Radio Guide

Radio Technology for Engineers and Managers March 2007

This Month's Gear Guide – AM/FM Transmitters and Exciters

Phasing Systems – Putting Power Where It is Needed

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Kintronics Phasors Bring a 50 kW Station to Life

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The word came down in December 2005 from Bob Ingstad, owner of the Ingstad Broadcast Group. The upgrade of KKAG to a "50 gallon blowtorch" in Fargo, ND was a go – and we had one year to "git-r-done."

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Radio Guide

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Cover Photo
Kintronic Labs Phasor and Control Rack at WFDF, Farmington Hills, Michigan

Radio Guide

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Radio Waves

by Barry Mishkind – Editor

FULFILLING OUR PROMISE

Our mission, as we say repeatedly, is to help you do your job. In preparing for the first ***Radio Guide*** *AM Transmission Seminar*, we were sure of only one thing: there was a need to help engineers learn, understand, or review the principles surrounding AM transmission systems.

As things came together in Orlando, yes – Murphy visited. But overall, Alan Alsobrook and Phil Alexander, along with Ron Rackley, did yeoman's work in making the Seminar informative and enjoyable (See page 28). Many of the attendees made positive comments and suggestions for improving the program.

That gives me the happy opportunity to announce that we will incorporate many of those suggestions, and there will be more of the Seminars. The details will be announced here as soon as plans have been made.

BUILDING ON THE MISSION

Again, our mission is to help you do your job – to make it easy for you to find the information you need.

But we didn't stop there. Rather than setting any mechanical restrictions to make it harder to save and use the electronic version of ***Radio Guide***, we made it easy for you to download the entire magazine as a pdf file. You can save, copy, or print as you wish. No gimmicks. We *want* you to have and rely on ***Radio Guide*** as your resource center.

Furthermore, rather than setting up mechanical restrictions making it hard to save and use the electronic version of ***Radio Guide***, we have made it easy for you to download the entire magazine as a pdf file – so you can save or copy or print them as you wish. We *want* you to save and rely on ***Radio Guide*** as your resource center.

Of course, for those desiring a complete set of all ***Radio Guide*** issues on a CD, we still offer the *Broadcaster's Desktop Reference* with the ***Radio Guide*** archive.

Is there something you need? Let us know. What else can we do for you? – *Radio Guide* –

Kintronics Phasors Bring a New 50 kW Station to Life

by Bill Spitzer

The word came down in December 2005 from Bob Ingstad, owner of the Ingstad Broadcast Group. The upgrade of KKAG to a "50 gallon blowtorch" in Fargo, ND was a go – and we had one year to "git-r-done."

While accruing over 40 years of radio engineering experiences, building a 50,000 watt, 6 tower DA-2 had not been one of them. So, I needed to get crackin'.

SELECTING VENDORS

We ran the entire project through Harris, with several stipulations. Our Harris representative, the lovely and gracious Teddy Moyer, kept me on the straight and narrow. She was a joy to work with and resolved a myriad of problems that arose as the project developed.

Harris would supply the two transmitters needed for the operation: the 3DX-50 for the daytime 50 kW, as well as the 8 kW critical hours power, and a DAX-1 for the 1 kW night time array. My personal history of dealing with tower construction crews made that choice easy: Rocky Mountain Erection Company in Oklahoma. Billy Johnson, Tyrone Humphries, and his crew are second to none in my book and I would never approach any tower construction project without his expertise and involvement.

Harris advised – and we quickly concurred – that the two phasors should be built by Kintronics. (Actually when this project was first proposed a few years ago, Harris was intending to construct the phasor themselves. But over the course of time they decided to opt out of the phasor construction and advised us to go with Kintronics.)

That made perfect sense to me, having had a good working relationship with the King family over the years. I always considered Louie and Tom to have built top-quality phasors and provided reliable service whenever we called on them. The project proved to be no different.

THE SYSTEM DESIGN TEAM

The entire Kintronics staff was first class as well. "Engineer-in-Charge" of the KKAG/Fargo system was James Banks. Not only exceedingly helpful and easy to talk to, he put up with my often ignorant questions providing understandable answers. And I would be remiss if I did not mention that beloved Eva. She put up with my frequently panicked phone calls in her inimitable southern warmness that made me want to reach through the phone and just give her a hug.

As I told Tom, with folks like that working for him, it is easy to see why he enjoys his job.

By early January 2006, the consultant, William Sitzman of Independent Broadcast Consultants, had sent Kintronics his requirements for the two phasors. While discussing the specifications with James, it was determined the cabinets would be seven feet tall, five feet deep, and *thirty-six feet* long.

MODIFICATION NUMBER ONE

But, but, but – I had already ordered a building from Thermobond of Elk Point, SD that would be 30 feet wide by 40 forty feet long. Either we had to stretch the building or shrink the phasor, or only extremely skinny folks would be able to work on that system – which would certainly exclude me.

James immediately put me at ease by saying he could split the nighttime pair of cabinets away from the daytime, which would "shrink" that main row down eight feet to a neat 28-foot length. The two nighttime cabinets would fit nicely along the side of the building with the transmitters, equipment racks, and phasor relay controller panel cabinet. Voila! – we have a layout that makes for a pleasant and roomy facility.

I gave James the precise distances between the two facing rows of cabinets and he put his staff to work on constructing the system with interfacing rigid 1-5/8 inch transmission line. This allowed the nighttime phasor to be constructed without any switching contactors or transmission lines to the towers. The six transmission lines, varying from 7/8 inch to 2-1/2 inches would all be fed from the daytime phasor, which also housed all RF contactors and the Delta common point bridge.

ASSEMBLING THE GEAR

When the trailer full of phasor cabinets arrived, they were all unloaded and crates arranged so we could place the nighttime cabinets into the building first and then the other cabinets in descending order.

Unloading and getting the gear into the building is always a messy job – even moreso under damp, muddy conditions.

Once inside, we uncrated the cabinets, leaving them on their pallets and began to juggle them into position. It was sort of a Rubik's cube exercise.

A phasor starts out with a *lot* of cabinets.

The Rocky Mountain crew was indispensable with this part of the project. Lots of "grunt" power was required to position these two rows of cabinets precisely as they were constructed at the Kintronics factory.

The phasor cabinets came together just as planned.

In due course, the moving job got done and all the interfacing was hooked up. As I recall, with all the cables that we had to hook up between the phasor, the relay panels, and the ATU's, we only had one color-coded indicator wire reversed! Absolutely amazing. The credit for that result goes to the Ingstad Broadcast Group Chief Engineer, Don Brintnall. He was relentless in his perfection inspections.

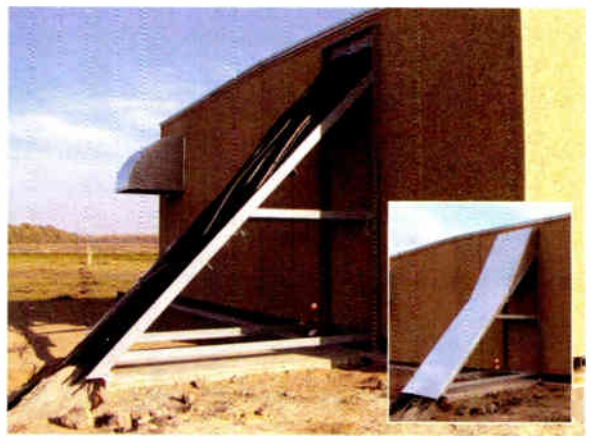
With everything in place, the transmitter building started looking ready for action.

The Kintronic's ATUs have only been mentioned in passing, but they really are a story unto themselves.

AN ATU SURPRISE

All six ATUs arrived ahead of the phasor cabinets, so we could position them on the concrete pads poured by the tower crew.

At that point the transmission lines were unrolled in the trenches between the towers, along with the control cables, AC cables, and the sample lines. We then placed the ATUs under their associated towers, as soon as the steel was erected.



Transmission lines are placed in a covered chase.

When the ATU's first arrived, we nonchalantly opened up a couple of the crates to show the tower crew how they needed to be fastened to the concrete pads. We put legs on one we opened (a smaller one for Tower 6), and let it stand there uncrated until we had the pads ready.

You cannot imagine our shock when we started to open the other ATU crates while we got ready to position them by the towers – and found the incredible damage to the Tower 1 unit.

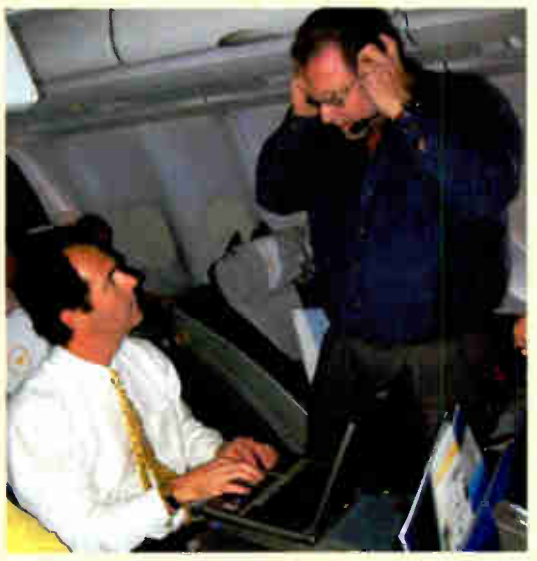
This is *not* what you want to see inside a new ATU cabinet.

There was nothing noticeable on the exterior of the crate to alert us to the fact that it had been damaged. Our only logical reasoning was the entire box had to have been dropped on its pallet and jolted every thing inside severely, turning it into a complete shambles.

