality. Livewire's specifications show live audio delay to be *less than 1 millisecond* per network hop – comparable to any professional A/D or D/A converter.

The Livewire network capacity is tremendous (up to 32,000 stereo channels) – well above the needs of a typical broadcast facility. The capacity is enhanced by the fact that all audio streams stop at the local Ethernet switch, consuming no network bandwidth unless and until a receiver subscribes to them. Each receiver takes only the stream it needs, eliminating the problem of unrequested data flooding the network.



A small (16x16 stereo) routing switcher configuration.

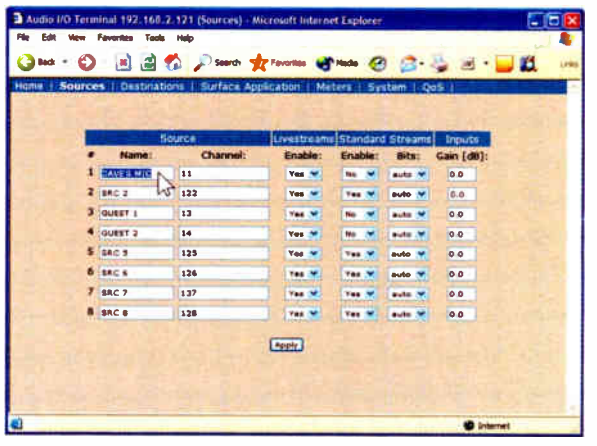
EXTERNAL CONNECTIONS

Since Livewire networks are Ethernet-based, the time and effort needed to install and configure components is significantly less than that needed for a comparable hard-wired router.

Axia's "user layer" consists of the devices used to translate analog and digital audio into network data packets. These "Audio Nodes" come in several different versions, each providing eight inputs to feed audio into the network, and eight programmable outputs to send audio back to studio devices or monitors.

Each studio's equipment list includes an Ethernet switch such as HP's ProCurve 2626, which has the guaranteed bandwidth and IGMP support necessary for Livewire. Setup begins by connecting each studio's audio nodes to that room's local switch using CAT-6 cable; inter-studio connections are made using a single 1000-BaseT link between switches.

Mark Manolio, Chief Engineer of Cleveland's WCSB-FM (where he installed one of the first Livewire systems) and an Axia support technician, gives us an overview of how Livewire studios are configured: "First, you connect your studio devices to Axia Audio Nodes. Audio Node inputs use standard RJ-45 jacks – except for mic inputs, which take XLRs. Users can crimp their own cables or use prewired adaptors.



Browsing the Audio I/O Node

"Next, you assign each Audio Node its own IP. This is done using the Node's front-panel controls. Then you can use any networked computer to access the Node's setup screens using your Web browser.

"Using these setup screens, sources and destinations can be defined by giving them descriptive names, choosing stream priority and input gain settings, and defining GPIO options if needed," Manolio says.

(Continued on Page 6)

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IP-Audio Routing

by Clark Novak

Continued from Page 4

Mixing and studio control is handled by the Axia SmartSurface™, a programmable 16-fader controller with all the functions of a traditional console – plus a bunch that were never possible on your BMX.

WCSB-FM, Cleveland

The SmartSurface has four program busses, extensive monitoring and talkback capabilities, and a GPIO interface to control connected devices. Users can save unique profiles with different layouts and defaults, any of which can be recalled on any networked SmartSurface.

LINUX ENGINE UNDER THE HOOD

The actual audio mixing is handled by the Axia StudioEngine, a network-based DSP mixing engine running real-time Linux to ensure bullet-proof, 24/7 operation. Axia plans to make additional control surfaces available in 2005.

To eliminate any need for D-to-A conversions in the sound card, the IP-Audio Driver enables computers to exchange audio directly using their Ethernet ports on the Livewire network. A multi-channel version of the IP-Audio Driver for use with audio delivery systems is available from Axia development partners Enco Systems, Prophet Systems and Scott Studios.

To assign and control the audio sources iPlay, an audio monitoring application for Windows workstations, allows individuals to select and monitor any networked audio stream.

iPlay assignment screen.

Another powerful network configuration tool – PathfinderPC – lets authorized users control the Audio Nodes, allowing engineers to build and manage facility-wide routing applications.

PathfinderPC can change between presets manually, on a day-part schedule, or in response to an external trigger from an automation system or other source. Developed by longtime Telos' partner Software Authority (whose work will be known to many Zephyr users), it can even be programmed to sense problems such as silence at a particular audio port, and patch around it without user intervention.

EARLY REPORTS

In early 2004, Auburn University's WEGL-FM, in Auburn, AL became the first station to build a studio using Livewire.

"We have been using this system for about 10 months. I could not be happier with the products, service, and dependability that Telos has assembled in their Axia equipment," says station Chief Engineer Marc Johnson. "The Axia equipment came straight out of the box and was on the air in a matter of hours. All we did was place the new gear, plug in the power, and connect it to the network."

Radio Skonto, Riga, Latvia

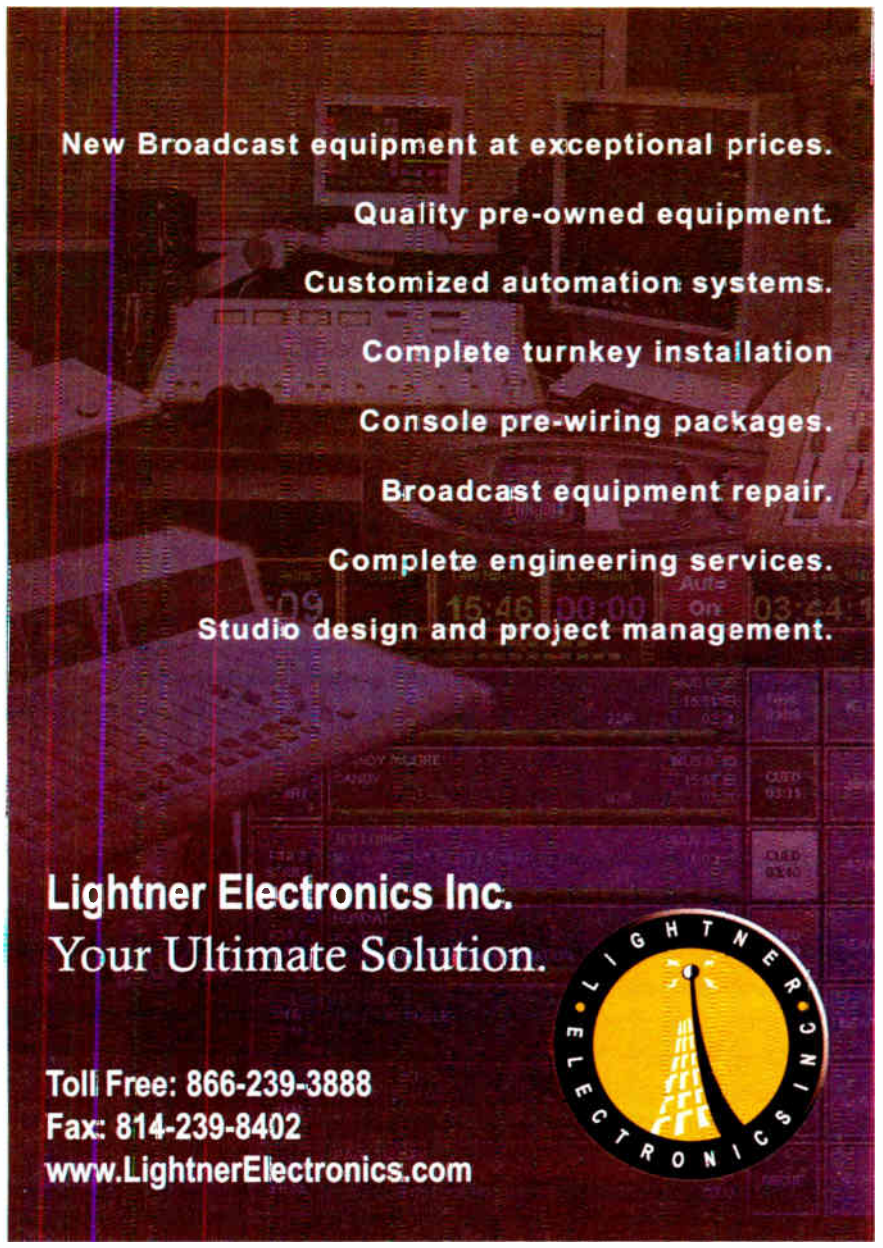
Ivo Bankavs, CE at Radio Skonto in Riga, Latvia – the first international installation of Livewire technology – is pleased with the reliability.

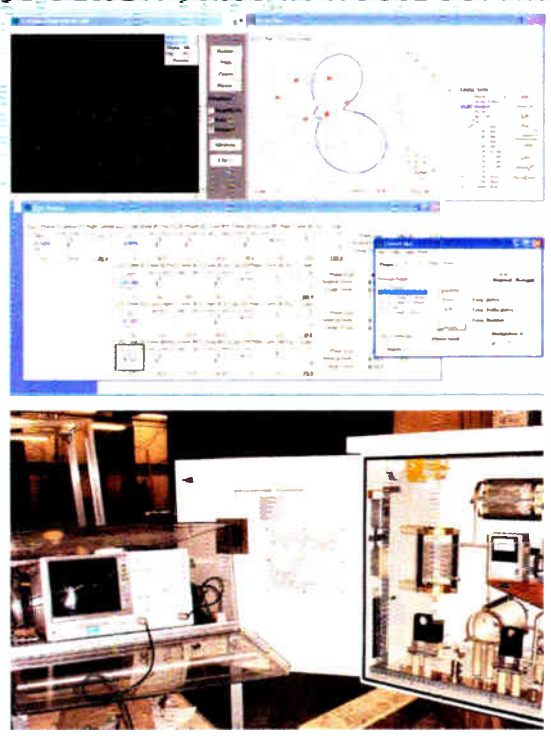
"We've had no failure or downtime of any kind since we installed Axia," says Bankavs. "The company warned us that we would be among the first to use this tech, so we were ready for start-up bugs," he says, "but we've been happy – there have been none."

While early adopters have been smaller stations, the Livewire concept will get its first major-market workout when WOR installs it in a new ten-studio facility in New York City, as part of a move in early 2005.

Chief Engineer Tom Ray says it was an easy choice: "WOR was looking for a high tech digital solution that was also cost effective. The Axia system provides all the flexibility the WOR operation requires, allows a mixture of analog and digital I/O, and was extremely cost effective. The ability to access virtually any audio source anywhere in the facility is mind-boggling," says Ray.

Clark Novak is a marketing team leader for Axia products. He is happy to answer questions at: cnovak@AxiaAudio.com





Audio Guide

by Cornelius Gould

Audio Processing From the Ground Up

Part 19: Digital Audio Processing

As a station builds its audio chain, it is the processing, as much as anything else, that gives the station its "defining" sound. Learning how to do that takes time. Yet, as we move into the new world of digital transmission, many hard fought lessons will need to be relearned. Not to worry, Corny is here to help!

[CLEVELAND, Ohio - January 2005] The broadcast industry is working its way down the path to a new medium. This medium is Digital Radio Services in all its forms, from the Internet to HD Radio. A very important part of the transition is learning to adjust audio processing for digital transmission.

Previously, we discussed some reasons why clipping is bad for HD radio, what the big deal is over not having a pre-emphasis curve to work against, and a little hint on how that changes the sound of audio processing. I would like to pick up from there.

LOOK AHEAD

A new kind of peak control algorithm has replaced the "function" commonly known as the loudness clipper for Digital/HD radio. This algorithm is known as the "Look-Ahead" limiter. You may recall that in the classic dynamic limiter design, you will always get some overshoots with peaks, and these peaks are usually handled by a clipper, which abruptly "chops off" that peak to keep maximum modulation levels under control.

On the other hand, we cannot use clipping in the digital radio domain, because that results in truly terrible sounding audio. The extra harmonics created by clipping just cannot be fed into a CODEC and still come out sounding "good." Something new is needed.

The concept of the look-ahead limiter has been around for quite some time. To understand what it is, recall why there are overshoots in the classic limiter design; it is closely related to a function called "Attack Time." Attack time simply refers to the amount of time it takes for a dynamic limiter to act on a peak, and do something about it – namely, turn down the level to prevent over-modulation.

Even if you set the attack time to its fastest setting, there has to be an initial overshoot before the limiter can do its thing. This is because in order for it (the dynamic limiter) to work, the overshoot has to happen so the circuit can recognize the condition. This is where overshoot comes from, and therefore the need for a clipper to follow the limiter.

As a side effect, the more you cause the clippers to work, the more apparent loudness you gain on the dial as this clipping both adds a "bigger/fatter" sound to your on-air signal, and creates a certain amount of distortion that most people have come to associate with "it must be louder."

LESS IS MORE

The look-ahead limiter can function and not cause overshoots. This is done by looking at the signal coming *into* the look-ahead limiter, and generating a control signal used to turn down the level whenever there is a peak that will cause over-modulation.

In any limiter system it is impossible to create a limiter that can truly do peak level in "real time" because the over-modulation has to happen *first*, before the limiter can do its work. What the look-ahead limiter does is to delay the audio by the amount it takes it to create the control signal, then feeds the audio into the magic level-control circuit – commonly referred to in the analog world as a Voltage Controlled Amplifier (VCA).

By delaying the audio by the same amount of time it takes to generate the peak control, the limiter can precisely turn down the audio to the perfect amount needed to manage this peak overshoot. However, this adds a certain amount of delay to the program signal. Depending on the design, this delay can be very minimal, to long enough that the DJs can no longer listen to the "air feed" while talking live on-air.

IDENTIFYING DIGITAL DISTORTION

So, the look-ahead limiter is the solution to keeping levels tight and controlled for HD/digital broadcast radio, replacing the function of the good 'ol clipper in digital radios analog counterparts.

This new technology is interesting in that it replaces the familiar gross "harmonic distortion" of analog radio with something called "intermod distortion" (IM distortion).

I will try my best to describe what this is in words for you. Harmonic Distortion is that "buzz" sound you hear when you overload an amplifier or other familiar audio devices. On the other hand, IM distortion sounds are most easily heard on voices, and is sort of a soft "gritty" sound.

To give you an aural reference, I have placed some examples showing harmonic and IM distortion on my website: http://techcentral.cgould.com/radioguide/audio/

Perhaps the best description of what to expect when using the look-ahead limiter is "a softer form of distortion" than what you have been used to with clippers. Will this create a new loudness war on HD? I do not think it will, as the effect of the look-ahead limiter is not the same as clippers by any stretch of the imagination. For one thing, little is gained in loudness as you "push it harder." The audio will get loud to a point, and then break into heavier and heavier amounts of IM distortion.

With that out of the way, let us combine some more perceptual coding information with the processing concepts we have talked about. This will shed more light on how different it is working in the digital radio space vs. analog.

A VISUAL EXAMPLE

A quick look at how video compression (bit rate reduction) works will help us understand how audio bit reduction works. The thing to remember about video is most of the information is "redundant."