(Continued on Page 6)

Internet remotes... there's been talk.

Live from 37,000 Feet—No kidding—Live Broadcast from a Lufthansa flight!

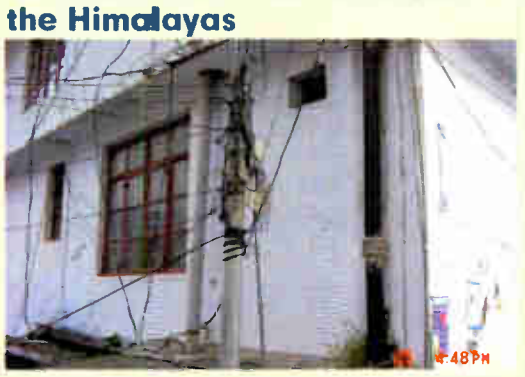


... successfully aired his three hour talk show from a commercial airplane [using ACCESS] at 37,000 feet on a regularly scheduled flight between Frankfurt, Germany and New York, US.

Peter Greenberg—Host of the syndicated radio program Travel Today

For the complete story visit
http://remotebroadcasts.blogspot.com

Radio Free Asia—Live from the Himalayas



"The results [with ACCESS] were especially reliable considering that Dharamsala has one of most "problematic" Internet infrastructures that we have come across." — David Baden, Chief Technology Officer Radio Free Asia

For the complete story visit
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Ski Mountain Remote

This picture, really demonstrates what ACCESS is about. This product truly has the ability to cut the wires.

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JAMN 94.5—Walk for Hunger

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COMREX

Kintronics Phasors Bring a New 50 kW Station to Life

Continued from Page 4

KINTRONICS TO THE RESCUE

Since this was the ATU for Tower 1 – and the one with all the components and switching for the non-DA measurements – we were in a panic. I had measuring crews scheduled for arrival in two weeks to begin the antenna proof. James and Eva got after the trucking company post-haste and got them to return the unit to their factory.

The Kintronic fabricator told James the damage was so severe, even the cabinet could not be salvaged. Therefore, they proceeded to build a totally new unit, spending many hours over the weekend so it could be returned to us as soon as possible.

They tried to get it shipped with the truckload of phasor cabinets. However, they could not get it done in time, so it came out a couple days later on private truck, in perfect condition and ready for installation.

The ATU for Tower 1 was finally in place on its concrete slab, ready for testing.

By the way, after talking with James and Tom, they agreed that shipping their premier products deserved better than some cross country freight hauler, so when the phasor arrived it was on an air-ride container, as was the ATU.

PUTTING THE INSTALLATION BACK ON TRACK

When everything was in place and connected together, the juice was applied. After taking Edsel Murphy's best punches, I think we were all mildly surprised that nothing smoked.

We tuned Tower 1 for the 1 kW transmitter, detuned the others, and began the nondirectional measurements. I had gotten permission from the surrounding land owners to trespass on their property with four-wheelers, so the close-in, two-mile measurements were made quickly. With a crew of eight, each with an FIM 41, the entire set of 19 radials took us only a few days to compile and send to the consultant.

A custom control system provides for three modes of regular operation.

While the consultant mulled over that information, we fired up the 3DX-50 into the daytime array and the DAX-1 into the nighttime system. After some minor adjustments on the big transmitter and some tweaking on the 1 kW unit, we felt the common point was ready for us to begin directional measurements.

James had done all the pre-tuning of both phasors, as well as all six of the ATUs. I think we only changed a couple of ATU coil taps in the course of "twisting the alligator's tail." Our tune-up crank-master was Tom Toenges of Topeka, KS.

Using the Potomac 1901-6 digital antenna monitor (a phasor-cranker's dream come true), Toenges turned the cranks and did the math, while the rest of us were positioned on various radials with two-ways so we could communicate with the transmitter site at all times.

UP AND ON THE AIR WITH 50 GALLONS

Within a couple of weeks we had both patterns tuned in to Mr. Sitzmans specifications. Don Brintnall had the figures charted and emailed for putting the proof together prior to the December 14th deadline, which Mr. Sitzman met. The ball, so to speak, is now in the FCC's court.

We have done some "playing" with our 50 gallon signal, just to see if it was blowing out any farmers windows, or pealing the paint off of neighboring radio towers. So far, the reach is as expected or beyond. But without Big Brother's approval on the wall, we cannot let 'er rip – at least just yet. But it will happen soon, maybe even while this is being published.

At press time, KKAG was already operating under Program Test Authority. A full license is expected soon.

Bill Spitzer is the Technical Director for the Ingstad Broadcast Group in Fargo, ND. You can contact Bill at dabullnbill@rushmore.com

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Processing Guide

by Jim Somich

Processing: Yesterday, Today, and Tomorrow

Part 2: Multiband Audio

It is with great sadness that we note the passing of Jim Somich (see accompanying article below). Fortunately for us, he had just finished this series of articles before his untimely death. So, leading up to a focus on the current state of the art – and where we are headed – we continue Jim's reflection on how the art of audio processing developed.

Up to the 1970s, audio limiters and processors essentially were marketed only by the big companies: RCA, WE, GE, and CBS. However, that changed in the early 1970s – and in a big way.

A NEW PLAYER

This is an exciting business. The pioneers have led the way. But maybe you are one of those engineers or programmers who has a dream – who has become so strongly dissatisfied with the sound of his station that it becomes an obsession.

One young recording studio engineer turned broadcast engineer, Mike Dorrough, was not a great fan of the famous "Maxx Brothers." He knew broadband audio processing had severe limitations, especially when it was pushed hard in order to achieve a competitive sound in a market. After all, this was why those "backroom engineers" were developing Audimax modifications left and right.

I first met Dorrough in the early 1970s and he was a young man with a dream under his arm called the DAP (Discriminant Audio Processor). I had never seen such passion about an inanimate object before. Little did I know how his ideas would revolutionize the sound of broadcasting.

But even Dorrough could not imagine back then how far we would have come in thirty years. Undoubtedly, we have better tools today than ever before in broadcast history. But, in many ways, we are still learning how to use them.

FINDING A NEW WAY

The greatest problem with broadband compression is intermodulation, as when a heavy bass line modulates the mid and upper frequencies. "Pumpy" was one of the milder terms used to describe the effects wideband processing caused. Any abrupt audio spike could cause the whole audio package to "duck" – or worse.

Dorrough remembered an old Altec-Lansing compressor from back in the 1950s that took a different approach to the intermodulation problem. It split the audio into two bands and processed them separately. The results were far superior to broadband designs and the idea for the Discriminate Audio Processor was born.

Dorrough's first prototype split the audio into eight bands with passive filters, processing the individual bands with SpectraSonics modules. "The Monolith," as this monster was dubbed, was put on the air at KRLA in Los Angeles and the results were spectacular. This 50 kW AM flamethrower became the most dominant sound on the LA radio dial!

But the box was very tweaky. Each cut sounded quite different from the one preceding it. Dorrough learned two things from his prototype: Eight bands were just too many and the filter slopes had to be much more gentle, allowing the individual band control to be much broader. The DAP 310 was born.

The DAP310

The Model 310 was a three-band processor with FET gain-control elements. Mike built a new prototype, and then embarked on a brilliant marketing campaign that was unique at that time.

SPREADING THE WORD

Dorrough would not only offer broadcasters a free trial, but he would not put a time limit on it! And he "hit the road" with a car full of DAPs. Visiting markets, large and small, he made the acquaintance of hundreds of engineers in the field.

On a one-to-one, personal basis he would install a DAP in their air chain and let them play with it. The marketing plan worked and the Model 310 became one of the most popular broadcast processors to date. To date, I do not know how many DAPs Dorrough ultimately sold, but it was in the thousands to be sure and it might be the all-time best-selling broadcast processor.

In the 1980s Dorrough introduced the Model 610, a discriminate processor with digital control. While the 610 never achieved the blockbuster status of the 310, it was a decent processor that was ahead of its time.

Dorrough's passion was to make radio sound better. Not louder, but better. He achieved success with the DAP. However, the loudness wars of the 80s and 90s were right around the corner, and many DAPs became "secret processing weapons" with their own set of "special tweaks." One interesting tactic was running two DAPs in parallel, setting one for light processing and the other for much heavier action.

THE ORBAN OPTIMOD

About this same time, a young Stanford engineering graduate who had started a small company to build equipment for recording studios was also dissatisfied with the state of radio audio – FM radio audio in particular.

While a freshman at Princeton, Bob Orban first decided to do something about how FM stations were processed. Up until that time, most processors were AM processors, with little or no modification to handle the 75 uS pre-emphasis curve employed on FM. The result was low average modulation and a lot of peaks – it was not uncommon to hear an overmod light relay clicking away behind the announcer.

In 1972, after experimentation with existing products and different approaches, including FET gain control, program-controlled time constants, nonlinear smoothing, and a pre-emphasized clipper, Orban built a self-described "contraption," the "Overload Protection System." Althogh not yet a complete processing solution, it stood out on the FM dial when unveiled on KPEN in Los Altos, California.

The Orban Overload Protection System

The big hurdle in FM processing was the significant overshoot in the 15 kHz low-pass filters required to protect the 19 kHz pilot region. Orban reasoned that if he could integrate the FM processor and stereo generator "under one roof" he could effectively control this overshoot and be as much as 6 dB louder on the dial without overmodulation.

The prototype in 1974 – the Model 8000 – brought the whole package came together and the next year, the Optimod 8000A production unit was released. To say it was an instant hit is an understatement. A legend was born! In fact, for many broadcasters, the name "Optimod" has become synonymous with FM processing.

(Continued on Page 10)

Remembering Jim Somich

by Frank Foti

Previously in his series, Jim Somich wrote:

"I think back to the 1980's and a young engineer I hired who had a certain gleam in his eye. He did not have much experience but his enthusiasm was almost boundless. Little did I know that he would go on to become a true rock star in the processing world. This article is for you, Frank."

Well, this one is for you Jim, as you are still bigger than a rock star in my life. With a very heavy heart I must share the news that Jim has passed on to the big audio processor factory in the sky, at the young age of 65.

A MULTIFACETED ENGINEER

Jim was a very successful broadcast engineer, as well as product developer. His career spanned radio, television, photography, movies, and just about any form of media imaginable.

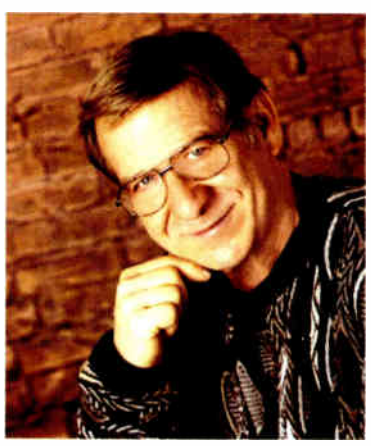
Over the years, Jim worked at KFI, KMET, KIQQ, WMMS, WGAR, WHK, WHTZ, and WJW, just to name a few stations. He also built quite a number of UHF TV stations for Malrite Communications, where, at one time, he was Director of Radio Engineering.

He was also involved in a number of ventures: Somich Engineering, MicroCon Systems, and a host of others. Jim kept a private life, and his curious mind ventured into some interesting and alternative areas, both inside and outside of broadcasting.

A MENTOR

And yes, he was also the person who took a chance on a goofy, long-haired, 22 year old kid. Stuck him under his wing and taught him the ropes of radio engineering. If not for Jim sticking his neck out for this passionate over-achiever, then Frank Foti would never have seized the opportunity to follow an exciting path in this industry.

They say that turn-about is fair play, and in 1987 I was able to return the favor. Malrite had promoted me to become the Director of Radio Engineering. The first assignment was to find my replacement for the Chief Engineer position at WHTZ-FM (Z-100) in NYC, at the time probably one of the top five radio engineering jobs in the country.



Jim Somich (1941-2007)

Jim was out in Los Angeles, working at an Hispanic UHF TV station, but was bored to tears. One evening, while out in LA, we hooked up for dinner. He told me he was considering getting back into radio. I asked him if this was an idle thought or for real. Upon realizing that he did want back into radio engineering, I said "Have I got the offer for you!" My first hire in the new position was my friend and mentor, Jim Somich.

A FRIEND

Jim was never at a loss for ideas about gadgets for the world. Whenever we got together, he would spout off at least half a dozen ideas; I only wish we could have made them together.

During the development of Omnia.fm, Jim would pop down to our office at least once a week to have lunch. He was an early supporter of the effort and an excellent advisor on the project, offering honest feedback that helped me tune the beast. He would bring in a bevy of CDs to see if he could break it and, when he could not, his enthusiasm overflowed!

He was truly an inspirational person, and one who never offered a cross thought, or negative belief. I have him to thank for the 100% optimistic outlook on life. He was never one to give in, no matter what the odds. Together, he and I overcame some crazy situations in broadcasting, and always came out on top. Suffice it to say, that there is a piece of Jim Somich in every Omnia, if by way of his inspiration alone!

But most importantly Jim was – and will always remain – my friend. While there are many wonderful memories of him, sadly, we will not be able to create new ones.

Be at peace, Jim. Life and our industry have lost a great friend.

Private services were held. The family would appreciate any memorials be sent, in his name, to the Northeast Ohio SPCA (pet rescue), 9555 Brookpark Rd., Parma, OH 44130.

Meet The New Innkeepers (they're a very functional family)

We've refined our innkeeper 1(x) line, gussied it up, gave it some great new features, expanded its family AND lowered the cost!

Why take a successful line like the innkeeper 1 and change it? Because we knew we could make it better AND lower your cost!

For starters, we've combined the features of the innkeeper 1 and the innkeeper 1x into a single hybrid that's more than the sum of its parts. As with the original, the new **innkeeper 1x** is a full-featured phone line interface which uses a proprietary dual-convergence echo canceller algorithm. It's designed to achieve excellent separation without any setup, and without sending a noise burst down the line. Plus, we've added an RS-232 connector for remote control applications and made them globally-compliant.

For remote control, we've now got two compatible products. The **Guest Module 1** gives you remote access to the on-hook/ off-hook and dial features of the innkeeper 1x series digital hybrids, using an 8 pin RJ45 modular cable.

The **RIU-IP** interface contains a web server which allows you to send and receive control data through your web browser. It can be connected to your computer NIC card for direct control, to a switch or hub for network control, or to an ethernet port with internet access for control from anywhere in the world.

Innkeeper 1x is more than a facelift. More than an upgraded feature set. It's a comprehensive, streamlined hybrid environment that gives you the tools you need to control it from anywhere. Visit us on the web or give us a call to learn more about innkeeper 1x.

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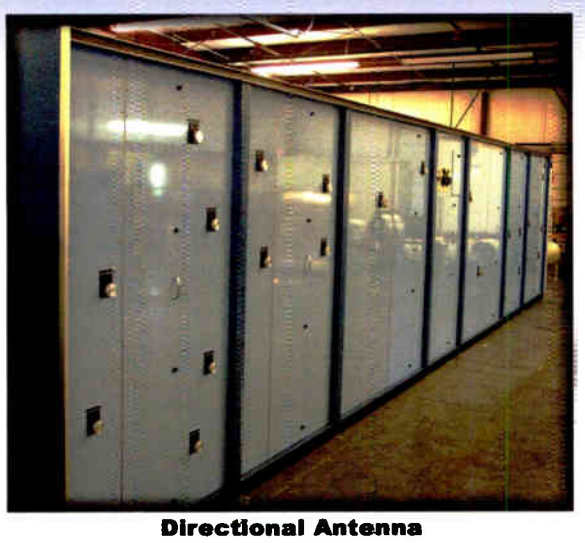

Directional Antenna
Phasing Systems

The way they ought to be...

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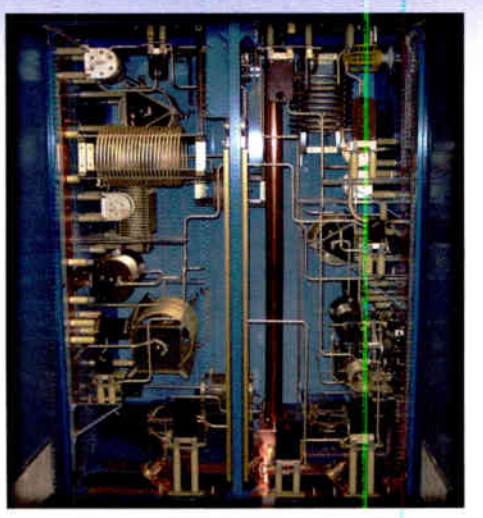
WQTM - AM 740
50 KW DA-2



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Processing Guide

by Jim Somich

Continued from Page 8

The Optimod 8000 was the first FM processor with a built-in Stereo Generator.
Top: the prototype. Bottom: production model.

The Optimod 8000A made stations louder than anything that had come before and it had substantially less distortion than the Audimax/Volumax combos of the time. It is a tribute to Orban that there still are many 8000A's running on the air today – over thirty years later.

THE MODULIMITER

Also during the 1970s, an audio guru who owned a major studio in the Los Angeles area decided to give broadcast processing a go. Bill Putnam's Universal Audio introduced the BL-40 AM Modulimiter.

The Modulimiter

The Modulimiter combined Putnam's patented, unique optical gain-control compressor that had achieved legendary status in the LA series of leveling amplifiers, with an FET limiter stage and proprietary "phase optimizer" circuit to maintain optimum polarity for maximum positive modulation.

The BL-40 was a hit and along with Orban's Optimod 9000A, gave the AM stations of the 70s a new, bigger sound.

THE 1980S: A DECADE OF REFINEMENTS

Orban introduced the 8100A in 1981. It was a significant improvement on the 8000A, going on to become the most successful Orban product – and perhaps the best selling broadcast processor of all time, with approximately 10,000 units shipped.

The 8100A improved on the 8000A by adding two-band processing with a unique cross-coupling scheme, an improved 15 kHz low-pass filter with distortion cancellation and an Orban designed VCA based on the RCA CA3280 dual Operational Transconductance Amplifiers. The improved design yielded greater loudness with less distortion and was used in several other Orban products.

The Optimod 8100A

Over the years, Orban and other manufacturers have designed a variety of PC cards and pre-processors to enhance the Optimod's operation. An optional six-band accessory processing chassis (XT) with was released in 1984, which included a distortion-cancelling clipper.

With or without the add-ons, the 8100A is still the main processor at hundreds of stations around the world.

APHEX

Aphex is a company best known for its recording studio equipment. However, they also ventured into the world of broadcast audio processing in the 1980s with Donn Werbach's 2020 analog processors.

Werbach's team at Aphex proved, with the 2020, that analog was far from dead. This was a highly complex box that would define and redefine analog broadcast audio processing for some time to come.

I believe the future is digital, but the 2020 proves that there is yet much that can be accomplished in the analog domain. The 2020 is a counterpoint to most of today's broadcast processors and that is good.

MORE AGGRESSIVE PROCESSING

As loudness became more of a factor in processing decisions, program directors began to have significant input into the sound of a station – something unheard of in the past. During this period, several audio processors hit the market with the express purpose of increasing a station's competitive edge on the dial.