In fact, most of the time the background in video is a static image; the only thing that changes is a single (relatively) small image. Thus, if you send the background once and keep it static, just sending only the data needed to reproduce the foreground movements, you can send digital video using a relatively small amount of bandwidth.

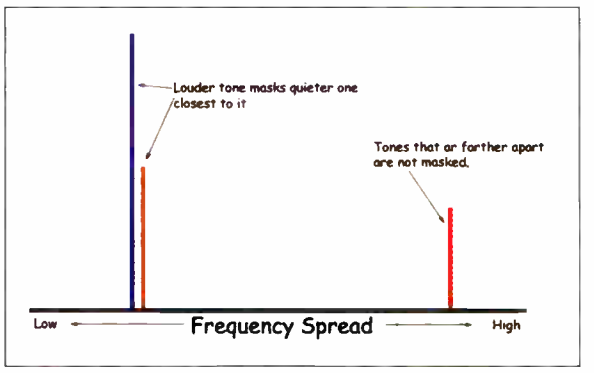
These video compression systems work really well until the system has to reproduce jittery camera images. Then the system has to constantly refresh the entire image, and as a result the resolution goes way down (and fuzzy blocks appear) until the background images "settle down." At that point the "sharpness" returns, and things look pretty good again.

With this as an example, we can say that using the incorrect amount and type of processing on the HD side of your signal is roughly equivalent to rapidly shaking all the camera feeds, and passing this video into a video bit-rate reduction CODEC. The audio just will not sound as good. In a way, you can say that it will lose resolution.

MASKING

To understand why this happens, we must review some basics of perceptual coding. We laid the foundation in the "Rock and Pin" article, and now we will try to present more insight and understanding on the process. I focused mainly on level masking. That is, a louder sound will (to our ear) generally mask quieter ones. More precisely put, we normally do not notice the quieter sounds in the presence of the louder ones, unless the louder sounds are removed.

Added to this concept, there is another type of masking used in perceptual audio coding to remove data we would not notice. That is "frequency masking."



The concept behind "frequency masking" is this: two signals closely spaced in frequency and equal in amplitude will be heard. Reduce one of them just a little bit, and we will only notice the one. It is the same concept as the loudness masking in terms of levels, but it also takes advantage of close frequencies.

Another masking techniques involves time domain (temporal masking), where time delays are taken into account to help hide the actions of the coding process from our range or aural perception.

Inappropriate processing wreaks havoc on all of the above, making the entire process (at best) run very inefficiently, and can also undo some of the masking techniques, creating tearing, metallic, and many other artifacts that cause an unpleasant listening experience for the listening audience.

NEW CONCEPTS FOR DIGITAL

Another new concept to digital broadcasters (Satellite radio, Internet, and HD radio) is the Spectral Band Replication (SBR) system. This system is really fascinating, and surprisingly effective. SBR allows the Digital Audio Broadcasting (DAB) CODECS to get full bandwidth audio while running a much lower sample rate – generally at a rate that would never normally support full bandwidth audio.

What SBR technology does is to add to the lower sampled CODEC audio a sort of "descriptor data stream" (my term). The base CODEC for FM (without SBR enhancements) would normally only support about 11 kHz of audio bandwidth (a little better than the perfect AM-NRSC AM radio signal).

With SBR the descriptor stream is used to describe what is going on between the maximum frequency of the "base CODEC," and the 20 kHz limit of this audio to (literally) create a full 44.1 kHz, 20 kHz audio bandwidth. The AM HD system runs its base CODEC at an even lower bit and sample rate, and the SBR technology is used to generate high frequency content out to about 15 kHz audio bandwidth.

The SBR "descriptor stream" data is encoded into the base codec algorithm. At the receiver side, two things happen: 1) The reconstruction codec uses a sort of "Aphex Aural Exciter" type algorithm to regenerate harmonic content based on the fundamental frequencies contained in the low sample rate audio, and 2) It takes the information in the "descriptor stream," and fine tunes this high frequency harmonic content for better accuracy.

It would seem this would be hard to make run in any accurate kind of manner, but, I must say it works, and *works extremely well!* Anyone who has listened to HE-AAC, MP3 Pro, HD Radio, and Satellite Radio has heard the SBR system in action.

Next time out we will continue painting the picture of what is happening with digital audio broadcasting and the issues facing audio processors in this new generation of broadcast services. However, I think (and hope) you now are getting a fuller picture of what is going on.

As we work our way through DAB, we will present some more basic advice on how to go about taming this beast enough to get the sound you want on these new media.

Cornelius "Digital" Gould is the Senior Staff Engineer for Infinity Broadcasting in Cleveland, Ohio. Corny can be contacted at: cg@radiocleveland.com

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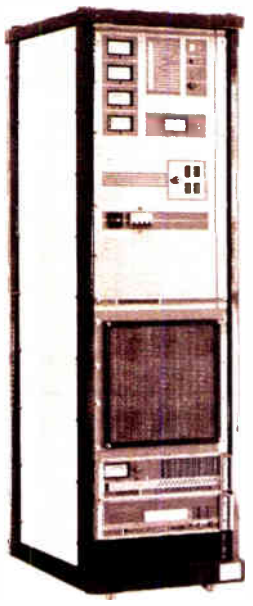

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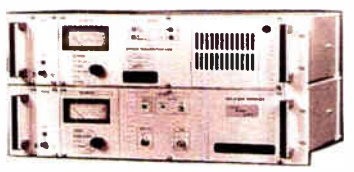

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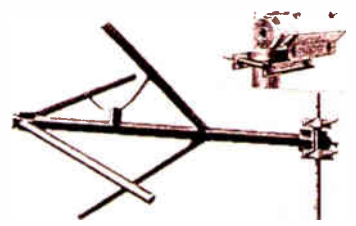

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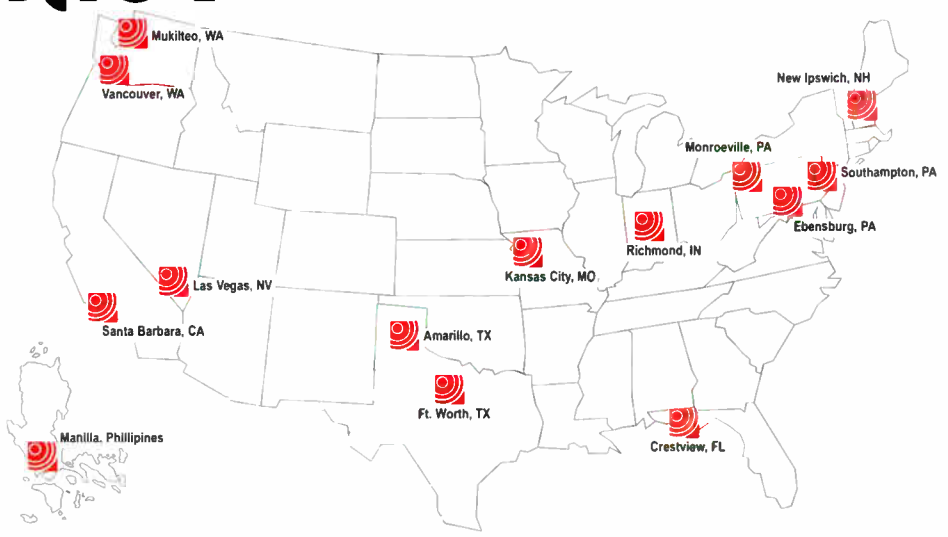

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Security Guide

by Marvin Collins

Good Fences (and Lights) Make Good Neighbors

Giving attention to the fences around the transmitter site, and those around the towers themselves, is not cheap, but is important for site security. But understanding what and who is outside the fences is also important.

[LOS ANGELES, California - January 2005] In December of 2000 I had an opportunity to see what happens when site security is non-existent at an unmanned AM transmitter site. It was not a pretty sight.

NO LONGER BUSTLING

I had been hired by Radio Unica, headquartered in Miami, Florida, to take care of their KBLA 1580 kHz six-tower 50 kW transmitter facility in Los Angeles. At one time, the building was the office, studio and transmitter for KDAY. During the KDAY era the building was a busy place with people on duty 24 hours a day, seven days a week.

A new owner changed the call letters and moved the office and studios to another location. The former KDAY (now KBLA) site now became unmanned with no security. It was shocking to see how much graffiti soon covered everything.

Wooden fencing around each of the six towers made great billboards for graffiti.

In addition there was evidence that the parking lot was used for all sorts of nefarious activities.

It was fortunate that no serious damage was done to the building, satellite dishes nor the diesel generator and its above ground tank.

REDUCING ACCESS

The first step to putting a stop to the vandalism was to call in a fencing contractor to install a gate across the driveway and repair the fencing around the property. It was then necessary to call in a cleanup crew to trim all the trees and bushes to make everything visible, so the property would no longer be desirable for the homeless who had moved in over the years.

The costs for tree and shrub trimming and hauling came to $10,000. This included cutting down and hauling away the wooden graffiti filled fencing around the six towers. Another $10,000 was spent installing wrought iron fencing around each of the six towers.

There was the occasional detour. One day, while work was being done replacing coaxial transmission lines to the six towers, a building inspector showed up at the site. It seems that a neighbor had complained about all the graffiti that had accumulated. The inspector asked what sort of work was being done and wanted to see a building and safety permit. This started a slight panic among the out-of-town crew doing the coax installation work.

Thinking quickly, I explained that replacing coax did not require a permit – though I have to admit I was not certain about that. Instead, I quickly directed the building inspector to a more serious problem caused by a neighbor.

Apparently this neighbor was constructing a large basement under his existing house. He employed a crew of workers who were digging under his house and bucket by bucket had been bringing the excavated dirt onto the KBLA property through a hole in the fence. Enough dirt had been brought onto the KBLA property to fill several dump trucks.

Some of the dirt left by a less than neighborly neighbor. The Building and Safety inspector's visit finally put a stop to it.

The last time I saw the building inspector he had his citation pad in hand and was on his way to talk to the neighbor. We have not seen him since. No more dirt has been placed on the KBLA property and the opening in the fence, made by the neighbor, has been since closed.

KEEPING IT CLEAN

The graffiti all over the KBLA transmitter building was a remaining problem. The solution to this problem was to locate a company by the name of Graffiti Control Systems. They did a great job of removing all the graffiti. The building looked very good again, for a while, after Graffiti Control Systems did their work.

Several weeks later the taggers came back to apply graffiti again. Another call to Graffiti Control Systems was necessary to have the new graffiti removed. To keep the building free from graffiti it is inspected at least once a week and if any graffiti is found a call is made to Graffiti Control Systems to have it removed as soon as possible. Now the taggers know their graffiti will not remain for long on the KBLA property so they usually do not even bother to try.

Winter rains caused a lot of grass and weeds to start growing on the acreage where the six towers are located. It was a big job to keep the weeds and grass mowed down to an acceptable level. But, as spring arrived the grass and weeds grew even faster. Mowing was again required. This was time consuming and expensive. A better solution was to have the acreage sprayed with an herbicide.

Tower site after herbicide.

Now the Fire Department is pleased with the way the property looks; there no longer is a fire hazard.

TROUBLE DOWN BELOW

Three years after the antenna system was rebuilt, another problem surfaced – so to speak – from below.

KBLA began suffering intermittent off air episodes. Soon it was discovered that these outages were caused by gophers, which had chewed on the buried control cables to the towers.

(Continued on Page 12)

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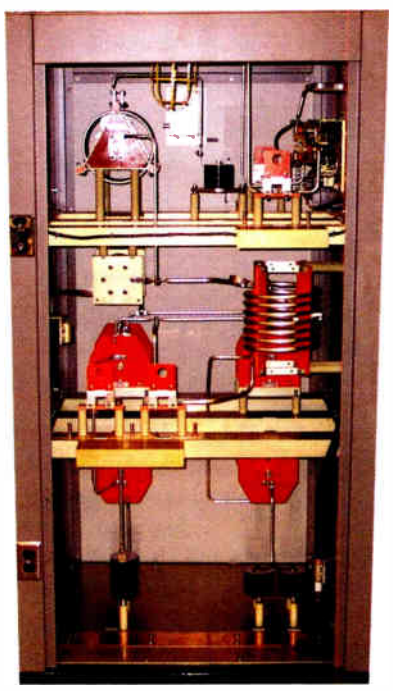

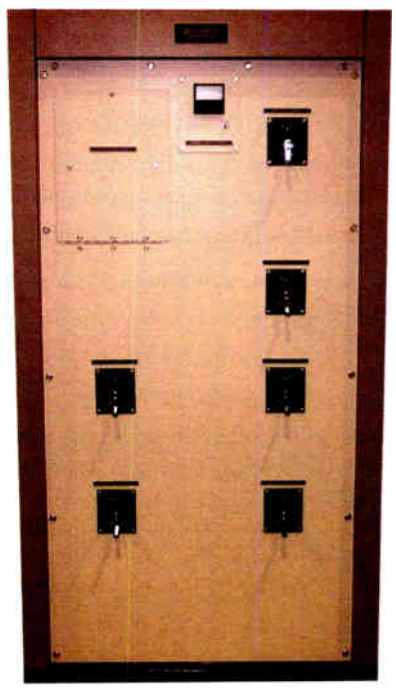

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Security Guide

by Marvin Collins

Continued From Page 10

The problem became so bad that the control cables had to be replaced with armored cables. In addition, a gopher extermination program was implemented. This also halted the large number of holes in the ground, which could be dangerous to anyone working (or trespassing) on the property.

CAN YOU SEE ME NOW?

One thing is certain: just about the time you believe you have things under control, you can be sure another interesting situation will arise. Since KDAY/KBLA was built in 1969, tower lights were never required. The rebuilding and subsequent proof of performance for the KBLA antenna system triggered an FCC notice to the FAA.

Based on this, the FAA determined that KBLA now was required to have tower lights. The day after the newly installed tower lights were turned on the complaints from nearby neighbors started arriving. The complaining neighbors live on a ridge several thousand feet away from the towers, but the ridge is close to being the same elevation as the top of the towers.

This meant the neighbors suddenly had four bright beacons flashing into their windows, which had given them their view over the city. One evening I drove to the ridge to see for myself how bad the situation was. I have to admit, I would not like to have that much light blinking outside my windows.

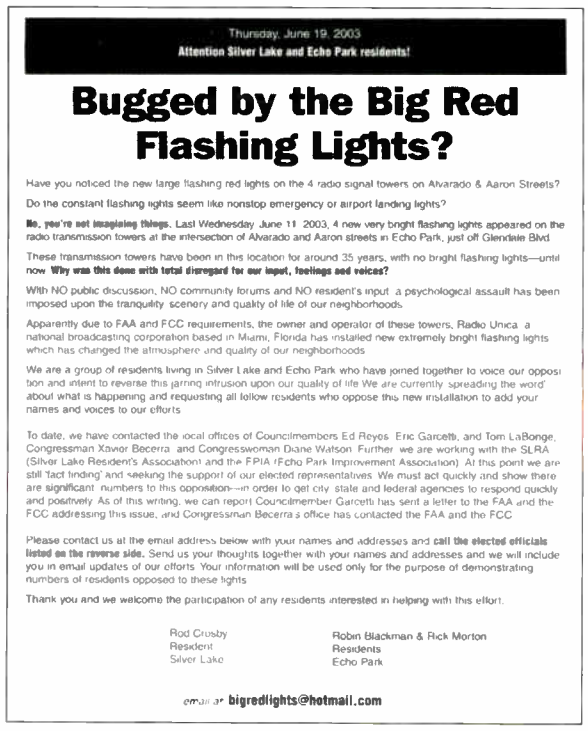
Hilltop homes get a slightly brighter "view."