Notable among these processors were those by Greg Ogonowski (Gregg Labs), Ron Jones (Circuit Research Labs, or CRL), and Glen Clark with the Texar Audio Prisms, which were four-band gain riders with a gain platform.

Users of the Gregg Model 2510 processors were passionate about their performance, especially the "killer bass," and they became "secret weapons" at many highly competitive stations.

Ron Jones developed a full line of processors, but his approach to AM processing was brilliant. He was the first to utilize pre-distortion in an AM processor to cancel out transmitter problems and thereby increase modulation.

The CRL AM System

THE WALL OF SOUND

Glen Clark's Audio Prisms became the backbone of Frank Foti's new "Wall of Sound" at Z-100 in New York City and word of their performance spread like wildfire. A pioneer in digital processors, Clark's digital Prism was adopted by many stations. Used in combination with the Optimod, some awesome levels of modulation were achieved.

The Texar Audio Prism

Anyone familiar with the New York City market knows that it places unique demands on audio processing. If you want to get lost on the dial, just try to apply conventional audio processing techniques to a New York City station. The market is loud and brash, just like the city itself.

Foti was uniquely qualified to shake up the market with the new Z-100, a fast-paced, take no prisoners CHR format. He cut his processing teeth at The Mighty Buzzard in Cleveland, WMMS and he was ready for the big time. Foti put the prototype of his "Vigilante" processor on the air at "The Big Gorilla" in New Yawk and it was creating quite a buzz. The Vigilante – an extensively modified Aphex Dominator peak limiter – was loud, just what the New York market needed.

The Vigilante

WHTZ (Z-100) went from worst to first in less than two books and the Z-100 sound had a lot to do with it. When combined with Scott Shannon's programming genius (he invented the "morning zoo") the team was invincible.

Toward the end of the decade word spread of a new form of audio processing, different from anything that came before. Around 1988, I saw a prototype of the Audio Animation Paragon digital processor and it gave me a glimpse into the future. Valley People, a recording studio equipment manufacturer, had also been showing a prototype digital processor. I do not know what eventually happened to either box, but we moved into the 1990s with dreams of digital audio processing, but nothing concrete.

ANALOG'S DAY ENDS, DIGITAL'S DAY DAWNS

As we slid into the 1990s another significant change was in the air. We were on the verge of the digital revolution and new players would emerge to join some of the old. Many would drop out and some, like Steve Hnat and Ron Jones, would have succumbed to untimely deaths.

Mike Dorrough had found new fame with his innovative loudness meters. Frank had left Z-100 and returned to Cleveland to strike out on his own building processors. Bob Orban had partnered with Greg Ogonowski to design the next generation of audio processing. It was an exciting time.

Foti's first commercial processor was the Unity 2000, an analog box that incorporated every trick that the master had learned at Z-100 and WMMS. It was a big hit and a terrific launch product for his new company, Cutting Edge Technologies.

The Unity 2000

But more change was in store for Foti as, in the early 1990s, he joined forces with his best friend and DSP guru Steve Church, to bring his new vision to life – the Omnia!

TRUE DIGITAL SIGNAL PROCESSING

The "Bob and Greg Show" in California was not letting moss grow beneath their feet either. They had to design a new box to replace the aging 8100A – a fabulous product that was, however, growing a bit long of tooth – and digital was on their minds.

The result of the research of this super-charged pair of engineers was the digital Optimod 8200 – and it was revolutionary. It was the first Digital Signal Processing (DSP) audio processor to achieve commercial success, designed and built by the pioneers of analog processor design.

The Optimod 8200

Foti and Church's "baby" was dubbed the Omnia and it was also a digital processor. But that is where the comparison with the Orban 8200 ended. The Omnia was a unique vision, born in the trenches of New York City radio and nursed to life by a DSP genius and a processing warrior. It is no wonder that the Omnia has been the most popular processor in the New York City market.

The first Omnia

MOVING AHEAD

It is clear that audio processing has quite a heritage but, alas, we must move on. This series is not designed to be a comprehensive history lesson; and we are just covering the high points of processor development. I apologize for leaving out dozens of other processors and their developers.

By the way, if you are a history buff, or just want to know more about the evolution of audio processing, be sure to check out this excellent paper by Frank Foti at: www.omniaaudio.com/tech/retrospective.htm Bob Orban also tackled the subject in 1992. His paper is at: www.bext.com/histproc.htm

The past is gone forever, but it gives us a foundation to understand why we are where we are at today. Sometimes it is quite difficult to analyze that which is all around us. We all think we know all there is to know about the current state of the processing art. But we should not take for granted that which is all around us.

With the advent of DSP (digital), the industry has reached the pinnacle of processor performance. Digital permits broadcasters to easily do things that were virtually impossible in the analog world. Yet, modern radio really does not sound all that good. Why not? That is part of what we will examine in the next installment in this series, a look at present day audio processing for radio.

The author would like to thank Barry Mishkind, Corny Gould, Frank Foti, and Bob Orban for their invaluable assistance in the writing of this series.

Jim Somich's career included positions as a major market Chief Engineer, Director of Engineering for a group owner, and as the designer of the FlexiMod FM Processor, among other products.

Operations Guide

by Ted Alexander

Is Cross Training an IT Person the Solution to the Engineer Shortage?

Over the past several months, a number of the folks across the USA with whom I have been talking have been bringing up their latest company buzzword: *cross training*. In particular, the cross training is that between the IT people and the "technical" engineers.

A GROWING PROBLEM

In these pages, as well as in other publications and venues, we all have been discussing the "drying up" of the pool of experienced broadcast engineers – especially those men and women with 30 or more years in the business, working in studios *and* on transmitters and antennas.

The reasons for the declining numbers of active experienced engineers are many and, again, have been discussed in many forums, but there is certainly a shortage developing. If the phone calls I am taking are an indication, it also appears that shortage will become more critical in a rather short time.

Is the solution to cross train someone who is competent in IT services to teach them how to keep your RF plant on the air? Can someone who has zero RF experience, has never worked around hazardous voltages, and never tuned a transmitter be "cross trained" to keep a stations RF/antenna plant on the air? Let us think about this for a bit.

GOING BEYOND THE BOOK

A technical manual can only describe a nominal set of operating parameters and cannot actually show exactly what real world effects a variation of those parameters will cause when a transmitter or phasor goes awry. That is a part of engineering that has to be carefully observed and learned.

On the other hand, just mention the term "phasor" to someone who has never heard of one used at a radio station's transmitter site. For most IT types, it probably brings forth thoughts of the Starship *Enterprise*, or Captain Kirk commanding "Phasers on stun."

How about using the term "Vizwahr?" Try "reactance." Mention "gate, source, drain." How can you "cross train" someone to recognize if one phase of three-phase power is out? Indeed, is three-phase power related to a phasor?

Some other terms that may elicit a "wha...?" are everyday engineering terms like "pinch-off" (a personal attack?), "soft knee" (problem with a joint after an injury?), "split-band" (rhythm and bass guitars on separate stages?), "clipping" (a 15 yard penalty?), "bias" (an unfair attitude?), "negative tower" (one a neighbor just does not like?), "blanketing interference, (someone who does not want the wool pulled over her eyes?), or "Spadiff" (the sound of expectorating?). Does "breaker tripped" mean fall-down, go "boom?" Does "Hazmat" mean that he actually has a mat? This could go on and on.

AREAS OF CONCERN

After many discussions, I have come to the conclusion that it takes a lot more than just a few "show and tell" visits to a transmitter site to cross train an IT person in transmission techniques, if it is possible at all.

My first concern is for the personal safety of the individual. Secondarily, there is concern about the investment in the site. Many of us are concerned that a minimally cross-trained person could suffer an early demise all too easily if he/she is not trained *and* experienced working on high power equipment. We also worry such a person might not even know to call for assistance until there is some smoldering wreckage.

Studio work is not anywhere as potentially hazardous as transmitter site work can be, but the cross training of an IT person to studio maintenance work can also be quite a challenge. However, we will look at just the RF plant for the moment – later you can draw your own conclusions about the cross training requirements for the studio end of a station.

SOME REAL DANGERS

There are not too many ways to kill oneself at an LPFM installation, but going behind the panels and doors at a 50,000 watt blowtorch facility is something that *must* be left to a highly experienced technician. And even then, working alone at a facility like that must be considered – at the least – risk taking.

That is part of why some transmitter company tech support representatives are getting more and more cautious in responding to callers. Without knowing the level of technical competence of the caller, there is worry that misunderstanding an instruction could create a dangerous situation – no matter how knowledgeable the caller thinks they are. One really has to "feel" an RF burn to know just what one is like.

At one job, an on-air personality who was a CB'er and home electronics enthusiast asked to come with me as I visited the tower bases to read base currents. In his opinion, he knew "a little" about electronics.

His first comment was to ask how current could flow in a single-ended circuit? He knew one wire connected to a speaker would not result in sound. He saw the coupling plumbing connected to the tower, but the tower was not connected to anything but air. I explained as best I could to him about antennas, 90-degree wavelengths, and s on, but he quickly developed a glazed-over look in his eye.

Then he pointed to the ball gap. He said, "What's this?" just as he shoved his thumb into the gap. The resulting "$#@&*! That's hot!!" statement told me about all I needed to know about his knowledge of RF.

Actually, it was an efficient lesson in cross training – it only took a few seconds and fortunately resulted in little more than a hot thumb. This was not someone I wanted alone at the site.