The neighbors went so far as to form a neighborhood association and file complaints with their political representatives. The neighbors were not happy with the station's explanation – that the FAA required the tower lights and KBLA had no choice but to install them at great expense.

Fortunately, the neighbors made productive use of their unhappy state. Soon, via their political representatives, they were able to obtain a compromise from the FAA.

The flashing beacons were removed from the top of the towers. The steady sidelights were moved to the top of the tower, where they remain as far less powerful steady lights. The neighbors are now content with this FAA compromise solution.

While the site continues to be unattended most of the time, our relationship with the neighbors has improved since the site is no longer an "eyesore." From time to time, we even get an assist from our neighbors in alerting us to impending problems.



Thursday, June 19, 2003

Attention Silver Lake and Echo Park residents!

Bugged by the Big Red Flashing Lights?

Have you noticed the new large flashing red lights on the 4 radio signal towers on Alvarado & Aaron Streets?

Do the constant flashing lights seem like nonstop emergency or airport landing lights?

No, you're not imagining things. Last Wednesday June 11, 2003, 4 new very bright flashing lights appeared on the radio transmission towers at the intersection of Alvarado and Aaron streets in Echo Park, just off Glendale Blvd.

These transmission towers have been in this location for around 35 years, with no bright flashing lights—until now. **Why was this done with total disregard for our input, feelings and voices?**

With NO public discussion, NO community forums and NO resident's input, a psychological assault has been imposed upon the tranquility, scenery and quality of life of our neighborhoods.

Apparently due to FAA and FCC requirements, the owner and operator of these towers, Radio Unica, a national broadcasting corporation based in Miami, Florida has installed new extremely bright flashing lights which has changed the atmosphere and quality of our neighborhoods.

We are a group of residents living in Silver Lake and Echo Park who have joined together to voice our opposition and intent to reverse this jarring intrusion upon our quality of life. We are currently 'spreading the word' about what is happening and requesting all fellow residents who oppose this new installation to add your names and voices to our efforts.

To date, we have contacted the local offices of Councilmembers Ed Reyes, Eric Garcetti, and Tom LaBonge, Congressman Xavier Becerra, and Congresswoman Diane Watson. Further, we are working with the SLRA (Silver Lake Resident's Association) and the EPIA (Echo Park Improvement Association). At this point we are still 'fact finding' and seeking the support of our elected representatives. We must act quickly and show there are significant numbers to this opposition—in order to get city, state and federal agencies to respond quickly and positively. As of this writing, we can report Councilmember Garcetti has sent a letter to the FAA and the FCC addressing this issue, and Congressman Becerra's office has contacted the FAA and the FCC.

Please contact us at the email address below with your names and addresses and **call the elected officials listed on the reverse side.** Send us your thoughts together with your names and addresses and we will include you in email updates of our efforts. Your information will be used only for the purpose of demonstrating numbers of residents opposed to these lights.

Thank you and we welcome the participation of any residents interested in helping with this effort.

Rod Crosby
Resident
Silver Lake

Robin Blackman & Rick Morton
Residents
Echo Park

email at: **bigredlights@hotmail.com**

A Neighborhood Association Gets Results

And best of all, the vandalism and graffiti problems have, for all practical purposes, disappeared. When going to work at the site, I no longer feel I have arrived in a Third World country. The trick now is to stay on top of things, so we do not leave an opening for the problems to return.

Marvin Collins has been a broadcast engineer in the Los Angeles market for over fifty years. You can contact Marvin at KFIam640@aol.com

FCC Focus

by Bruce Eisen

Why You Need a Washington Attorney

[WASHINGTON, DC - January 2005] In the days before there was a 1996 Telecommunications Act, satellite radio, personal computers, or an FCC trying to insure that radio is controlled by the fewest possible mega-companies, broadcasters needed at least two essential pros to guide them through the regulatory waters: an engineer and a communications attorney.

There were, of course, other professionals who could (and did) provide help along the way. But if you wanted to increase your facilities, or argue that a competitor was doing you wrong, you stood to benefit if the engineer and the lawyer you retained knew the FCC inside and out.

COPING WITH CHANGES

So many things have changed in our regulatory world since I began practicing communications law in 1976! One of the few remaining Truths is that a broadcaster still relies heavily upon a competent engineer. But the changes of the last 10-15 years, I believe, have diminished the need for regular contact with a communications attorney.

As the FCC repealed Rule after Rule, or deferred oversight to some other regulatory body, broadcasters were able to unburden themselves with paperwork, without fear of FCC intervention into their day-to-day business practices. While some lawyers struggled to keep their heads above water, the increased deregulation enabled broadcasters to save thousands of dollars a year in legal fees that could otherwise be spent on, perhaps, more productive matters.

Depending on your outlook, this might seem to be either a good thing or a bad development – great if you are a broadcaster, lousy if you are a lawyer.

Actually, though, it may not be so bad for the attorneys who, like me, have tried to make their living through the interpretation of complex Rules and Regulations and the profound alterations that have overtaken the broadcasting world. Lawyers, being an adaptable breed, were in some cases able to redefine themselves. They got into other legal areas often regulated by the FCC, and some even became entrepreneurs. That, too, is a good thing.

WHY CALL AN ATTORNEY

This may sound like a commercial, but there remains a significant need for broadcasters to continue some level of contact or affiliation with an experienced FCC attorney.

First, there really are occasions to file something important which may be relatively complex (assignments or transfers, renewals, waiver requests, etc.). Even with electronic filing, sometimes questions raised by applications call for careful investigation and research, as well as some artfully tendered exhibits that can still be easily understood by the staff.

Second, there are a host of legitimate questions concerning what can be done or what is prohibited by the agency under a particular set of facts. The hot topic of the moment seems to be "indecency." There are so many pitfalls and issues swirling around the manner in which the FCC applies its indecency standard that it would be self-defeating for a broadcaster to avoid asking an FCC attorney for a legal opinion if something said on-air (or proposed to be said) may be in doubt. Who knows what the issue of choice will be in five years?

DO NOT WAIT FOR PROBLEMS

Unfortunately, many of the questions I receive come "after the fact." That is to say, the broadcaster has already engaged in some conduct that may or may not be illegal, and an immediate answer is needed to determine what steps, if any, must be taken.

Often, these questions relate to nuts and bolts issues like Public File difficulties and FCC inspections or, worse, in response to a complaint that may have been filed at the agency by someone in the audience or a competitor.

Whenever possible, a broadcaster really should be proactive and solicit a legal opinion before difficulties arise. This is why it really is a good idea to have a communications attorney upon whom you can rely and whom you can call at any moment to discuss an issue that may be of concern.

It may cost a little, but your livelihood rests with the goodwill of a certain government agency, and you have an obligation to protect your interests by keeping informed of the many changes in the law.

USING LEGAL RESOURCES EFFICIENTLY

It is worth noting that broadcasters and their engineers have another tool that can often be effectively used even before counsel is called. It is the FCC's website at www.fcc.gov. Many have already learned its secret intricacies, and I believe persons engaged in the broadcasting industry who learn to navigate that site will have a clear advantage.

Keeping abreast of news and other developments included on the web site will not end the need for the assistance of a communications attorney, but it may save time and money, and provide easy answers that might otherwise have resulted in legal fees.

The coming years will bring more difficult questions to be resolved within the industry. The Internet, equipment developments, satellite radio, etc., all promise a whole new generation of problems. Preparation for the future is critically important to anyone's continuing success; I think it remains essential to continue to rely upon expert professional help in order to dodge the unseen land mines of broadcast regulation.

The nature of physics, being what it is, means engineers will continue to be essential. Lawyers will be less so, but anyone who waits until a violation has already occurred and does not seek legal assistance proactively will someday find himself in an unhappy dilemma.

Bruce Eisen is an experienced communications attorney at Kaye Scholer in Washington, DC. He can be reached at beisen@kayescholer.com

Radio Guide

Road Trip

by Barry Mishkind

Peter Dahl

Transforming Broadcasters for Over Four Decades

[EL PASO, Texas - February 2005] It is comforting to know that when you really need help there is someone out there, able to take care of your needs.

For broadcast engineers, perhaps one of the most stressful situations is when a high voltage transformer blows in a radio transmitter. That is especially so when there is no auxiliary transmitter, and there is no longer any support from the manufacturer. Unlike most of the other parts in a transmitter, you cannot just run down to the local parts house or neighborhood Radio Shack to pick up a high voltage transformer to get back on the air.

All in all, it is as much of an "emergency" as many ever want to have.

THE PLACE TO CALL

In such emergencies, the company most often turned to is headed by a man who has made transformers and reactors his life's work. I recently had an opportunity to visit Peter Dahl, president of the Peter W. Dahl Company, at his plant on the northside of El Paso, Texas.

Since moving to El Paso from Minnesota in 1966 the affable Dahl has presided over what many broadcasters would say is the premier source of "iron" in the country, if not the world.

Peter Dahl

Peter Dahl has a Bachelor of Electrical Engineering (BSEE) degree from the University of Minnesota, and has specialized in the technology of transformers and their construction.

On the surface, it all seems pretty easy to put a transformer together. All you have to do is use the simple recipe: take the right sized core, the proper steel laminations and copper wire, wind them properly, affix the leads in the proper place, clamp them all down, check for proper voltages, cover with a good varnish, bake for 4 to 6 hours at 300-350 degrees, apply the paint finish, and do a final test. Sounds easy, right?

PROPER DESIGN AND CONSTRUCTION

Since the object is to produce a transformer that is as good or better than the original one supplied by the manufacturer, there is more to it than just tossing parts together and shoveling them out the door. The attention to the product is what makes a Peter Dahl transformer.

Over the years, Dahl has designed and produced over four thousand types of transformers. He wrote his own custom software to not only calculate the material lists for the various transformers but to index all the information available on units produced by the different transmitter manufacturers – including the electrical specifications and the sizes. It is useful, after all, for the replacement transformer to fit in the transmitter!

At the same time, as Dahl says: "The technology really hasn't changed over the past 40 or 50 years. Magnetics is magnetics – Hertz and Faraday. On the other hand, the materials have gotten so much better.

"You have steel now that you can run with much higher flux densities [and] the same or less core loss, and magnet wire that has 200 degree insulation on it instead of the old Class A, 80° C enamel wire," he said.

PUTTING THEM TOGETHER

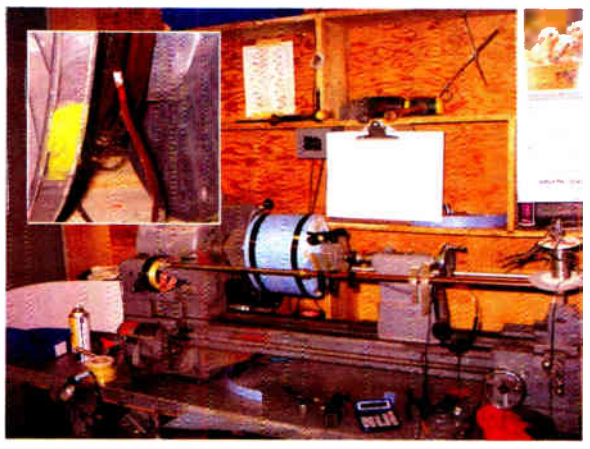
Dahl's factory has produced units as large as 100 kW modulation transformers, but among the toughest to build properly is the 1 kW size. Each transformer is built to order, although from experience they have learned to stock a few of the more commonly ordered units: some modulation transformers for various 1 kW transmitters, a couple of 25 kW FM three phase HV transformers, and even some for MW-5s.

Designing and building a transformer is, for such a heavy item, somewhat of a balancing act between the quality of the steel laminations, its thickness, the wire used, how it is wound, and the internal losses. For example, in modulation transformers, Dahl notes, "the more turns and the more iron you have the better the low-end response. The fewer turns, closer and more interleaved, the better the high-end response."

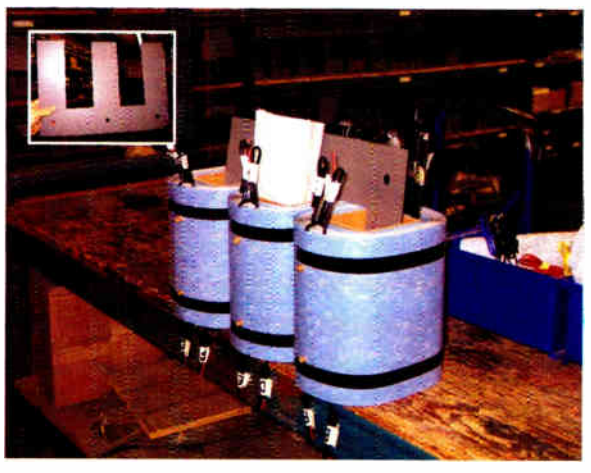
Although many of the costs have gone up dramatically in recent months, Dahl focuses on a high quality of components. The first step, then, is to generate a listing of the specifications and parts, which stays with the unit as it moves through the factory.

Perhaps surprisingly, Dahl uses a square/rectangular magnet wire whenever possible. "This allows you to put more copper in a given area, making the transformer more efficient," he says.

The laminate is what they call "3-14-3," made from 3 mils of Dacron, 14 mils of mylar, and another 3 mils of Dacron. The Dacron helps keep the wire from moving, and, "One thickness of this laminate is good for 25 kV."



Winding the Transformer

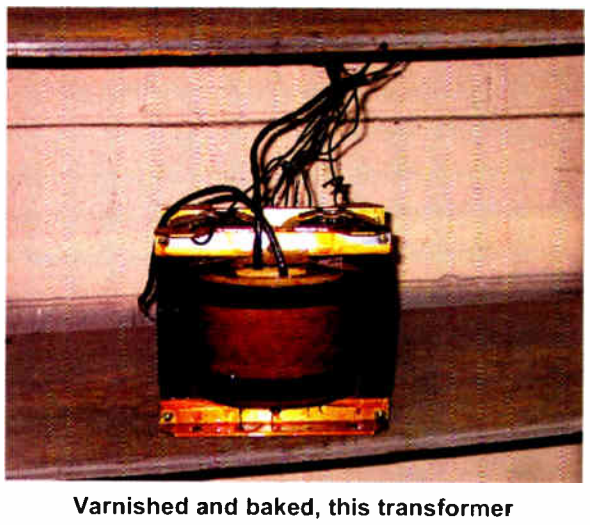


An MW-5 Plate transformer winding. The steel laminations used are the biggest used by American manufacturers.