AN EYE ON SAFETY AND SECURITY

Physical safety and personal security are equally important. However, the untrained often are unaware of many dangers. This can be demonstrated by looking around a typical transmitter site, the kind of which many of us have kept going for all these years.

The first thing you should see upon arrival is a locked access point well removed from the transmitter building door (a fence or gate). More often than not though, you have just driven, unchallenged, right up to the front door. Sadly, we have all heard of the unfortunate engineers who have encountered "unwanted" people at a site, individuals who are armed and dangerous.

Having a two-way radio, or cell phone to check in with a third party as one approaches and enters a usually unmanned site is becoming a necessity in some locations, and is wise to do at all locations. That is why cops always radio in to the dispatcher when pulling over a suspect, *before* disembarking from his vehicle. Once safely inside the transmitter building, the third-party call can be terminated.

QUICK! WHAT TO DO?

So, what would a cross-trained IT person do if he/she entered a transmitter building and immediately smelled smoke? As we all know, there is "building fire" smoke, and "equipment" smoke. Having lived through all kinds of smoking equipment failures, as well as a major house fire, I can tell the differences.

But, unless they have been there, how can you train someone to recognize the different kinds of smoke you may find at a transmitter site? Or, what do you interpret if your cross-trained but inexperienced person calls up and says "Something smells hot..."? Is the building on fire, or is it a transmitter, or audio amplifier, or something in an HVAC system? How much cross training versus experience does it take to educate the student?

Aside from the obvious external dangers, a whole new set of hazards exist behind those closed transmitter building (and transmitter!) doors. The "main floor" is fraught with potential hazards, but the basement and/or crawl places are where you really find some startling surprises. There are a plethora of wild critters that occasionally find their way into an unmanned site.

Stinging insects are routine in most any climate, but in some areas, you may encounter animals that *really* bite. Think anything from rattlesnakes to scorpions to wolves. Someone familiar with the site may carry around cans of bug killer or even a shotgun for protection. Would a cross-trained, occasional engineer have that protection with him and know how to use it?

Once, we were working underneath the main floor at a transmitter site, in the four-foot high crawl space where old equipment, antenna parts and transmission line sections were stored. We were moving around an old box and suddenly were face to face with a huge raccoon, lying on its side, teeth bared, and claws in a menacing pose. It was dead, with the death grimace on its face, but it did really have almost the same effect as an overdose of a laxative. Now, *that* was an experience!

DANGER FROM INCOMING

There are other, usually unexpected external hazards of a remote site. It is experience that teaches you to keep the "eyes in the back of your head" open at all times.

One afternoon while working on a three-tower directional, installing new top and side lighting and the associated lighting chokes, my associate and I heard a sharp "crack" not more than several hundred yards distant. Then came several more within several minutes. Hunters!

After one of the shots, we actually heard the bullet ricocheting among the trees just several hundred feet from the base of one of the towers. The front door of that transmitter building had a nice half-inch hole in it and the front panel of the auxiliary FM transmitter had a nice dent in it, precisely in line with the door's hole – and in line about shoulder height above ground if one stood several dozen feet away from the front door.

We both agreed that if we heard one more shot, we would wrap up work for the day and come back later. We did not hear any more shots that day, but we did keep our ears on alert for any "pops" coming from the property perimeter.

POWERFUL HAZARD

A significant potential hazard is with the AC mains – and everything connected to them. It is tempting to open up a breaker box if one of the breakers keeps tripping. What should someone do if they find a smoking amplifier and the on-air audio processor in the same rack?

Consider: does an inexperienced person trust the breaker to actually be off when it says "off?" After all, IT voltages are rarely lethal. Would they know enough to put a meter on the circuit to be sure it really is off – metering *both sides* of the plug/socket *and* between both sides and ground to see if it was really off? I once found an "extension cord" – made with a male plug at each end – "backfeeding" an outlet strip in a rack. What if an inexperienced person pulled that cord and found himself with a handful of 120 volt AC mains power exciting his palm?

Power mains hide many potential hazards. What about an installation that has an auxiliary generator that also involves a transfer panel? Only experience that has become good habit will allow for the essential margin of safety. These are hazards that only an experienced engineer can work around safely.

(Continued on Page 14)

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Operations Guide

by Ted Alexander

Continued from Page 12

DO YOU DROP THE BREAKER?

Let us assume there is some smoke in the room. What would happen if an inexperienced person simply shut down a transmitter with a mains breaker and not allow the after-run of the blower to cool the tubes and/or components?

What would an inexperienced person do if his station was off due to a mains power outage and his emergency generator did not come on line? An occasion like that could really get scary.

If it was simple, maybe the generator ran out of fuel, or it was cold and the block heater quit. ("What's a block heater?") Or just maybe, a bear chewed through the fuel line and made itself comfortable in a dark corner. Hope for the best and expect the worst. But be sure to read the telltale signs before getting close to the danger area. Only experience will allow one to approach safely or not at all – instead knowing when to call the police or the animal ranger.

HAZARDOUS LIQUIDS

At an old site, does that goop on the floor contain PCB's? Only testing can show one way or the other, but it is better to stay safe than get cancer. If you are experienced and familiar with the site, you should know if the site had ever been cleaned of PCB containing components. Would someone with no experience in that situation throw some kitty litter on the puddle and scrape it up, or call a Hazmat team?

If the building has a below-ground area, does it have a sump pump or some other method to remove unwanted water? A long-time friend was almost electrocuted when he put on his boots and jumped into hip deep water to try to repair a non-functioning sump pump.

The pump had developed a short from the mains to its casing and, because the accumulated water was dirty and very conductive, when the engineer grabbed the pump casing he was hit with a 240 volt AC potential. The inexperienced staff kept shutting off breaker after breaker, panicking. The engineer was yelling as best he could to tell someone to throw the building breaker. No one knew where it was located.

Someone finally found it, and the engineer was OK, but very weak. And the station was off the air. The engineer's mistake was to attempt to repair the pump without turning off the breaker. He was very fortunate that day that he was not alone. He gained experience the hard way.

THE STUNNING PHASOR

How much can an inexperienced, cross-trained person help when troubleshooting a problem AM Directional Antenna (DA)? I was called in once to repair a six-tower DA-2, working with an "experienced" contract engineer from the station. One of the center towers of the six-tower nighttime array was not responding to any adjustment of the phasor. The array was somewhat out of tolerance, but the engineer was afraid to touch it.

The contract engineer said he measured the base current and it showed about 20% low. I confirmed that, but also determined that there was an open in the transmission line between the phasor and tower. He flatly refused that possibility since there was substantial base current showing on that tower.

As we were attempting to adjust the parameters and seeing no response to control input, I asked what the antenna monitor readings were doing. They were not moving, but strangely enough, the remote current reading was just slightly low and the phase reading seemed to be within several degrees of licensed value.

WHY EXPERIENCE IS NECESSARY

He kept reading 153 degrees. Then, after a flash of inspiration (brought on by my experience), I asked him if the antenna monitor indicated a + or – angle. The licensed value was -153 degrees. The antenna monitor read +153 degrees! The "engineer" then asked me "Oh, does that make a difference?"

This guy had been a contract engineer for over ten years. But if he did not know the basic ins and outs of an AM DA, how could we expect a cross-trained person to be any better? (By the way, their two-tower, daytime DA was also way out of tolerance because a coil tap had pulled loose from their power divider. They had been running an out-of-tolerance daytime DA around the clock on the day pattern, wondering why they had gotten several calls from some co-channel stations complaining of nighttime interference.)

Trying to cross train an IT person with no other technical experience in how to tune a transmitter, let alone an antenna system, can be a trial by fire. Literally.

WHEN GOOD TUNING GOES BAD

If a GM or owner could see what 25,000 Volts at 5 Amperes can do, they would not hesitate in hiring the most experienced person their money could buy.

While most AM's now are solid state to beyond 50,000 watts, fifty kilowatts of AM needs to be handled carefully – and only by someone who knows exactly what he/she is doing. Furthermore, there will be a lot of high power FM's using tubes (read "high voltage") for many years to come. Think about what your 35,000 watt FM transmitter would do if someone mistuned it without realizing it.

Have you ever helped a cross-trained person see just what happens to a tetrode when its mistuned? I once saw a 20,000 Watt FM, using a 4CX15000, running close to an Amp of screen current! Instead of lowering the screen voltage and/or PA voltage by moving the taps on the power supplies, this station was adjusting its transmitter power output (TPO) by cranking back the PA loading control until the TPO met the licensed value.

As you can imagine, the station did not sound quite right and the PA tube's screen was burning up. If anyone reading this does not understand why this was happening, please go back and review the basics of power tubes. As they say on television, "do not try this at home!"

IT TAKES A LOT OF TIME

Does it really make sense to have a cross-trained person with otherwise little experience handle the responsibilities of any RF plant? Without a lot of "apprentice" time, actual on-the-job experience just is not there.

The problem is that a cross-trained person may be the first one sent to a transmitter site to discover a smoking rack, with the station still on the air but in imminent danger of suffering additional major damage unless whatever is smoking is isolated from the essential on-air chain.

Suppose the cross-trained person is sent to a transmitter at 6:30AM on the day the "Book" starts. The signal is a bit "odd," but is still on the air. He enters a smoke-filled room and sees some unusual "flickering lights" reflecting off the side wall.

Does he shut down the main power breaker and spray the dry-powder fire extinguisher all over the equipment? The station is now off the air and the morning zoo, PD, Sales Manager, and GM already are screaming. Or should the cross-trained person have stopped and taken time to call an experienced engineer, while watching the flames consume some more equipment, but leave the station on the air – for the moment?