Once the wire layers are wound, the steel laminations are inserted and the entire unit is tightly bound together with straps.

"Lefty" shows off newly built transformers, ready for testing and finishing.

Once the transformers have been assembled they are sent to a special test rig to ensure each one operates at the correct voltages with no broken wires, and has taps that are correctly aligned. Then they are sent over to the varnish and baking area. After baking and cooling, they are then retested at a test bench capable of handling 80 kV.



Varnished and baked, this transformer is ready for final testing and finishing.

(Continued on Page 16)

Radio Guide
Road Trip

by Barry Mishkind

Continued from Page 14

READY WHEN YOU ARE

As mentioned before, a number of stock transformers are ready to be shipped on a moment's notice. Emergency support is available 24/7. Or, virtually any custom transformer can be on its way to its destination within three days.

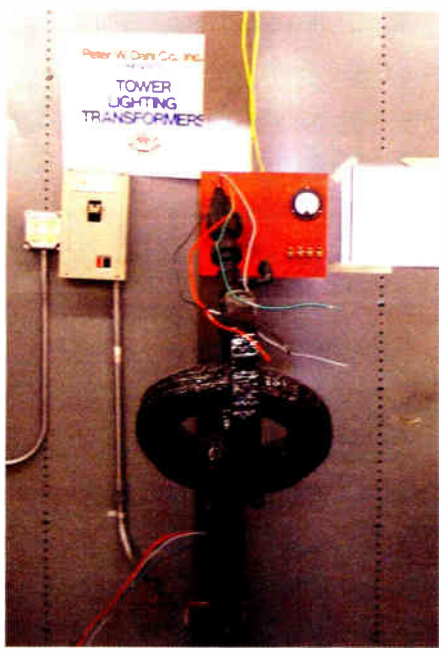
Anticipating the replacement parts needs for solid-state transmitters, Dahl sees the challenge presented by today's lower voltage/higher current operations. He says, "In the older design transformers you worry about the high voltage breakdown, keeping the high voltage wires away from the lower voltage wiring or the case itself.

Test bench, with load resistors in the upper right.

"When you are working with low voltage, but a lot of power, you have a big core, so you have a fraction of a turn per volt. That sometimes makes it difficult to get the taps in just the right place for the correct voltage.

"It is also important to design it to handle a lot of heat, and with solid enough connections to handle the current."

Another slightly "different" product that Peter Dahl designs and sells is Austin Ring Type Isolation Transformers for tower lighting applications.



These transformers are wound on a high quality low loss "HIPERSIL" steel toroid core, using a special toroid-winding machine designed and built by the Dahl Company.

INFORMATION AND ASSISTANCE

One of the most common questions that Peter Dahl handles from callers is when the HV breaker has tripped and the caller wants to know how to tell if the problem is in the transformer or is elsewhere. Dahl will take the time to suggest several diagnostic tests, trying to help the caller develop their diagnostic skill as they go.

The company website – www.pwdahl.com – has a wealth of information on transformers as well as the various products the company has produced, and the projects, both civilian and governmental on which they have participated.

An enthusiastic Ham operator, Dahl loves to spend time in his Ham Shack, adjacent to his office. The comfortable room is the perfect place to relax and "get away" from the daily "hassles," and even read his latest **Radio Guide** (yes, it was right there – on the table!). If you catch KØBIT on the air, get ready for a good chat – you are talking with the transformer man, Peter Dahl.

For more information on Peter Dahl transformers, or to get emergency assistance at any time, call the Peter W. Dahl Company at 915-751-2300

Peter Dahl in his Ham Shack, observing some of his favorite QSL's and awards.

Transmission Guide

by Phil Alexander

Measuring AM Power

[INDIANAPOLIS, Indiana - January 2005] Perhaps one of the most important parameters at any radio station is the transmitter power output. After all, without power, who can hear your Program Director's "perfect mix of 20's, 30's and 40's Hits?"

However, even with what appears to be the right amount of RF going to the antenna, you may not be getting all the coverage your license allows. Why not? A quick example: a thermocouple meter can become damaged and read high. A 0.5 Ampere error at the tower base could easily cost 200, 300, or even more watts on a modestly powered station.

On the other hand, if the base meter is known to be accurate, how do you know the antenna resistance stated on your license is correct? And if you have a directional antenna, do you know how to correctly calculate common point current for your station?

An easy mistake could cost your station important coverage or, worse, could put you in violation of the Rules. With that in mind, a discussion of how to measure station power might be beneficial.

DIRECT MEASUREMENT

Direct power measurement is the standard method for AM broadcasting according to 47CFR73.51 except, "When it is not possible or appropriate to use the direct method of power determination due to technical reasons ..." The Rule goes on to say, "the indirect method of determining operating power ... may be used on a temporary basis." We will return to that later.

So, most of the time AM stations use the direct method of measurement. As we shall see, Ohm's Law ($E = IR$) makes the calculation simple – as long as you have accurate data.

IT BEGINS WITH RESISTANCE

Like many of the older AM station Rules, the Rules for direct power measurement are very specific. The first requirement is a valid measurement of tower base impedance, or in the case of a directional array, common point impedance. According to 47CFR73.1225(d)(1), "a copy of the most recent antenna or common-point impedance measurements" must be available for inspection on request. This means the last one done, even if it is decades old.

For some stations, this may be the original tower impedance measurement made decades ago; for others it may be the common point measurement made as recently as the night before. For shunt fed antennas, the same rule applies except the point of measurement is the driving point of the feeder system or slant wire past the point where any other components, such as those that are grounded in any way, are attached.

The key point is a record of the measurement must be *kept on file until a newer one replaces it, regardless of age.* Unless that copy is on file for inspection, using direct power determination by calculation from current and resistance does not comply with the Rules and may lead to a citation and forfeiture.

The object of the measurement is measuring a fixed, non-adjustable resistance value that will be constant excepting changes made by tower work. Do not forget: any tower work that might change the impedance requires an immediate change to indirect power determination and a new impedance measurement.

The complete details of impedance measurements are included in 47CFR73.54 as revised October 1, 2003. The latest revision permits a simpler single frequency measurement rather than the "full bandwidth" curve that was required in the past. It also permits measurement of the impedance presented to the transmitter at its output terminals as a valid point for direct power determination while the old Rules limited this strictly to the tower base, drive point or common point.

However, a word of caution: If IBOC is a part of your future planning, single frequency measurements (or any measurements not made according to the old Rule) may not be fully useful for IBOC conversion. In this case, a full "sweep" or multiple point measurement across and beyond the entire bandwidth of the station may be more useful. Fortunately, when the measuring equipment is set up, a full set of measurements involves very little extra work.

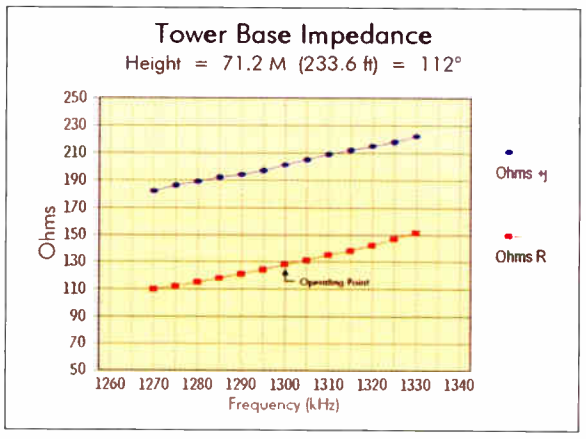
RECORDING THE MEASUREMENTS

The following table shows a set of base impedance measurements for a tower of 112 electrical degrees, spanning 60 kHz at 5 kHz intervals, and centered on the 1300 kHz operating frequency of a mythical station.

Interestingly, at one time 112 degrees was the average of all tower electrical heights in FCC records, thus this height was chosen as the minimum height for all former Class II stations. Towers with characteristics similar to these still remain in service at daytimers first granted on those old Class II channels.

kHz	R	+j
1270	110	182
1275	112	186
1280	115	189
1285	118	192
1290	121	194
1295	124	197
1300	128	201
1305	131	205
1310	135	209
1315	138	212
1320	142	215
1325	147	218
1330	152	222

The charted data is similar to that required in the old Rule (Section 73.54) requiring measurement across 50 kHz at 5 kHz intervals, and an even older standard that used a span of 60 kHz at 10 kHz intervals. The points are plotted on a standard base impedance chart with the operating point in the center.



The Rules about measurements can be confusing because they are not all in a single sub-section of Part 73. For example, one of the most important requirements is tucked into the section which primarily concerns AM antenna systems, 47CFR73.45(c)(1) which says, "Whenever the measurements show that the antenna or common point resistance differs from that shown on the station authorization by more than 2%, FCC Form 302 must be filed with the information and measurement data specified in Sec. 73.54(d)." Thus, a change from 49 ohms to 50 ohms in the resistance requires filing Form 302 while a change from 50 ohms to 49 ohms would not!

DIRECT POWER CALCULATIONS

Direct operating power can be determined either by direct measurement, "using a suitable instrument for determining the antenna's input power directly from the RF voltage, RF current, and phase angle," or by calculation. If direct power is measured by an instrument, a notification letter must be filed with the FCC Audio Division complying with 47CFR73.54(e).

Determining direct power by calculation is simplicity itself. The formula is $P = I^2R$, where the power is measured in watts, the current in amps and the resistance component of the impedance measurement is stated in ohms. The power is the nominal power of the station stated on the station's license. The correct current is found by working the formula backward, using the authorized power and measured resistance as inputs to determine the acceptable range for station operation at the measured operating point.

The power tolerance for AM stations is -10% to +5% of authorized power. A station permitted operation with 5 kW non-DA daytime and 1 kW DA nighttime would have an acceptable power range of 4,500 watts to 5,250 watts days. With a nighttime directional system, another factor enters the picture.

Directional stations are permitted and expected to operate their transmitters at slightly higher powers to make up for phasor and transmission system losses. The Rule at 47CFR73.51 governs this, and states in part: "For stations with nominal powers of 5 kW, or less, the authorized antenna input power to directional antennas shall exceed the nominal power by 8 percent."

It goes on to say, "For stations with nominal powers in excess of 5 kW, the authorized antenna input power to directional antennas shall exceed the nominal power by 5.3 percent." Thus, the nighttime power range for this nominal 1 kW DA system would be 90 to 105% of 1080 watts – or not less than 972 nor more than 1134 watts.

MORE THAN RESISTANCE

Impedance measurements show both resistance, stated as ohms, and reactance, generally stated as a plus or minus "j" value (ie. 200 + j275), or j0 if there is no reactance. Although reactance is measured in ohms, that is seldom stated; the value is used only for correctly matching the tower base, common point or drive point to another component. Reactance has no bearing on the power calculation.

Suppose a daytime tower impedance was measured as 200 ohms +j 275, the phasor used for night operation is adjusted with a common point impedance of 50 ohms j0, and the power formula is rearranged to find power as a function of current, the following operating table can be developed for keeping the station within its licensed power limits. We transform $P = I^2R$ into $I = \sqrt{P/R}$ or $I = (P/R)^{0.5}$

DAYTIME			NIGHTIME		
P	R	I	P	R	I
4500	200	4.743	972	50	4.409
5000	200	5.000	1080	50	4.648
5250	200	5.123	1134	50	4.762

Always multiply the nominal power by the correction factor before using the formula as shown above. That answer gives a current conforming with the Rule for operation between 90% and 105% of authorized power. Because power is a square function of current, simply multiplying the nominal current by 0.90 and 1.05 would result in too low a minimum and too high a maximum – a very common mistake found during station inspections. If the inspector is from the FCC rather than an alternative inspector, it may even mean a fine!

RF AMMETER READING TIP

When monitoring operation, current must be measured without modulation because modulation affects thermocouple RF ammeters. While toroid meters are not affected directly by modulation, if the transmitter is asymmetrically modulated with heavily processed audio – for example constantly between 115 to 125% positive and 90 to 95 or 98% negative – the result is a slight positive carrier shift that will affect a toroid meter.

Thus, if you see the meter of a toroid indicator moving during modulation, it is wise to reduce or mute the program momentarily for reading the RF ammeter just as you would for the thermocouple type. (It is also wise to confirm the station is not exceeding the 125% positive modulation limit set by the FCC's Rules.)

Next time we will cover indirect power measurement.

Phil Alexander operates Broadcast Engineering Services and Technology in Indianapolis, IN, when he is not squeezing out more coverage for stations in the Midwest. You can email Phil at: dynotherm@earthlink.net.

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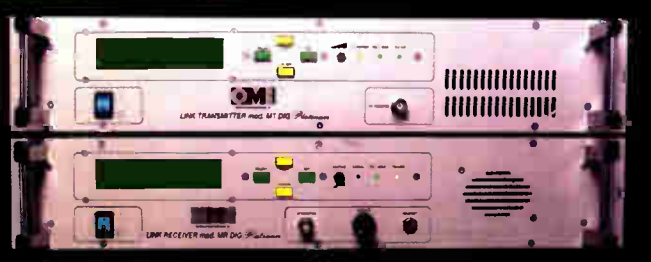

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Leading POTS Codecs Compared.

	Comrex Matrix	Tieline Commander	**Zephyr Xport**
Audio Bandwidth @ 24 kbps	14 kHz	15 kHz	**15 kHz**
@ 19 kbps	11.2 kHz	9 kHz	**15 kHz**
Direct Internet Software Updates	No	No	**Yes, via Ethernet port**
Digital PC Audio Input	No	No	**Yes, via Ethernet port and supplied driver**
Audio Metering (XMIT/RCV)	Transmit only	One-at-a-time	**Simultaneous**
Audio Processing	None	Simple AGC	**Digital multi-band AGC with look-ahead limiter by Omnia**
Remote Control	No	RS-232 and dedicated computer	**Ethernet via Web browser**
Auto Dial Storage	19 Numbers	50 Numbers	**100 Numbers**
Frequently-Used Settings Storage	none	none	**30**
Standards-based POTS Codec	No - Proprietary	No - Proprietary	**Yes - aacPlus (MPEG HEAAC)**
Transmit-Receive Quality Display	No	Yes	**Yes**
Contact Closures	2	2	**3**
Display Resolution	120x32 LCD	120x32 LCD	**128x64 LCD**
Analog Cell Phone Interface	Optional	Standard	**Standard**
Mixer Inputs	1 mic, 1 mic / line	2 mic / line	**1 mic, 1 line**
Phantom Power	No	No	**Yes - 12 volt**
Automatic Voice-Grade Backup	No	No	**Yes**
Power Supply	External	External	**Internal auto-switching**
Local Mix Audio Outputs			
Headphone	Yes	Yes	**Yes**
Line Level	Yes	No	**Yes**
Direct Receive Audio Output	No	Yes	**Yes**
Uses ISDN at the Studio Side for More Reliable Connections	No	No	**Yes - your Zephyr Xstream becomes universal POTS and ISDN codec.**
Available ISDN Option	$850.00 (adds MPEG L3 & G.722)	$850.00 (adds G.722)	**$495.00 (adds G.722 & state-of-the-art AAC-LD for high fidelity and low delay)**
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The routing switcher gets a new twist.

(About five twists per inch, actually.)

Everybody needs to share audio. Sometimes just a few signals — sometimes a few hundred. Across the hall, between floors, now and then across campus. Routing switchers are a convenient way to manage and share your audio, but will your GM really let you buy a router that costs more than his dream car? Unlikely.

If you need a routing switcher but aren't made of money, consider Axia, the Ethernet-based audio network. Yes, Ethernet. Axia is a *true network*. Place our audio adapter nodes next to your sources and destinations, then connect using standard Ethernet switches and Cat-6. Imagine the simplicity and power of Ethernet connecting any studio device to any other, any room to any other, any building to any other... you get the idea.

Routers are OK... but a network is so much more modern. With Axia, your ins and outs are next to the audio, where they belong. No frame, no cards, no sweat.

Scalable, flexible, reliable... pick any three.

An expensive proprietary router isn't practical for smaller facilities. In fact, it doesn't scale all that well for larger ones. Here's where an expandable network really shines. Connect eight Axia 8x8 Audio Nodes using Cat-6 cable and an Ethernet switch, and you've got a 64x64 routing switcher. And you can easily add more I/O whenever and wherever you need it. Build a 128x128 system... or 1024x1024... use a Gigabit fiber backbone and the sky's the limit.

Are you still using PC sound cards?

Even the best sound cards are compromised by PC noise, inconvenient output connectors, poor headroom, and other gremlins. Instead, load the Axia IP-Audio Driver for Windows® on your workstations and connect *directly* to the Axia audio network using their Ethernet ports. Not only will your PC productions sound fantastic, you'll eliminate sound cards and the hardware they usually feed (like router or console input modules). Just think of all the cash you'll save.

Livewire

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There's a better way to get audio out of your PC. No more consumer grade ⅛" connectors — with Axia your digital audio stays clean and pristine.

Put an Axia Microphone Node next to your mics and send preamplified audio anywhere you need it, over Ethernet — with no line loss or signal degradation

Put your preamps where your mics are.

Most mainframe routers have no mic inputs, so you need to buy preamps. With Axia you get ultra-low-noise preamps with Phantom power. Put a node in each studio, right next to the mics, to keep mic cables nice and tight, then send multiple mic channels to the network on a single Cat-6 cable. And did we mention that each Mic Node has eight stereo line outputs for headphones? Nice bonus.

Put your snake on a diet.

Nobody loves cable snakes. Besides soldering a jillion connectors, just try finding the pair you want when there's a change to make. Axia Audio Nodes come in AES/EBU and balanced stereo analog flavors. Put a batch of Nodes on each end of a Cat-6 run, and BAM! a bi-directional multi-channel snake. Use media converters and a fiber link for extra-long runs between studios — or between buildings.

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A networked audio system doesn't just replace a traditional router — it *improves* upon it. Already, companies in our industry are realizing the advantages of tightly integrated systems, and are making new products that reap those benefits. Working with our partners, Axia Audio is bringing new thinking and ideas to audio distribution, machine control, Program Associated Data (PAD), and even wiring convenience.

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"This sounds expensive." Just the opposite, really. Axia saves money by eliminating distribution amps, line selectors, sound cards, patch bays, multi-pair cables, and tons of discrete wiring — not to mention the installation and maintenance time you'll recover. And those are just side benefits: our hardware is about half the cost of those big mainframe routers. That's right... *half*. Once you experience the benefits of networked audio, you will never want to go back. AxiaAudio.com for details.

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Tower Topics

by Leonard Weenou, P.E.

The Truth About Towers

Part 4 – Triggering the Specifications

Having digressed from the discussion of tower design and selection for a math lesson, Leonard Weenou returns to the specifications for building his fantasy tower.

[SEDONA, Arizona - January 2005] We have elected to do a sort of fantasy design tower for illustration purposes, and have now progressed to the point where we have ascertained our principle *loads* and identified the limitations of our *location*.

This leads us to the tower specification: our Mt. Alexander fantasy tower is going to be guyed, triangular and 42 inches in face width.

WELL PROVEN STRUCTURE

Guyed structures similar to our case study have been with us for hundreds of years. The most ordinary appearances in past Western culture were the guyed masts on sailing vessels.

Anyone who has seen the recent motion picture "Master and Commander: The Far Side of the World" can recognize the parallels. The grand British ship, H.M.S. Victory, had a main mast system that topped out 223 feet above deck. Many AM towers do not even reach this height, and they are not mounted on a rolling ship!

Prior to Pierre Eiffel and his contemporaries, there was little attention paid to the mathematical analysis of the structures constructed with a "design by failure" sort of approach. Those who hated failure however annotated what data they had gathered from countless structural calamities culminating in such tomes as "Steele's Elements of Mastmaking, Sailmaking and Rigging," which was a guide for the British Navy, et al, for fabricating rigging and masts systems. The author has given us a great book for those who crave pages of tables.*

HERE COMES THE MATH AGAIN

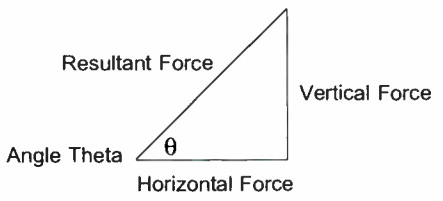
Last time, we made the blanket statement that engineers love trigonometry – possibly more than they love a free lunch on the station. Perhaps your first response is: "No way!" But, just follow along with me for a moment; it is not that bad.

To begin that love affair, here are our basic formulas. These formulas allow us to calculate the forces in each of that mass of triangles that make up the vast majority of towers. If you intend to do much with towers, make these formulas your mantra.

Vector of Force Components:

Vertical Force in Triangle (VF) = F(Sin θ)
Horizontal Force in Triangle (HF) = F(Cos θ)
Force Resultant = Vertical Force/Sin θ
Force Resultant = Horizontal Force/Cos θ

These components can be illustrated this way:



Putting all this to use, here is a stripped down, highly simplified example of the formulas to exercise your calculator. Suppose you have a short little tower that looks like the triangle above in your back yard and the total force away from that lonely, single guyline is 200 pounds. If the angle of the guy line between the ground and the wire is 45°, what force in pounds is being exerted in that guy line from the tower falling away?

Force resultant (the force on the guyline) = Horizontal Force/Cos 45° = 282 pounds

Please do not get upset if you do not get the same answer. First, check your calculator's batteries. Most personal calculators do not have trig lookup tables as you found in the back of your school texts, but rather calculate the trig value via iteration; this is one of the longest and most current demanding calculations performed in that little handheld miracle. If the batteries are adequate, then check the data entry.

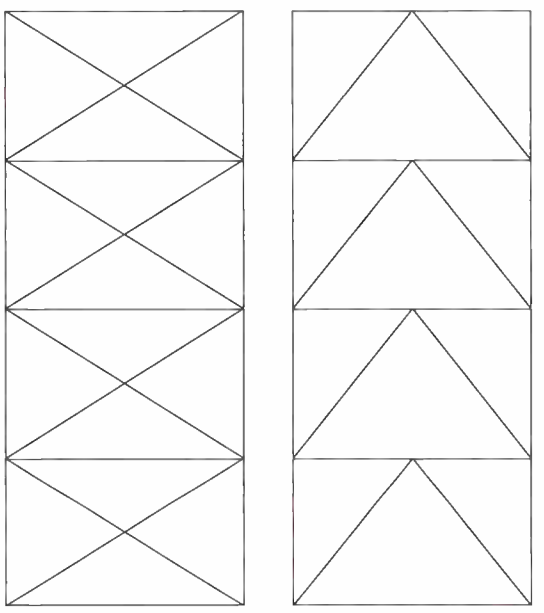
Suppose you move the anchor of that little tower closer to the base making a more oblique angle. Try 60°. Interesting is it not? Now try the anchor further out, creating something like a 30° angle.

Now you see why tower designers prefer long guys over bowstring guys where the angle nears 60° or more.

FINAL SPECIFICATIONS

Taking this back to the WQRM-FM tower, we are closer to making some critical final selections to get our tower eventually ordered and built. Remember, the design comes together from recognition of the tower *loads* and *location*. We are also ready to issue the purchase order for the antenna, since the antenna has the longest delivery time.

Our preferred tower vendor has two standard 42-inch face width tower member patterns, a "K" brace and an "X" brace.



Typical "X" Brace Face Pattern | **Typical "K" Brace Face pattern**

The MFFMAC (Mighty Fine FM Antenna Company) will start to do model range testing of our antenna on an accurate scale model of both the "K" and "X" braced version of the 42-inch face towers. A 4 to 1 reduction is the norm, so the folks on the range are testing at 435.2 MHz for WQRM's 108.8 MHz operating frequency on toy-like 10.5-inch tower faces instead of a full size 42-inch tower. A 10-inch face is a whole lot easier to pick up and move around, compared to a 42-inch unit!

Once this testing is complete, they will then be able to answer three questions for us.

IMPORTANT QUESTIONS AND ANSWERS

The first question is: can we use a standard tower section around the main antenna? The issue here is to minimize the influence on the antenna pattern from the tower itself. The goal is to achieve the smoothest, most circular pattern practically possible.

The second question is: (and can only be answered after the general section selection – or design – is determined), what is the optimal if not ideal antenna positioning? This includes details for the antenna elevation on the face, angle address of the antenna to the tower, mounting position point on the face (leg, face center, face offside, element in open space, element in front of a horizontal member, etc.) and standoff distance.

When considering the mounting of the antenna, the FCC allows plus or minus 2 meters of elevation from the construction permit value (Center of Radiation, or COR) to fool around with and achieve the best antenna performance. So why not use it?

An intrepid climbing rigger boldly ventures into a "mass of triangles."

The third important issue is: what is the minimum distance the STL antenna can be mounted above the main FM antenna to reduce or eliminate interaction?

In fairly short order MFFMAC informs us that they have found a "sweet spot" on the standard "K" brace section without cable ladder that produces minimal nulls and a handsome full and smooth sweep of signal towards Utopia, our city of license. The COR elevation will be 418 feet AGL (Above Ground Level) with a slight offset from the legs. They also tell us that positioning the STL in line with the main, 3-feet above the stub end, will result in minimal interaction.

From everything we have learned so far, we have good news all around. Our tower can be made out of mainly standard "K" sections to a total height of 449 feet AGL, which was on our first Notice of No Hazard (FAA height approval). This would be 443 feet of steel and 6 feet of lighting. We will not have to ask for a height increase.

KEEPING THE TOWER UP

As we have repeatedly mentioned, the forces impressed on a tower are: the wind, ice, its natural tendency to fall over and its own weight. Also as noted, in essence, both guyed and unguyed towers create the strength resistance to these forces by using triangles incorporating the proper materials. These same four forces are also exerted on the antennas and their mounts.

Mounts for antennas and other appurtenances such as ladders and beacon supports are not usually viewed as being very sophisticated in design requirement. But let me tell you, *they are*.

The original design engineer is normally responsible for the antennas and mounts of the original buildout. After that, it is sort of "open season" on the tower and quite often all sorts of bailing wire, duct tape, super glue, coat hangers, etc. wind up as part of any follow up mounts.

All kinds of people get involved in what is installed next: the hardware store guy, the newbie climber, the local welder, and the guy who sells you your antennas, but has never seen your tower – does not know where it is – but assures you emphatically that "this is the way it has always been done."

My observation of the aftermath of the last few decades of "big blows" in Florida and elsewhere is that it is more than ordinary to see a tower that has survived, and many of the antennas have failed. Or vice-versa, the tower should have survived but poor mounting and tower antenna housekeeping brought it down.

If you want to protect your tower investment, have a competent structural review and mount design made for every attachment.

** For those who enjoy technical history, may I heartily recommend the book, "Structures: Or why things do not fall down" by J. E. Gordon. His superb monograph proves that, unlike this series, prose about engineering and science topics can be very interesting.*

A legendary consulting engineer, Leonard Weenou has overseen many tower projects. So far as we can tell, his trig formulas have not caused anyone to actually faint. Contact him at: editor@radio-guide.com

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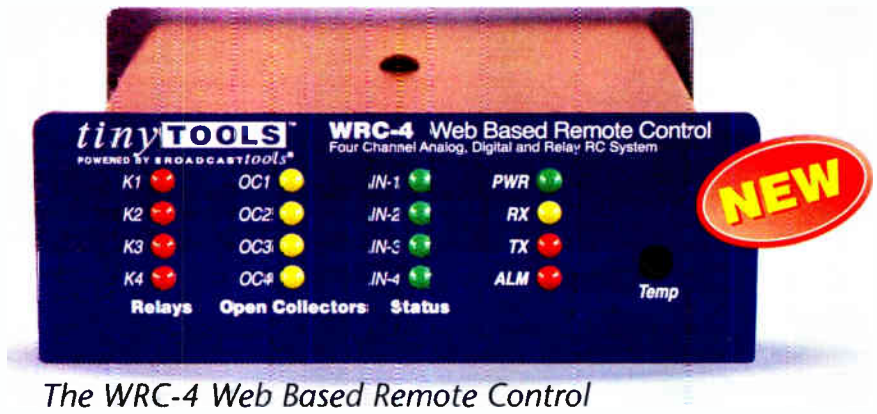

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Tiny TOOL products are manufactured with the same quality and innovation as all our Broadcast Tools® products. All amplified products are powered by a surge protected internal bi-polar 15vdc power supply, affording superior HEADROOM! and high definition audio. Each tiny TOOL is a compact one-quarter-rack space unit, allowing the mounting of up to four units on the optional RA-1 rack shelf. Most products are furnished with plug-in euroblock connectors.

The **WRC-4** is a fresh approach to site monitoring and control, or providing an inexpensive solution to Internet enabling your present remote control system.

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TT-1 – Telco Tool.
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DTE-16 – DTMF Tone Encoder with program mixer. Encodes all 16 DTMF tones or macros with control via contact closures and/or RS-232 serial strings.

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RDDA 4x4

The Broadcast Tools RDDA 4x4 is a routable four input, sixteen-output digital audio distribution unit capable of distributing the same format AES and/or Word Clock around your facility. Each input may be configured to feed any one or all of the four groups of outputs. Each group consists of four transformer-balanced outputs. Inputs, outputs and status are supplied on removable Euro block connectors. Input signal presence is monitored and displayed on four front panel led's with remote control status provided on the rear panel. The RDDA 4x4 is powered by a surge protected internal power supply. The half rack profile, allows the unit to be set on a desktop, mounted on a wall or as part of the new RA-1, "Rack-Able" mounting shelf.