In any emergency, only experience can help one make an instantaneous judgment call to shut down or isolate the problem causing equipment. If the experienced engineer takes an additional half hour to get to the site, how much damage can continue to occur? Would calling an experienced engineer first have saved air time and equipment? This is just an example that you can think over, but I believe you know the points I am making.

ENTHUSIASM IS NOT ENOUGH

Can a cross-trained person recognize what is wrong if he/she gets to the site once every three months and is not at all familiar with anything from transmitter meter readings to the "aroma" of the building interior? What about an overenthusiastic, cross-trained but inexperienced person who actually recognizes that the PA tube in the main transmitter failed? Is that not good?

Despite the caveats of cross training, the lack of experience can show if the overconfident (or just plain scared for his job) person just whips open the PA cavity door and grabs the tube. Hopefully the interlocks worked and shut down the high voltage. I would rather not contemplate the alternative.

Just unbolt the plate assembly and pull out the tube, right? Then pop the new tube right in. Reassemble the plate plumbing and flip it back on. Simple, right? Sure it is.

Instead of audio from the monitor, "Bam!" is what he hears. What happened?

It could be he assembled the plumbing completely differently than the spacings and assembly required for resonance. Or some of the tabs in the tube socket got bent and shorted to an adjacent ring. The "Bam!" was the screen bypass caps exploding. So a relatively straightforward tube swap by an inexperienced, cross-trained "engineer" just cost thousands in lost air time, a replacement tube socket, blown bypass caps, and so on. Is it efficiency of personnel or false economy?

RELYING ON CONTRACT ASSISTANCE

Well then, the question would seem to be: should they not have called the contract engineer first?

Most contract engineers have full time jobs elsewhere. They have to work several places, since the radio station felt no need to have one full-time, "always available" engineer on staff. "On call 24/7" does not mean that the contract engineer can always respond instantaneously. He needs his full-time paycheck, so if the station he contracts for is off the air, that station may have to wait for the engineer to finish his "day job" to get there. That might even take days in some remote locations.

The transmitter site is the station's final link to the audience. It is the connection to the ears of the listeners who, through measured ratings, translate directly into station income. No signal, no ring of the cash register.

A colleague once told me that if he were invited to be the contract engineer for a station and discovered that station had no auxiliary transmitter, he figured the ownership was not interested enough in staying on the air by investing in standby equipment. He simply would not take the job.

WHERE CROSS-TRAINING WORKS

Cross training can work if several important factors are considered and the employer provides some additional time to allow for the on-the-job cross training. The cross-trainee should have some meaningful experience with equipment other than computers and stereos. Management needs to realize that experience is not gained overnight.

The station must give enough time to the engineer who will be doing the cross training. Recently, I read a letter from a potential "trainee" complaining that no one has the time to train him. With experienced engineers being so busy most of the time, non-emergency training time is very hard to come by. There is rarely time for a working engineer to explain every detail of his duties. Plus, as an engineer heads out in a hurry to handle an emergency, he/she is not thinking about calling a trainee.

So the next time the GM asks, in the same breath, if you can run down to Radio Shack, pick up a new ISDN transceiver, and give a quick training session to the IT person on how to run the transmitter, suggest that you and he set a time for an informative talk about the perils of cross training. Oh, one last thing: do not hold your breath for too long.

*A frequent contributor to **Radio Guide**, Ted Alexander has long experience in engineering as well as the other departments of radio facilities. Contact Ted at AMFMTV@aol.com*

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A Non-Comm View

The Annual Activity Report

A Valuable Tool for the College Radio Station

by Randall Davidson

Every year, my employer (Wisconsin Public Radio) produces a glossy annual activity report. The effort dates back to 1939, when the network's original station, WHA in Madison, WI, produced its first typewritten report.

A USEFUL TOOL

Many public radio stations do this and I have even seen a few commercial stations do them (one example: WCCO in Minneapolis, MN). However, I have rarely seen a college radio operation produce such a document. That is a shame, because college broadcasters could likely benefit the most from producing one.

Not only can such a yearly report bolster support for the station among key stakeholders, but it has added benefit for the internal workings of the operation, providing continuity of purpose and organization.

I recommend all college broadcasters consider the production of an annual report. Every station is unique, but any such report should contain these items:

• **Background:** a brief sketch of the station's history, its mission (training, service to the university, breaking new music, providing an alternative broadcast service, etc.), its organizational structure, and how the station fits into the overall operation of the university (part of an academic department, a student activity, a university/community partnership, etc.)

• **Programming:** a description of the station's program offerings, including music policy (examples: "all independent labels," "the best in new music," "music not heard anywhere else," etc.) and policies with regard to non-music programming (such as "a source for campus news," "the voice of local sports," etc.). Include a copy of the current schedule grid.

SHOW OFF THE STATION'S VALUE

• **Past year programming highlights:** This can be broken down by format and genre. For music, highlight contact with labels and reporting to the College Music Journal or other publications. Mention any artist interviews, live concerts or special recordings presented.

For non-music programming, tout notable broadcasts, particularly those that benefit or promote other university departments or that provide the public with a positive impression of the institution. Offering play-by-play sports is an obvious example, but there are other possibilities.

Were any professors (or the university President/Dean/Chancellor) interviewed as part of news programs? Were campus activities included in the community calendar? Did other departments or students from other majors contribute to the station's operation? Do not be shy about mentioning these – they show the station has value campus-wide.

Also be sure to mention any Public Service campaigns in which the station participated.

• **Non-programming highlights:** Mention any activities of those station staffers who have off-air roles. Underwriting success shows that the station has value with area businesses and that they support this university enterprise (if you have more than a couple, list them).

Be sure to mention any awards won by the station during the year or staff attendance at regional or national conferences. Also, if the station had a successful ABIP inspection, say so, explain what it means and why it was worth the expense.

This is also the place to mention improvements in equipment or facilities (or license renewal activities). Highlight any publicity endeavors like public events, a bumper sticker campaign, design of a new logo, improvements to the web page or the distribution of a new program guide.

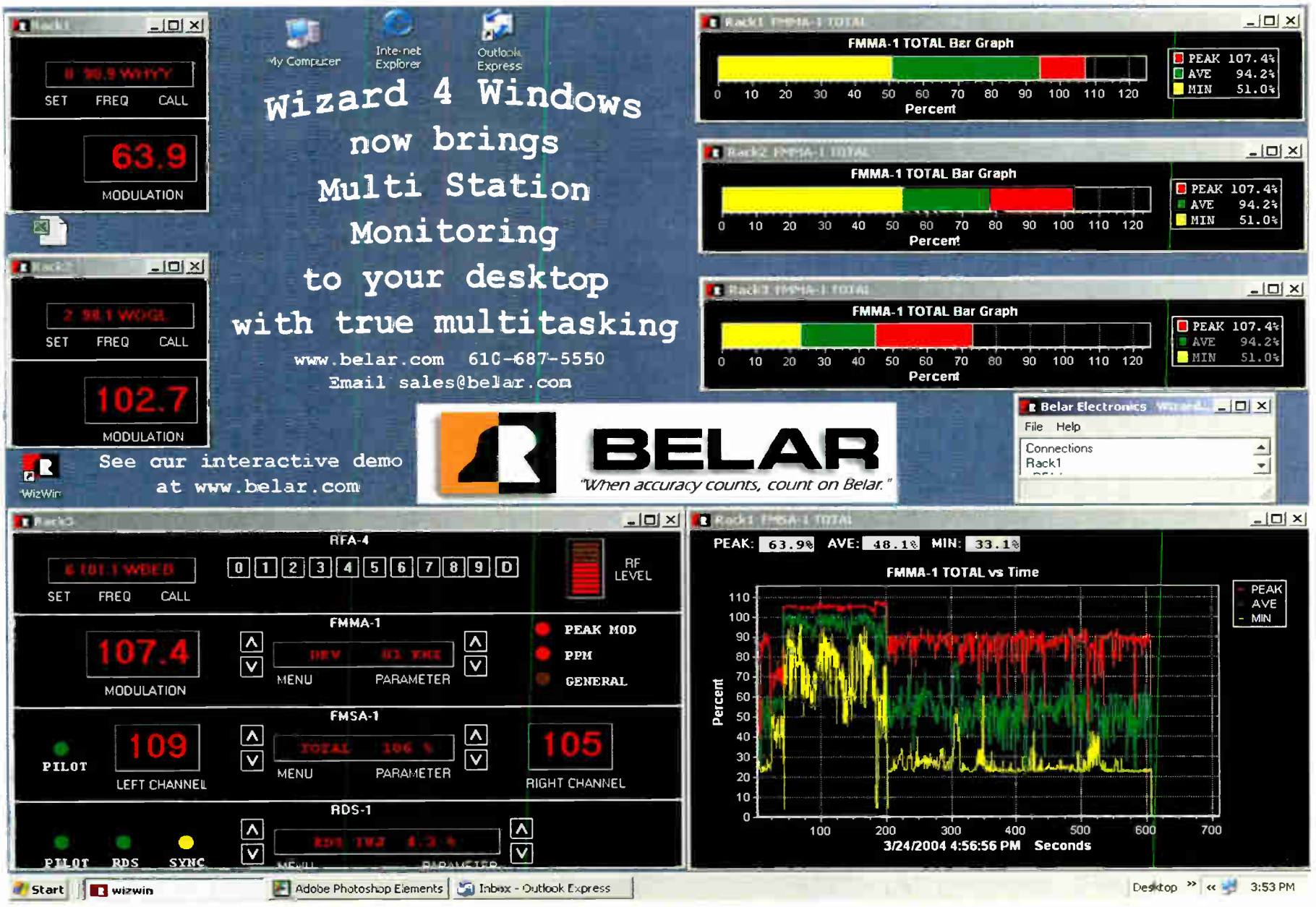
A KEY PART OF THE COLLEGE PROGRAM

• **Service:** this is the opportunity to show that the station is "outward-looking" and is providing valuable service to others. Did the news staff contribute any stories to the AP wire? Did they share news audio with other stations or offer audio to a network? Was assistance provided to another college broadcaster? Were staff members on panels at conferences? Did the station do the engineering of some event for a national network? Was there participation in an Amber Alert?