Additional features:

- Four transformer balanced loop-thru inputs with selectable termination
- Sixteen transformer balanced outputs with selectable termination
- Accepts sample rates from 8 to 96 kHz
- I/O selection via DIP switches
- Power and Status indicators
- Open Collector Status outputs

HPA-4

The Broadcast Tools HPA-4 with cue powers up to four sets of headphones. Each output is supplied with a hefty stereo amplifier and may be configured to accept cue audio on the left headphone with a simple contact closure to ground. Front and rear panel T/R/S jacks are provided with each output, along with a front panel level control. The stereo balanced input is adjustable with the front panel master level control. The balanced cue input is equipped with a rear panel trimmer. The HPA-4 is powered by a surge protected internal bi-polar 15vdc power supply affording superior headroom and high definition audio. The half rack profile, allows the unit to be set on a desktop, mounted on a wall or as part of the new RA-1, "Rack-Able" mounting shelf.

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Studio Guide

by Mark Shander

Streaming on a Budget

[PHOENIX, Arizona - January 2005] Enhancing your coverage area by streaming audio (and optionally adding video) is one of the easiest things you can do to help reach a much wider audience, and help grow your audience.

In 1995, I streamed my Phoenix talk radio program live over the Internet as it was broadcast live on an AM station. The recorded program was archived and syndicated to a dozen popular Web sites. As a result, I was able to document an average of between 50-55,000 listeners per week.

GOOD NEWS, BAD NEWS, GOOD NEWS

With that audience, I sold out my commercial inventory close to rate card. That is the good news. The bad news is that if I did not have an ISP as a sponsor, it would have been virtually impossible to justify the bandwidth costs associated with that volume of Internet listeners. Advertising would not have covered the costs.

Times have changed. In most major areas, T-1 lines are no longer $1,500 a month, with $2,000 up-front for hardware and installation. Now we worry about local loop (last mile) charges, then costs from an Internet Service Provider to light it up.

Regardless of your local Internet access costs (including burstable plans), adequate bandwidth to stream your signal without turning potential listeners away is still very expensive to buy. Besides ensuring enough streams are available to handle peak loads, there are hardware requirements and maintenance issue, as well as a lot of planning, speculating and projecting.

The good news is that technology has changed, and so has the cost of delivering media content to end-consumers.

CONTENT DELIVERY NETWORKS

There are two excellent ways to contain the costs of streaming stations over the Internet: content delivery networks (CDN), or something very new: a peer-to-peer network specifically designed to share media broadcasts.

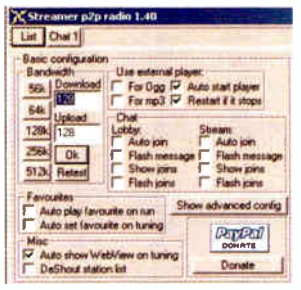
There are a few well-known media CDN services available. One is Speedera, at www.speedera.com; another is Akamai at www.akamai.com. The CDN network I am currently using for streaming a non-profit station across the world is Limelight, at www.limelightnetworks.com. Bob Brown is my rep there.

Like the other CDN providers, the Limelight network is cost-effective and scaleable. You send a stream to the CDN provider, and listeners link to their network via a URL that you post. That removes the issue of handling hundreds of listeners one day, then tens of thousands the next. Imagine having to ramp-up for an event, on a day's notice, while handling your bandwidth needs internally.

Content delivery networks also have the advantage of points of presence and caching. Every router a packet passes through between one place and another on the Internet is called a hop. The CDNs help provide content with a minimum number of hops between you and listeners, even if the listeners are thousands of miles away from your station, ensuring a faster and potentially more reliable connection.

PEER TO PEER

If you are adventurous, another way to control the costs of streaming your station is to use peer-to-peer bandwidth-sharing technology to your advantage. A new kind of sharing, where audio and video streams are sent through the network as opposed to MP3s and movies, is becoming very popular.



Streamer P2P Radio is at www.streamerp2p.com. A custom client can be made available, so only your station(s) appear in a listing. It is your own peer-to-peer network helping to share the costs of streaming your station. If someone requests up to a 128K feed, they are expected to provide up to 128K back up to help share your stations programming.

One caveat regarding peer-to-peer streaming: such a radio network may potentially expose listeners to some of the same Internet security challenges and requirements as peer-to-peer file sharing. While it is true that each listener directly connects to the computers of other listeners for peer-to-peer radio streaming, that is exactly what happens when a listener connects directly to the Internet.

For example, once computers in a particular network can be identified, they can potentially be targeted for malice. Thus it is always best to use firewalls and proxy servers.

Streaming costs are something that can get out of hand very quickly. If containing these costs is important to you, CDNs and peer-to-peer sharing may be a viable solution.

Mark Shander has been in broadcasting and "new media" for 32 years - an interesting feat for a 40-year-old guy. His current projects are on view at www.shander.com

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Pioneer Profiles

by Frank Absher

Thomas Convey

St. Louis Promoter and Radio Pioneer

The stories of the men and women who built the early radio stations are fascinating. It took a lot to put a station on the air, and to keep it going. Building a legend, well, that took a special sort of person.

[ST. LOUIS, Missouri - January 2005] Thomas Patrick Convey could not possibly have known it at the time, but when he moved to St. Louis, he began a short, but dramatic career that would make the Convey name famous in St. Louis radio for decades. The road, however, was often a rocky one.

Legend has it that Convey, a Chicago promoter, traveled to St. Louis to stage a radio exposition, bringing together radio manufacturers from around the country to show their wares. He later told a reporter he was so taken by the public reaction to the expo that he uprooted his family and relocated. He then set out to find a job in St. Louis radio.

ROCKY BEGINNING

Convey was instrumental in organizing a group of St. Louis' biggest business names as investors in a "super radio station." KMOX, under the ownership of their partnership, signed on in December of 1925 with Convey as the manager. By August of the following year, there was a falling out, and Convey was let go – broke at the age of 40.

But Convey was a born promoter who had caught the radio bug. Pawning a watch and a diamond ring given to him by radio manufacturers appreciative for the successful expo, Convey rounded up $500 and bought a station that had been dark for several months. This set in motion a phoenix-like radio career, eventually even bringing his connection with KMOX full circle several years later.

KFVE was based in suburban University City. Convey was quoted in the *St. Louis Post-Dispatch* later as saying, "I started a broadcasting station literally without a dime." New calls – KWK – were eventually assigned, and the studios were moved to a prestigious location: the ninth floor of St. Louis' luxurious Chase Hotel, on March 17, 1927 – a place it would call home for 22 years. At this point KWK truly became the Convey Radio Station.

A REAL MOM & POP STATION

In addition to the adoption of his air persona "Thomas Patrick," Convey enlisted the other members of his family to do on-air chores. Son Robert became "Bob Thomas," daughter Charlotte became ukulele player "Juanita," and wife Grace also took an occasional turn at the microphone under the air name "Peggy Austin." She was listed as the station's program director.

Several times, Convey demonstrated the ability to get his way with the Federal Radio Commission. When the FRC juggled frequency assignments and forced St. Louis' WIL and KWK onto the same frequency, Convey made frequent on-air pleas for help from his listeners.

The *Washington Post* reported 1,900 St. Louisans donated a total of $3,000 to send a forty-person delegation to Washington to protest to the Commission. Signs were posted in yards all over St. Louis: "Hands off KWK." It worked. Within three weeks, WIL was assigned a different frequency so the two stations no longer had to alternate broadcast days.

To celebrate KWK's first anniversary the station leased the Odeon Theater on March 17, 1928 for a special stage show. A year later, in celebration of the station's second anniversary, a huge production was staged at the city's largest building, the Coliseum. The program featured 36 acts, 24 of which were performed by the station's entertainment staff. A reported 18,000 people attended.

In 1929, Convey ran an ad for KWK in the city's Chamber of Commerce newsletter in which he extended a unique invitation: "You are invited to visit our studios and offices on the ninth floor of the Hotel Chase, where every facility has been provided for the expert handling of radio programs. Our staff of twenty-one people is especially trained in radio broadcasting." The station had come a long way from the early days when the staff consisted almost entirely of Convey family members.

FEISTY COMPETITOR IN THE MARKET

Never one to take a back seat to the competition, Convey decided to provide his listeners with live coverage of a major aviation story in spite of the fact that his former employer (KMOX) had negotiated exclusive broadcasting rights. Things got tense on the scene of the event at St. Louis' Lambert Aviation Field, and as the arguing heated up, a KMOX engineer cut KWK's microphone wires during the broadcast.

The resulting lawsuits were settled out of court, with KWK getting shared broadcast rights to the next year's St. Louis baseball games.

In another 1929 confrontation, with a station employee who was moonlighting at a nightclub, Convey ended up in front of a police magistrate. Prohibition was still a way of life, and when asked in court if he had been drinking the night of the incident, Convey replied: "Well, I wouldn't consider it drinking. I had a bad cold and was taking spiritus frumenti prescribed by my doctor. I think it was in a pint bottle, but I don't know because I'm not used to carrying bottles."

Thomas P. Convey, station owner and master promoter. (c. 1930)

Convey made the most of his baseball broadcast rights, encouraging the ladies in the audience to come to the ballpark and enjoy the special Ladies' Day promotion. An example: in the era immediately following the stock market crash, women were admitted to the ballpark for a 25-cent service charge.

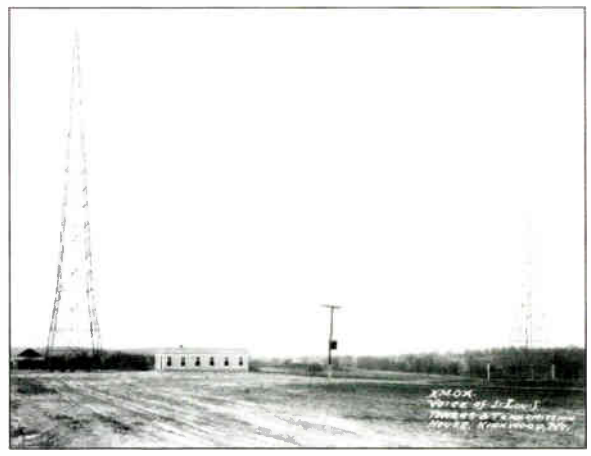
A few years later the Cardinals banned radio broadcasts in the belief they were hurting attendance, so Convey sat atop the North Side YMCA across the street from Sportsman's Park and, with the help of a good pair of binoculars, related what was happening to the home team.

The experienced promoter continued to take advantage of opportunities to pump his station. In January of 1930, a scant three months after the stock market crash, Convey announced the addition of 10,000 square feet of studio and office space, along with "a complete line of new furniture ... in keeping with the futuristic decorations which have been included in the improvements."

TECHNICAL IMPROVEMENTS

Convey was also working diligently at improving KWK's signal strength, tweaking the FRC with on-the-air diatribes at every opportunity: "With each application for an extension of the license – you know the law requires this be done every three months – we make the request that station KWK be granted increased power. So far our pleas have been unheeded, but if we are given permission one of these days we will ... give St. Louis the best we can possibly give in high-grade radio features."

The *St. Louis Star* reported Convey sent petitions to the Federal Radio Commission containing over 96,000 signatures in support of the power increase. Those major expansion plans were finally announced in November of 1930 when KWK arranged to take over the original KMOX transmitter site in suburban Kirkwood.



KWK purchased the old KMOX transmission site, complete with horizontal antenna.

They also bought a 5,000 watt transmitter, Convey stating the entire acquisition exceeded $100,000 in value (although only $30,000 actually changed hands). It was a purchase signaling a step toward the good life Convey had envisioned for his family, but it also contributed to his early demise.

A STAFF PARK

The suburban transmitter site gave the Conveys a new home in a relatively rural area. Ever the promoter, Thomas Patrick Convey announced in 1931 that he was converting the grounds around the towers and his home into a country club for his station's employees. But that was not all – the *St. Louis Globe-Democrat* reported: "Two large, modern soundproof broadcasting studios will be constructed on the present site of the broadcasting plant of station KWK.

"According to Convey, the new studios are being erected to accommodate the artists at times when the weather conditions are such that cooling breezes would be particularly desirable and to provide fresh air to all who wish to ride out to the Kirkwood plant ... [he] contemplates improving the four-acre tract, to be turned over to the employees of KWK as a recreational center ... with a swimming pool, regulation tennis courts and a summer playground for the children of the employees."

Late one Sunday night in May of 1934, Thomas Patrick Convey suffered a burst appendix while at his home on the KWK Country Club grounds. Unfortunately, the residence was so far removed from the closest hospital that he was mortally ill by the time a doctor was able to begin care.

Convey died five days later at Dr. L. B. Tiernon's hospital in suburban Pine Lawn after peritonitis set in. He was just 49 years old. In the obituary that ran in the *Post-Dispatch*, Thomas Patrick Convey was described as "a human dynamo of energy, impulsive, tenacious when he was sure he was right and uncompromising in a fight."

His son Robert T. (Bob) Convey immediately took over the job of managing KWK. Only 21 at the time, he continued as the manager, expanding KWK into a large operation employing 75 people, until the family sold the station for over $1 million in 1958.

Although his radio career only lasted about ten years, Thomas Convey made his mark on St. Louis. The stations he set up are still there: KMOX is a Midwest "powerhouse," now owned by Infinity. KWK went through some major crises over its life; it went dark twice, had its license revoked once, and was rescued from bankruptcy by Doubleday Broadcasting. Today, the station continues to exist as KSLG, 5,000 watts at 1380 kHz.

Few St. Louis radio listeners today have ever heard of Thomas Patrick Convey, but it was his enterprising spirit that left a legacy of a station deeply committed to St. Louis, speaking to and with the community it served.

Convey photo courtesy of St. Louis Media Archives at St. Louis Public Library. Tower photo used with permission of KMOX.

Frank Absher is a broadcast journalist and historian based St. Louis. He can be contacted at fabsher@stlradio.com

Survival Guide

by Rich Wood

How Not to Get Eaten Alive in Radio's Food Chain

Pumping Iron Butterfly and Other Clashes

[SPRINGFIELD, Massachusetts - January 2005] Sometimes a pun is just too tempting to resist. That is my story, and sticking with it provides the basis for this article – there really is relevance. (However, I do offer a very insincere apology to Governor Schwarzenegger and the artists mentioned.)

AUDIO CLASH

Program Directors and Chief Engineers clash over many things, but audio processing appears on every Top Ten list. My philosophy is that the PD is the driving force in the sound or "stationality" of any station. By that I mean the overall impression made on a listener identifying one station over another – encompassing everything from the music to production elements to how the audio jumps out of the radio.

Most Program Directors are hired because of some previous ratings track record. The fact that such successes may not be repeatable in a new market is fodder for another article, but the bottom line is: his career is most directly on the line if the station fails.

Program Directors and Chief Engineers are from different planets. The PD wants loud. The CE wants clean. The beauty of Saturn's rings (clean sound) clashes with the far out, airless, processing of Jupiter.

Their jobs are vastly different. The PD's job cannot be entirely quantified; the only equations that apply come from Arbitron and even they come with disclaimers. On the other hand, the CE has a toy box full of instruments to tell him (or her) exactly what is happening. Ohm's law is cast in stone until you deal with it on a subatomic level much too deep for radio.