• **Staff development:** be sure to list those station staffers who are working part-time at area radio or TV stations. This can be an impressive listing that provides further evidence of the station's value. This section could also mention alumni working in the industry.

• **Plans for the future:** this is proof that the station is constantly evolving. Be sure to mention future programming ideas, as well as desired technical im-

(Continued on Page 18)



Radio.edu

A Non-Comm View

Continued from Page 16

provements. Be bold when outlining long-range possibilities (do not forget to add the caveat "given sufficient financial support").

PUT YOUR BEST FOOT FORWARD

Throughout the document, make the organization sound as professional as possible. One good technique is to mention other organizations involved with station programming.

Some examples: "twice each hour, the station presents the official area weather forecast from the National Weather Service," "the station now airs *Euroquest*, a weekly news magazine of European news and features from Radio Netherlands" or "the Saturday lineup now includes *The Midnight Special*, the long-running folk music program from WFMT-Chicago."

If you are carrying anything from another university of any size or from other university-based stations, mention that affiliation here: "*The Environment Report* radio news features from the University of Michigan" or "*Latino USA* from public radio station KUT at the University of Texas at Austin."

FINDING THE REPORT CONTENT

The station's first report will be the most difficult one to generate; future efforts can build on earlier reports. Students working in station publicity are the ones who will likely be the most involved with this endeavor.

One easy way to find material is to scour the minutes of staff meetings and what was sent out in station news releases (you *do* send out regular news releases, do you not?). Having everyone at the station always thinking about "reportable" items can have the effect of getting staffers thinking about more than their own show or project – perhaps you could have a web form where staffers could report notable events.

Also, "anything for the annual report this week?" is a great question to pose to department heads at the weekly staff meeting. These items end up in the minutes and could perhaps be issued as a news release – and the cycle continues.

CIRCULATING THE REPORT

Once you have the report completed, what do you do with it? Printed copies should absolutely be sent to the licensee, usually the university's Board of Regents or Board of Governors and to the institution's executive (President/Dean/Chancellor).

If the station relies on funding from activity fees, the students on the committee that oversees this should each receive a copy (how many competing student groups will have something as impressive?). It could also be included in the packet of materials given to potential underwriters.

You may also consider offering a copy to prospective students and their parents, and have some on hand for members of the public who want more information about the station. Perhaps a copy could be sent to the program directors at area commercial stations; if they see that some of their competitors are benefiting by hiring your staffers, they may post openings at your station first – at the least they will give a second look to your students applying for jobs.

Recent graduates may wish to include one with their resume as they apply for full time jobs (particularly if they were the ones producing the document; it can be a great portfolio item).

Be sure to send one to your campus library for their university archives; this is a historic document after all. Also, it is a natural to include it as a pdf on the station web site, but do not use that as an excuse for not producing hard copies.

A LITTLE SELF-PROTECTION

As many other college stations have experienced, there is genuine value in sending this report to the people who hold the station license. It shows that the campus radio operation is an endeavor of value to the institution, which should help blunt appeals from outside groups wishing to buy the station.

These reports also provide small but regular drops into the pool of goodwill any organization should constantly be cultivating. It is handy to have that well of good feeling to draw upon if something goes wrong.

Finally, the report also serves to educate the licensee about the fact that the impact of the station extends beyond the campus and has responsibilities to groups other than the institution itself, like non-student listeners, political candidates, underwriters, other broadcasters, record labels and, oh yes, the FCC.

Randall Davidson is the chief announcer and the statewide afternoon news anchor for Wisconsin Public Radio in Madison. He began his career at WRST-FM at the University of Wisconsin-Oshkosh and also worked in commercial radio. He is the author of "9XM Talking: WHA Radio and the Wisconsin Idea" (University of Wisconsin Press 2006). He can be reached at davidson@wpr.org

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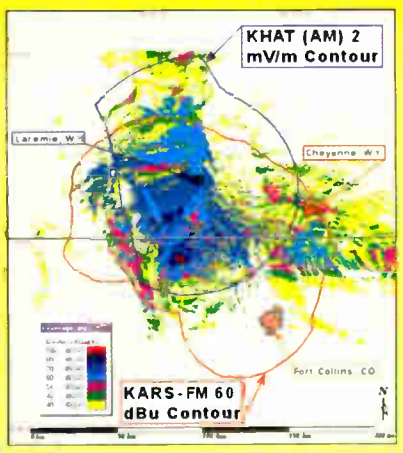

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Studio Guide

by George Zahn

Avoiding Poor Microphone Placement May Be Just a Matter of "Coincidence"

Most radio stations have multiple microphones in each studio. It might be for a "team" show or for guests. However, sometimes you can notice the audio is degraded when more than one microphone is open. George Zahn provides some suggestions on how to prevent that from happening.

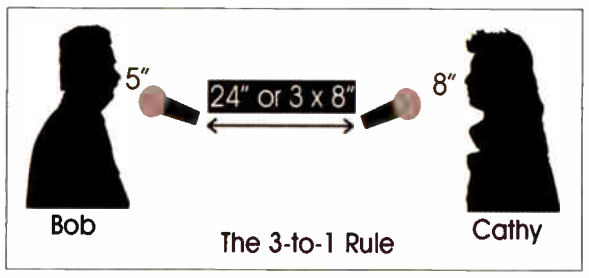
In our most recent discussion of microphones and studios, we considered the issue of phasing – the cancellation of some frequencies as a result of poor microphone placement. This time we want to expand on the concept and demonstrate how to correct some of the problems that may happen to your audio.

TIME DELAY

To quickly recap, when two microphones pick up the same sound at slightly different time intervals, it can wreak havoc on a recording or live broadcast. Audio can be lower in level or sound muffled.

Furthermore, the "3-to-1 Rule" was mentioned as a good guide to placing microphones for capturing interviews or music. When we are using more than one microphone to record or broadcast, the Rule urges that we measure the longest distance from any microphone to its sound source. We multiply that distance by three and be sure that the next closest microphone is that distance away from any other microphone in our mix.

For example, if two people are speaking in an interview, and Bob is five inches away from his microphone while Cathy is eight inches away from her microphone, the two microphones (both unidirectional) should be at least 24 inches (three times eight inches) apart for optimal quality.



This is a great general rule, and it is observed far more in individual miking of musical instruments than in many cases for talk shows and studio discussion. But the next time you are working in an interview situation, "eyeball" the distances. I bet you will see that the best sounding studios follow the 3-to-1 Rule.

DEALING WITH THE "ANIMATED" SPEAKER

There are other phasing battles arising from improper microphone placement. A common problem found in PA and in some broadcast situations is using multiple microphones to cover a speaker at a podium.

If you have a particularly animated speaker who tends to move around while presenting, putting one microphone in the center of the podium may not work well, instead creating dramatic changes in audio levels as the speaker alters his/her distance from the centrally located microphone. How would you solve that mystery of getting better audio in this situation?

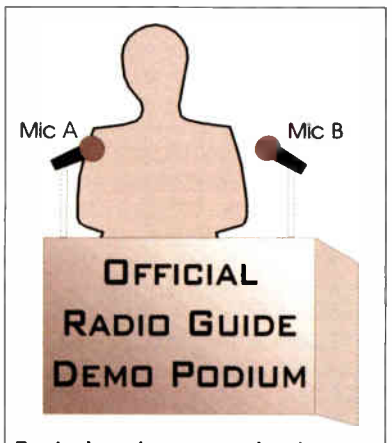
One of the most common solutions is for a unidirectional microphone to placed on either side of the podium, with the idea that the speaker will be "covered" no matter where he/she moves. The microphones then are placed approximately one to two feet apart.

AN OLD PROBLEM PHASES IN

Problem solved? Well, yes, the original problem is taken care of. You will be sure to have better coverage of the person speaking at the podium. But you have created another dilemma, bringing us back to phase cancellation.

The fact that the microphones in this case are separated can create time differences between when the speaker's words hit the two microphones. When you mix the audio of the two separated microphones together, you get phasing because there is a slight time difference between when the voice hits each of the two different microphones.

But they are only a few feet apart. How can that be such a big issue? To understand this, you need a quick understanding of wavelength.



Dual microphones can develop major problems with a speaker who moves a lot.

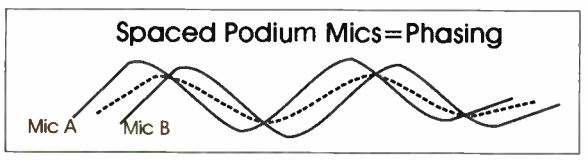
HOW IT HAPPENS

Sound entering the microphones is converted into audio waves which are analogous to the original sound.

The wavelength of a bass frequency can reach up to ten feet or more in length, but the wavelength of an "S" or a "T" sound that we make when speaking can be as short as an inch or less.

To determine the wavelength, simply divide the speed of sound (1130 ft/second) by the frequency. For example, a bass frequency of 113 Hz would have a wavelength of 10 feet, 1130 Hz would be a one-foot wavelength. Most sibilance, the core of our voice intelligibility is around 4000 Hz, which has a wavelength of just a few inches.