PEOPLE CLASH

Both departments are steeped in pride. The problems begin there. When the PD comes to the CE and wants those clipping diodes to do more work, the CE either clutches his chest in horror or pounds it like a dominant animal being threatened by another male with his eye on all the females. And the butting of heads begins.

The PD is convinced the station sounds wimpy and listeners will tune past it because it sounds "too soft" – not loud enough, not "punchy" enough. The CE is proud of his audio chain with that "ting, ting, ting" audio bandwidth – a term recently coined on the Internet by a prominent processing expert.

Since the systems are relatively fixed (more than 100% negative modulation of AM is a problem, and the pre-emphasis curve on FM causes some serious trade-offs), we have to use processing workarounds to get whatever sound the PD can squeeze through the CE. Been there. Done that. There were engineers who cooperated and were perfectly willing to let me take the blame. After all, the PD told them to do it. Or, perhaps my preference for gentler processing (and the resulting higher fidelity) based on several audio studies measuring Time Spent Listening more closely matched the CE's preference.

I also have had engineers who absolutely refused any input (invasion of their turf) by me, but also refused any accountability if the ratings went down. In one case, the CE wanted to pump the daylights out of the signal. He had enough corporate clout to get the GM – who knew nothing about audio and could not hear a passing subway train if it ran over him – to give him free reign.

CLASHLESS SOCIETY

Although many PDs complain about engineers erecting barriers to their concept of the desired station's sound, my luck has been almost astoundingly good. I have great respect for Engineering, and – as someone who almost became an engineer – *I love the toys.*

I have helped build studios and speak tech-talk pretty fluently. Even though Tom Ray and I disagree about IBOC on WOR, we worked as a team and brought the station and the WOR Radio Network decades ahead of where it would be if we had fought. Our network affiliates consistently commented on how good we sounded.

Jim Huste (the CE before Tom) and I converted the news department from carts to minidisks. No more cassettes went out with reporters. The quality improved and, in mono, there was plenty of space on the disc to archive important events. As a Talk AM, our options were limited (no pun intended) by the typical need to pump as much power over Manhattan as possible.

At WJIB(FM), in Boston, CE Jim Howard followed the programming department's requests nearly to the letter. The station sounded great, and the ratings had us #1 after WBZ's morning drive. Together we were able to take credit for success of one of the industry's most successful FM pioneers.

CHRISTMAS CLASH

I did have one engineer straight out of Dr. Seuss. Just before Christmas he replaced the heads on our cart machines. Like a contractor with a new bulldozer who is afraid of chipping the paint, he threw out all my Christmas music because the tape formulation was too abrasive. CDs were just becoming popular and the material had not been remastered. It was nearly all out of print. It was an ugly sounding Christmas with Madonna as the core artist.

A suggestion: never do that. The cost to the station in ratings – especially now when Christmas music begins around July and we have All-Christmas formats – was far more than a new set of heads.

A reasonable level of cooperation always works wonders.

Rich Wood has programmed stations and networks for over four decades, and now operates Rich Wood Multimedia, a programming/production consulting company in Western MA. Contact Rich at: richwood@pobox.com

The Worst I've Ever Seen

A periodic display of curious solutions for technical problems.

[January 2005] Weepholes are little holes at the bottom of tower sections, designed to prevent accumulation of moisture inside the tower members.

On the other hand, the usual way to keep moisture out of coaxial cables is to ensure the seals are good, and use nitrogen or a dehydrator to pressurize the line.

Most FM stations control and regularly monitor the pressure in the coax as a way to prevent arc-overs or other potentially disastrous problems.

Notice the duct tape "latch" for the weephole.

However, this Missouri station apparently got their methods slightly crossed, and installed a weephole on the transmission coax!

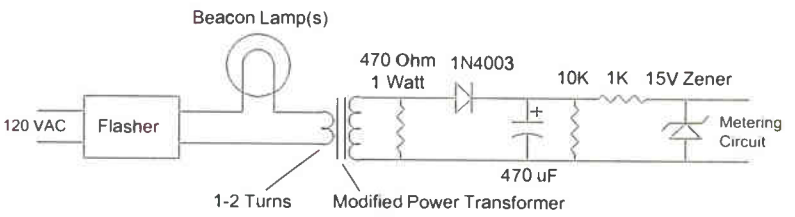
We want to thank Charles Dozier, Director of Engineering for Legend Communications of WY, for sharing these pictures. Charlie assures us "when we purchased the station, we immediately installed brand new transmission lines and a new antenna. Then, then just for grins, we installed a dehydrator. We also "upgraded" our engineer; I think [the former one]'s flipping burgers now."

Do you have a picture demonstrating genius in engineering – or something that wouldn't quite measure up to the "Rube Goldberg" standards? Please – send it on to us, so we can share the good, and the not so good! Email to Editor@radio-guide.com

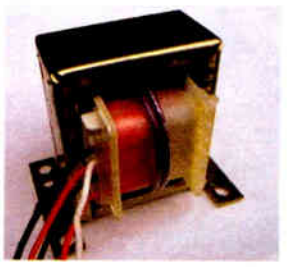
Tips From the Field

Tower Beacon Monitor Circuit

From David Forsman



Note: If a given load current produces more than 12 VDC of output, use only a one-turn winding. If the output voltage is in excess of 12 VDC, then replace the 470 ohm resistor with one of a lesser value – say 270 ohms @ 1 watt. The 15 volt zener diode prevents surges from reaching the metering circuit.



Modified transformer.

[Lewiston, Idaho - January 2005] Starting with a small 120 VAC power transformer (perhaps 40-50 VA), first remove the low-voltage secondary winding(s). This is possible only where the secondary winding(s) are wound on the outside of the 120 VAC primary winding. Then replace the secondary winding(s) with a one- or two-turn winding of #10 gauge copper wire. Finally complete the above circuit, and test the DC output voltage with a 1 kW electric heater connected in place of the lamp(s).

In the power transformer that I used, I calculated that it had about a 700-turn primary winding. With two turns of copper wire in place of the old secondary winding, and connected to a 1 kW electric heater drawing 8 Amps, it produced about 12 VDC of output into a 10 megohm meter. Different transformers will produce different output voltages. Radio Guide asks you to please be very careful with this device, as you are working with lethal voltages.

The author assumes no liability for the use or misuse of this device. Dave Forsman is Chief Engineer for KOZE and KATW in Lewiston, Idaho. You can contact Dave at: shampoo@syringa.net

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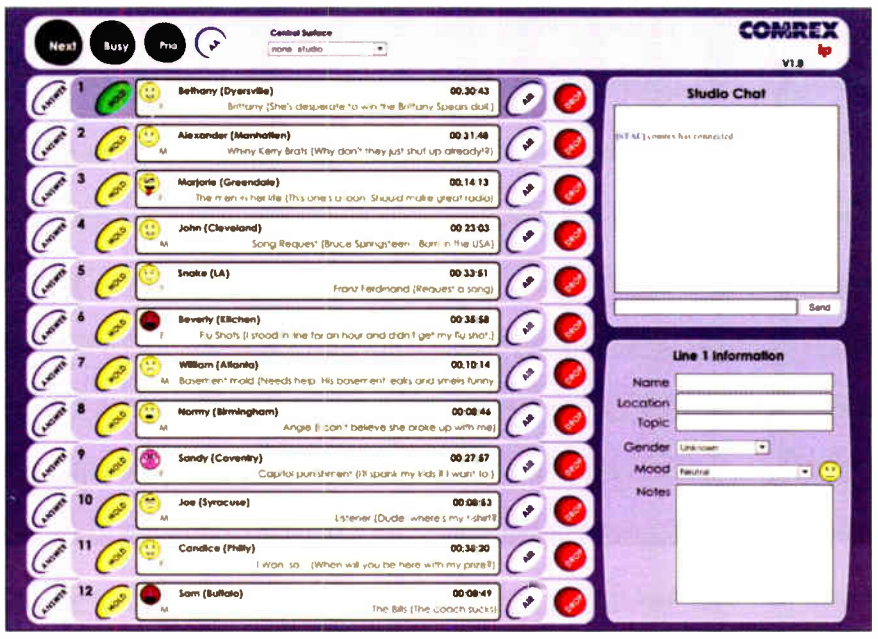
The STAC system is available in six (STAC 6) and twelve (STAC 12) line versions Connect up to four control surfaces using standard CAT5 cable — no custom cabling required. Best of all, STAC is incredibly easy to use — anyone can master it in seconds.



Use STAC any place there's a web browser!

If you have a computer, you've already got all the hardware and software you need. Just log onto the internet using a standard web browser — NO SPECIAL SOFTWARE TO INSTALL — go to your STAC IP address, and you are there! STAC 'EM from home, the studio or that great beach in Cancun!

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COMREX

IT Guide

by Tren Barnett

Effective and Safe E-mail Communication

The Internet, e-mail, Wi-Fi, and VoIP have all changed the communications landscape. Using them effectively (and safely) takes, as with many things, good planning and good operating practices by your staff.

[TUCSON, Arizona - January 2005] As has been pointed out many times, technology is constantly changing. The same is true in the world of communication.

For example, cell phones are quickly replacing fixed landlines; the traditional telephones plugged into the wall are increasingly being supplanted by wireless connections. To take this a step further, Voice over IP (VoIP) is allowing multi-sited companies to communicate across the world without a long-distance carrier. Worried that the Internet will eventually mean the demise of long-distances carriers, the telecommunications companies are lobbying strenuously to get legislation passed to control wireless Internet access, e-mail, and instant messaging.

Communication now happens in ways never before expected. My daughter regularly communicates with a friend half way around the world. Twenty years ago, either the un-reliability of snail mail or long distance charges would have precluded much of their chit-chat conversation, the type that is important to true friendships.

That does not mean that communications occur without undue concerns. Viruses and many forms of privacy invasion inflict the common usages of e-mail and wireless telephony. In many ways a wired telephone line still provides the highest security. Spam is so rampant that many people change their e-mail addresses regularly.

One might well ask: How reliable and worthwhile is e-mail? To answer these questions we will look at e-mail from several different aspects: common courtesy, basic instincts, good practices, and what to worry over.

COURTESY MAKES A DIFFERENCE

As mentioned, e-mail has led to a world where communication is relatively free and easy. Free wireless Internet access as proposed by many cities today would only increase this. Yet e-mail without rules will without fail cause its own collapse as a reliable form of communication.

To begin with, I realize that not every Doug Jones out there can have an e-mail address like djones@isp.com, or dougj@isp.com. But when we create duddlydougy@isp.com, sparks42@isp.com or dj@isp.com as our address, we ought to at least take the time to set up the account so that those receiving our message can still get a recognizable name when we send a message.

This is an important step in e-mail courtesy; it is the same courtesy you provide when you call someone. If you block your number from caller ID, then you should realize many people will ignore your call, as they will not recognize you. Similarly, the following address will be more likely to stand out in a sea of spam: From: "Doug Jones" <dj@isp.com>

COMMON ABUSE

There are reasons for concern over how e-mail is used. Employees who abuse e-mail at work can only expect that sooner or later e-mail privileges will disappear for them. Common sense would cause most to realize that if it is inappropriate for an employee to be on the phone all day talking with friends, constantly typing personal e-mail or using instant messaging would also be frowned upon.

Recently I received an electronic chain letter. Yes, I greatly care that many people were lost on 9/11, but that does not mean I want a chain letter about it. This e-mail has supposedly been in constant circulation since the event, and I "must not allow the memory of these individuals to die," therefore I am supposed to forward it on to twenty people that I know.

Come on! That is obnoxious. First, it is rude to obligate a friend to do anything; secondly, it is inconsiderate to insist I force the same burden on my friends.

With chain letters, spam, and urban legends, those who send such messages are effectively contributing to ruining communication for the rest of the intelligent world. This can already be seen, as many large companies are limiting Internet communications – some no longer even responding to e-mail. Courtesy matters!

BASIC INSTINCTS

Basic instincts follow e-mail courtesy relatively closely. Do not just forward e-mail indiscriminately. If a message contains an attachment, scan it for a virus before opening it. If a message contains a link and you just *have* to see the content, open the link by typing it directly into a browser.

The reason for this is that many messages contain hooks, hooks that work to your disadvantage. Be they verbal, HTML links, or attachments, hooks are dangerous. Hooks fall into many categories. Consider these common hooks...

1. Dear Sir, I am writing you as a friend of the family. Apparently unbeknownst to you, you are the sole heir to a fortune that ...

2. Click here to see:

- **a.** Something funny.
- **b.** Your horoscope.
- **c.** Free stock alerts.

Whether or not these hooks come from a known e-mail address or not, they can be dangerous. If a message has a known e-mail address it does not mean that individual really sent it. So if a message looks strange, bear in mind that it very well *could be* strange. Basic instincts save headaches.

Basic instincts should throw up a flag when a message arrives from any of the free e-mail services. Why? Because most free e-mail services have been exploited widely and abused by senders seeking anonymity. The anonymity they provide, along with ease of opening many accounts, means risk for us.

Some foolish IT departments over-react and block everything. Their motto: "The only thing wrong with e-mail is the users. If there were no users, we would have no problems." Unfortunately, some of them are not kidding!

GOOD E-MAIL PRACTICES

Good practices complement common courtesy and basic instincts. Since there are many tools that provide POP (Point of Presence) or IMAP (Internet Mail Application Protocol) to get e-mail messages off of a server, obviously the tool we use makes a difference. But the important point is not about which tool to use, but what good practices we want the tool to support.

Junk e-mail filters can be useful. Many mail clients support junk e-mail filtering, but all too often such clients can make a mistake and filter out something you want. A case in point: recently Microsoft Outlook automatically filtered out as junk some family pictures that my brother sent to me from a hotmail account. So while these filters are useful, they likewise are not always trustworthy. Good practice dictates using junk e-mail filters, but also perusing the messages before tossing them. Nevertheless, be warned: viewing a junk message can be the same as requesting more junk e-mail.

It is also important *how* you send a message. Perhaps you have received an e-mail with a hundred names on the "To:" line – spammers love them. "Bcc:" fields were created for two reasons: 1) to keep addresses confidential, and 2) to avoid having to read six pages of addresses just to see the cartoon at the bottom of the page. Normally, you should use "Cc:" when sending to others within the company, and "Bcc:" outside the company.

HTML WARNING

When getting e-mail from an unknown source, or when looking at filtered messages, I recommend disabling HTML formatted messages from loading. I personally do not open messages in HTML format without having requested them. (I am not saying best practices preclude this format, but instead use basic instincts before opening them.) This therefore means that a good e-mail client would be able to support such a format, but also allow for this format to not be viewed unless specifically requested to do so.

Each member of the staff should clearly understand *why* they should be very careful: one mistake could compromise computers all over the facility. The many cases of virus attacks validate this concern.

Most all communication can occur with simple plain text. The rest is just fluff. If, for some reason, more than plain text is needed, include additional data as an attachment, and explain what you sent, with the reason why they are included. Common courtesy dictates any attachment sent be of reasonable size; not everyone has unlimited bandwidth – many still use dial-up connections. How happy will they be with that 5 MB funny cartoon you were thinking of forwarding?

A good e-mail client will not control whether or not I can receive attachments, or what types of attachments I have, but will *allow me to decide* what types of files, if any, I will accept. I do not like my e-mail client denying me a document file that may contain macros, instead I should be able to put best practices to work and know if I want to open such attachments.

Compressed files or a standard graphics format are best used as an attachment. Compressed files can allow any data type to be sent to another recipient without serious implications. They can be scanned prior to opening and they obviously can decrease the size of attachment being sent. If sending a compressed attachment, common courtesy would dictate that the message would explain what the attachment contains.

Furthermore, basic instincts would preclude us from opening an attachment in any format that was not expected. A good e-mail client will allow the user to identify an attachment prior to reviewing the message.

COMMUNICATIONS WORRIES

Sadly, the various abuses of e-mail may soon make it a very neutered means of communication. Spam has caused many companies and ISP's to subscribe to services that clean our in-boxes prior to our ever seeing what was actually sent. Unfortunately, this makes it possible for your e-mail address to be added – without notice – to a spam senders list, and your friends may never know that you sent a message.

As to incoming e-mail, some corporate IT folks (those that hate users) have determined the best way to prevent problems is to prevent e-mail. They may set the system to strip any e-mail or attachment that it thinks has a virus or .exe, or even .zip file. One company IT fiend even instituted a "white list," deleting all incoming e-mail that was not on the list, *without telling anyone*. Hundreds of employees never even knew their e-mail from outside was being killed.

What is a user to do? There are webmail clients, that allow a user to bypass the company mail system. But most webmail servers are entirely insecure. If the webclient does not use a https connection, then all data sent back and forth is not secure. This includes username, password, and message content. Consequently, some IT folks now routinely block access to webmail clients.

By the way, many people forget e-mail messages are not private; they are often stored on servers, readily viewable by managers and many others besides the intended recipient. Likewise many messages posted to the Internet newsgroups and mailing lists are stored indefinitely, and easily found and veiwed via various search engines.

E-mail was intended as a means of communication, not as a means of passing intelligence or top secret documents. Yet, as you can see, there are some rather stiff barriers to keeping the communication flow open. So, it is wise not to rely on e-mail as a means of secure, certain communication. If it is important, it may be prudent to use the phone, fax or standard hard copy in the mail. Or all of them.

Effectively using e-mail can enhance communication at work, and provide other common friendly communication. Using good practices will avoid abuses, scams and virus infections. Safety comes from awareness.

A computer programmer and System Administrator based in Tucson, Arizona, Tren Barnett can be contacted at tpb@ironmind.net

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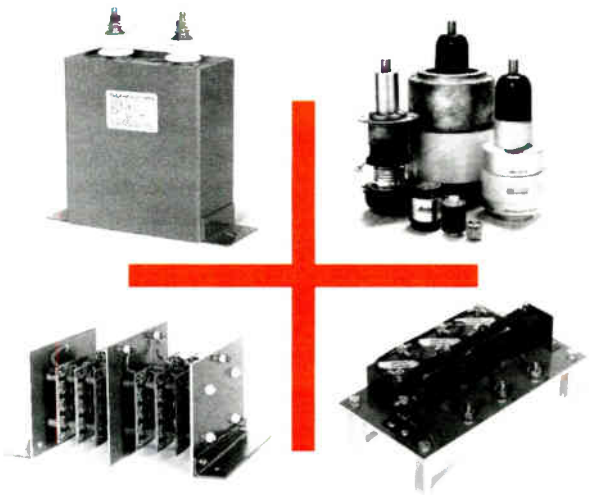

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Tech Tips

by Bob Hawkins

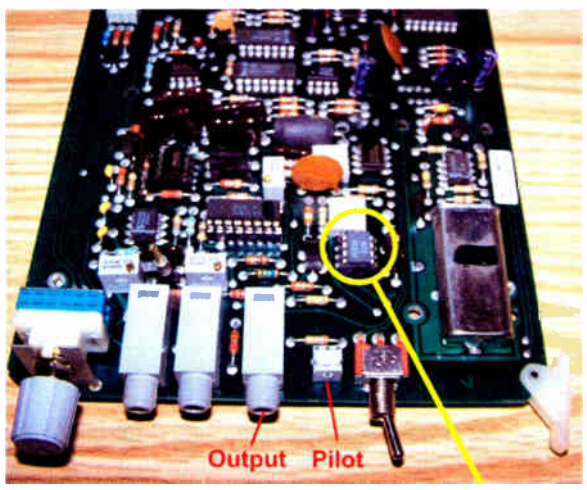
Optimod 8100A Low Output Fix

[EDINBURGH, Indiana - January 2005] You are having one of those nights: lightning has struck and the station audio is almost gone. There is no stereo light on your receiver. It is time to pay a visit to the transmitter site; your mind is racing as you try to analyze what could be the problem.

FOCUS ON THE AUDIO CHAIN

Because the station carrier is still on, suspicion turns to the audio chain, and specifically the processor – in this case an Optimod 8100A. I have found that often the culprit is the NTE918M output IC on the Stereo Generator/Output card, as it is electrically connected directly to the composite output.

Once on site, a quick inspection shows that, sure enough, some part of the processor is "toast." The STL output looks "normal," as well as the input to the Optimod. The modulation monitor is essentially dead. Yet, if you turn the radio up real loud, there is still some audio there.



The NTE918M sits right behind the switch.

If you are faced with these symptoms, the "fix" is pretty easy. Just remove the "cover plate" and look for the card #7, the Stereo Generator and Output card. You will find the NTE918M right behind the pilot switch.

If you have a spare NTE918M on hand (a good item to have on the shelf – they are under $5.00 each), just pull the card, swap the chip, and you should be "back to normal."

BACK UP WITH A TEMPORARY FIX

Assuming you do not have an NTE 918M with you, you can still save the day, at least to a degree. The audio level may be quite low now, but it can be made better.

The first step is to remove the defective IC from the socket on the card (depending on the failure mode, this step may not be necessary). Then turn the composite output pot all the way *down*. The way the gain is regulated in this stage, lower resistance reduces the output level – if the IC is working. So, without the IC in the circuit, full CCW rotation of the composite output effectively connects the IC's input & output together.

In other words, you have a quick screwdriver-assisted stage-bypass!

You should also turn the pilot injection fully CW. I have found this to result in approximately 30% modulation and 3.5% pilot injection. In other words, it will be about as loud as that 87.7 MHz FM audio that channel 6 TV stations tell everyone to listen to. And some radios will even play in stereo at 3.5% pilot injection.

At the very least, this solution beats the 10% mono modulation that you had before hands down. And you can safely run indefinitely like this – certainly until you get the replacement chip when the parts shop opens in the morning.

Bob Hawkins is a contract engineer in Edinburgh, IN. He can be reached at bob53bob@hotmail.com

Gear Guide: AM/FM Transmitters and Exciters

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Armstrong Transmitter's new B series of FM Solid State transmitters are built around the FMX2000B platform.

Multiples of the FMX2000B are externally combined to provide extremely rugged and reliable FM Solid State transmitters. Armstrong's "B" Series FM Solid State transmitters are available in even power levels from 2 kW to 20kW. For more information contact Armstrong's Sales and Marketing Manager Ernie Belanger.

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Website: www.armstrongtx.com

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Bext
Phone: 888-239-8462
Website: www.bext.com

Broadcast Electronics

The BE **FXi 60** and **FXi 250** digital, direct-to-channel FM exciters eliminate analog up-conversion and filtering requirements. An optional plug-in board allows the HD Radio signal generator to remain at the studio. This flexibility, available at low-cost only from BE, allows you to upgrade your exciter and then implement HD Radio whenever you choose.

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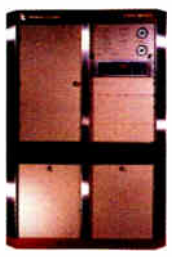
Broadcast Electronics
Phone: 217-224-9600
Website: www.bdcast.com

DRS Broadcast Technology

DRS Broadcast Technology will be introducing the new Continental Electronics™ **815D5 and 815HD** line of Solid State FM Transmitters at NAB2004 Show, booth #N2402. This transmitter line wields a unique combiner system option that insures that the most RF possible gets to the output in the event of single or multiple amplifier module failure.



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DRS Technologies - Continental
Phone: 800-733-5011
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Energy-Onix continues to offer one-tube FM transmitters from 2kW to 30KW and solid state transmitters from 20 watts 10KW.

The one tube transmitters utilize "zero bias triodes" with plate efficiencies of 75 to 85%. Some of their customers experience 3-5 years of tube life, and by utilizing Eimac remanufacturing, their average tube cost is insignificant.

Energy-Onix FM transmitters utilize understandable control circuitry with standard parts readily available. Transmitters are available for single or three phase operation. These USA manufactured equipments are available at very attractive prices. Delivery is from 3 -4 weeks.

Energy-Onix
Phone: 518-758-1690
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Harris Broadcast

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Nautel
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Website: www.nautel.com

OMB America

The **Model EM 1000** is an FM transmitter using solid-state power amplifier Mosfet technology . An LCD meter displays forward/reflected power, frequency selection, power consumption, modulation level, modules voltage and current levels, etc.

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SBE Certification Exam
Feb. 4-14 – Local Chapters – Dec. 27 App Deadline

National Religious Broadcasters Convention
February 11-16 – Anaheim – www.nrb.org

National Assn. of Tower Erectors (NATE) 2005
February 14-17 – Dallas – www.natehome.com

Great Lakes Broadcasting Expo & SBE-91
March 7-8 – Lansing, MI – www.michmab.com

IBS International College Radio Conference
March 11-13 – New York – www.collegeradio.tv

Oklahoma Assoc. of Broadcasters & SBE-56
April 1-2 – Tulsa, OK – www.www.oabok,org

SBE Certification Exam
April 19 – Las Vegas – March 1 App Deadline

NAB 2005 Spring Convention
April 16-21 – Las Vegas – www.nab.org

SBE Certification Exam
Jun. 3-13 – Local Chapters – Apr. 22 App Deadline

Northern New England Broadcasters & SBE-110
June 23 – Manchester, NH – bteffner@wcax.com

Texas Assoc. of Broadcasters (TAB)
Aug 3-5 – Austin, TX – www.tab.org

Nebraska Broadcasters Assoc. & SBE-74
Aug 10-12 – Lincoln, NE – www.ne-ba.org

IBC2005 Conference
Sep 8-12 – Amsterdam – www.ibc.org

2005 Fall Radio Show
September 21-23 – Philadelphia – www.nab.org

SBE Chapter 22
Sep 28 – Verona, NY – www.www.sbe22.org

Pittsburg Chapter 20 Regional SBE
Early Oct. – Pittsburgh – www.broadcast.net/~sbe20

Madison Broadcasters Clinic
Oct 11-13 – Madison, WI – www.wi-broadcasters.org

Boscon, Boston & SBE 11
Oct 25-26 – Marlborough, MA – www.bos-con.org

Totally Automated Weather Forecasts for Radio Stations

Las Vegas-based Digital Weatherman LLC is now distributing Tom Churchill's Digital Weatherman system, a totally automated system for delivering up-to-date weather forecasts to radio stations.

Churchill says, "Many stations just record a weather forecast that runs every hour, with no way to update it with current conditions and temperatures. Weekend weather is an even bigger problem because many small stations are running unattended and there is no one around to provide updates."

To solve the problem, Churchill wrote a custom program that "reads" the National Weather Service data feed and then pieces together a forecast using pre-recorded audio segments with Churchill's own voice.

Churchill says, "It sounds like I'm right there at the radio station reading the weather forecast." The system updates the forecast every hour and even announces the current sky conditions and the local temperature.

"Competing services that supply weather forecasts via phone or FTP can't do that," according to Larry Fuss, a veteran broadcaster who heads Digital Weatherman LLC. "I started using Digital Weatherman on all my stations in Mississippi in 1994. Having the ability to air accurate forecasts every hour, complete with current conditions, gave me an advantage over the competition. Our local weather sponsorships were always sold out."

The Digital Weatherman system also produces its own weather bulletins – from Flash Flood Watches and Warnings, to Tornado Watches and Warnings. By interfacing Digital Weatherman with a station's EAS equipment, weather bulletins can interrupt regular programming immediately, saving valuable time during severe weather.

Digital Weatherman LLC
Phone: 702-898-1554
www.digitalweatherman.com

Broadcast Devices Announces Composite Audio Mixer/DA

The CMP-300 Composite Mixer/DA system is designed to combine various FM/TV base band signals together to form one composite out that can be fed to up to three separate exciters and/or STL systems.

The CMP-300 can accept composite stereo, SCA, RBDS, and/or TV SAP signals simultaneously. The CMP-300 features three wide band inputs with level control for each and three independent outputs which also have separate level trims. Each input can be individually configured for balanced or unbalanced operation. Suggested uses include premixing of up to three base band signals for older exciters lacking enough inputs or distribution of signals to up to three exciters when only one stereo generator, STL, SCA, RBDS, or SAP signal is available.

Broadcast Devices
Phone: 914-737-5032
www.broadcast-devices.com

Consultant Guide

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Radio Guide Tech Initiative

As announced at the NAB 2004 Radio Show, **Radio Guide** magazine has embarked on a **Tech Initiative** to encourage the sharing of technical knowledge and experience among the engineering community.

As part of this outreach to encourage information sharing, a number of manufacturers have already contributed over $15,000 of gear, to be awarded to the best submissions. Some of the items include:

- **Broadcast Warehouse DSP-X Digital Processor**
- **Comrex DH-20 Digital Phone Hybrid**
- **Audion Labs Voxpro Digital Audio Editor**
- **Henry Engineering Studio Drive Mixer**
- **Orban Optimod 1100 Processor Card**
- **rfSoftware rfInvestigator (full package).**

What we are asking is for you to share your Tech Tips, User Reports and War Stories as well as longer articles on topics that interest you, from studio construction or renovation, to transmitter site maintenance. Please address any questions or submissions to: **Editor@radio-guide.com**

Broadcast Warehouse DSP-X

The DSPX: Small Box – Small Price – BIG SOUND.

The BW DSPX audio processor is now shipping with version 2 software. V2 adds remote control by TCP and serial, real time clock daypart scheduling, composite clipper filtering, multiband window gating, adjustable x-overs, revised clippers with even lower distortion, and audio failure switching.

The DSPX packs all of this into a 1 rack-unit sized compact case and offers 99% of the features found in the other processors that traditionally cost five figures and up.

Keith Renton from London's KISS100FM and MAGIC FM has this to say: "At first we were one of the disbelievers but it's not until you actually listen to the DSPX that you are quickly converted."

To test drive the DSPX, point your browser to **www.dsp-x.com** and remote control a DSPX by TCP, over the internet while listening to a stream that is being processed by the DSPX that you are controlling.

The DSPX, the soon to be unveiled DSPX2 and other BW products will be shown at the spring NAB show in Las Vegas, booth N422

For more information on the DSPX and other BW products visit **www.broadcastwarehouse.com**

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