The podium diagram shows a speaker at a podium with two spaced microphones. Note that the speaker is a bit closer to Mic A than to Mic B. The sound hitting the microphones at two slightly different intervals creates the phase effect shown below.



Mic A and Mic B are picking up the same sound, but audio from Mic A enters the mixer just a hair earlier than audio from Mic B. The result is a washed out or phased signal (the difference between the signals from Mic A and Mic B), represented by the dotted line. Note that dotted line never reaches the same peak amplitude from Mic A or B. (This is a highly simplified wave form graphic, but it gets the point across).

The result is that a slight movement between two microphones spaced a few feet apart creates a "comb filtering" effect in which frequencies start to cancel depending on the time interval the sound is hitting the microphones.

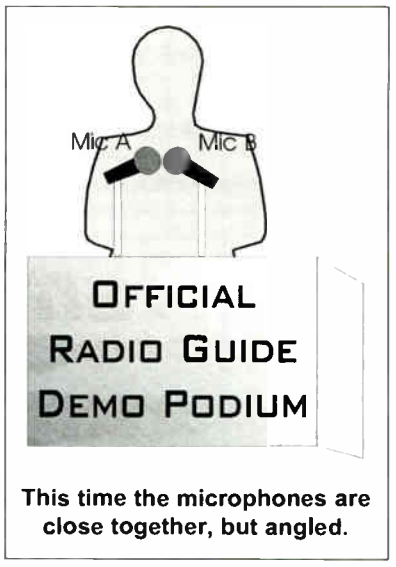
Higher frequencies have shorter wavelengths, hence are more "corruptible" by phasing than bass wavelengths. This is why the voice sounds washed out and "lispy" when heard on microphones that are spaced apart.

Thus we conclude that "spaced microphones" at the podium is not an acceptable solution. We still have not solved the problem.

COINCIDENT, MY DEAR WATSON

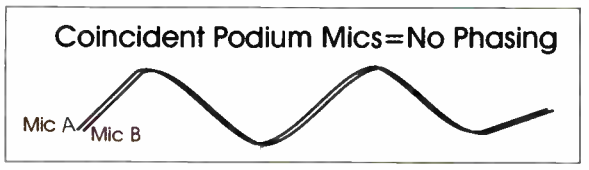
We can still cover both sides of the podium, but approach it differently. Let us move the two unidirectional microphones to the center of the podium with their capsules virtually touching at approximately a 45-degree angle.

This is the same podium with coincident microphone placement. One microphone is covering the left side of the podium, the other the right side. Yet the two individual microphones are now basically "coincident" meaning in the same place and time. Ah! Time – *that* is the key.



This time the microphones are close together, but angled.

The two microphones now effectively cover the same area, but because the capsules are basically in the same time/location, there effectively will be no real time difference between the sound hitting each of the two microphones. This eliminates potential frequency cancellation and prevents the loss of intelligibility in the sibilance range of human speech.



EXPANDED APPLICATION OF COINCIDENCE

The theory of coincident miking also has larger applications. The most stressful application is with large groups of microphones, such as live music recording with a large chorus or an orchestra.

For those who may be facing the broadcast or recording of a large chorus or an orchestra, you would likely agree that giving every singer in a 100-person choir individual microphones and then trying to mix group and control the musical dynamics would be an impossible task. Similarly, an orchestra is never miked individually by instrument. It is an unmanageable situation. However, there are solutions and we will address them in a future article.

We hope you have learned a little about battling microphone phasing. The biggest hurdle is simply being aware of what phasing sounds like and how you can protect your listeners from it. It really is not a "coincidence" that great audio comes from great microphone placement!

What are your favorite microphones? Why do you say so? Let me know what has worked best – or the worst – for you. Send your email to George Zahn at gzahn@lifesphere.org

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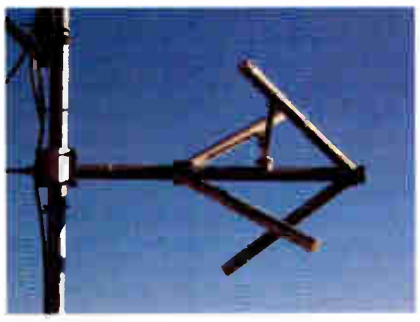

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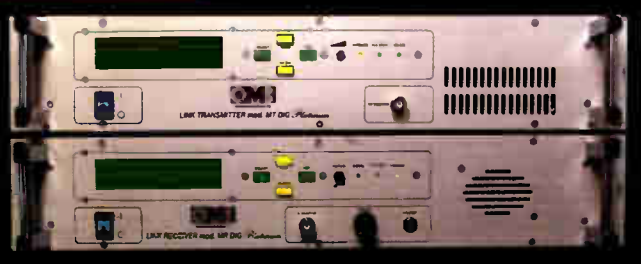

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Practical Engineering

Tracking a Rogue Signal

by Dick Kruse

As Chief Engineer of KEEY-FM 102.1 MHz (and AM 1400 kHz), I also helped maintain the WLOL-FM, 91.1 MHz transmitter, located in the same building. The stations were among more than 40 other AM and FM radio stations in the Twin Cities area near the Mississippi River between downtown Minneapolis and St. Paul, Minnesota.

One bright, sunny, summer day in 1972, while walking from my car to the KEEY-FM studio/transmitter site, it was hard to miss the florescent orange DC-3 airplane flying tight circles around our 420 foot tower at about 500 feet of altitude, but promptly forgot about it as the plane droned out of sight after a few minutes.

Later that day Mr. Harold Allen, the FCC Engineer-in-Charge of the district appeared at the station's office and asked for me. A quaking secretary found me in the shop and led him in. In a gruff voice the EIC said, "They're getting your station on the Air-to-Ground frequency of 122.95 MHz down at the (international) airport. It's not coming from here though. Fix it!" He turned and left, with nary a glance at my transmitting plant.

TRACKING THE PROBLEM

At the time, KEEY-FM and WLOL-FM had antennas on opposite tower faces of our tower. A quick check showed the traps were working properly, with no unusual hot spots to hint of trouble.

One of the announcers, an airplane nut, had a VHF portable radio with all of the aircraft frequencies and a directional antenna. He lent it to me saying, "Good Hunting." Sure enough, there we were on 122.95 MHz but, as the FCC engineer had said, it did not look like it was coming from our station location.

In true "Hidden Transmitter Hunt" fashion, reminiscent of my early ham radio days, I grabbed a map of the area, compass and straight edge, jumped into my car, and drove to a point a mile or so away from the station.

I took a fix and with the straight edge, drew a line on my map on the heading of the signal. I drove to another point a couple of miles away, took another fix, and drew another line on my map.

THE SOURCE IS LOCATED

At the intersection of the two lines, I found myself on a residential street corner, about a half-block east of a small college campus. "Ha!" I thought, "the students are bootlegging on the campus."

However, as I left the corner, walking towards the college, the signal strength went down. Retreating back towards the corner house brought the signal strength back up. The house, about 40 years old, had a nice yard (and large barking dog) fenced in with a chain link fence. As I walked each way from the corner in each direction, I found the signal level dropped.

Finally, as I brought the radio near the North-South face of the fence, there was little doubt as to the source of the VHF signal. As I shook the fence violently, the growling barking dog got louder and the VHF signal disappeared.

SOLVING THE PROBLEM

The house and fence were located about 3.5 miles almost straight north of the International Airport and about two miles southeast of the station.

What happened was the strong radio signals were received by the fence, detected in the corroded or oxidized chain link joints, mixed, and then the sum and difference frequencies were re-radiated – in this case on 122.95 MHz, the Air-to-Ground frequency!

Once located, shaking the fence broke down the corroded joints where each wire crossed the others, stopping the detection and re-radiation process.

A SIMILAR ISSUE

Many years later, I was teaching the subject of Radio Communications at a local prestige technical school. During the Antennas, Transmission Lines, and Propagation week, I recounted to my class the adventure with the Air-to-Ground interference coming from a fence.

Suddenly, Tony, another instructor sitting in on my class preparing to teach it, slapped his knee, jumped up, and hurried out of the room.

He later told me he had recently put KQQL-FM, a Class C FM station, on the air and was getting complaints of serious television interference from nearby residents. His investigations indicated that the interference was not coming from his transmitter – and my lecture provided him with an idea that he wanted to try right away.

OLD SOLUTION WORKS AGAIN

Tony already had his tower sections re-welded at great expense, but to no avail. Using a portable TV, he tracked the interference to some nearby utility power poles using a big, heavy hammer, with which he struck each pole while watching the nearby portable TV.

The problem was further traced to the clamps holding the power pole ground wires inside the metal shield. The power company was called and, under his supervision, cleaned and bonded each of the offending oxidized joints. The TVI was eliminated.

This type of detection and re-radiation can occur in any rain gutter, down spout, barbed wire, or chain link fence. It can occur in almost any metal object that is in a strong RF field. (In very strong AM RF fields, you may even hear the AM station's modulation!) Since these are non-linear signals they will be rich in harmonic energy and may find their way to a VHF receiver near you.

Dick Kruse retired after 35 years in the broadcast industry. Contact him at dkruse0@yahoo.com

Maintenance Guide

by Richard H. Wood

Infrared Imaging Helps Find RF Noise

Troubleshooting transmission systems sometimes requires us to use tools that are unfamiliar or even to bring in someone with specialized gear. As Richard Wood points out, being able to pinpoint the problem rapidly can save a lot of time and money, especially when a tower crew is involved.

As we all are aware, with the new digital gear comes a new set of challenges. Recently I received a request from WXPR-FM, a Northern Wisconsin FM station, to help locate a source of RF noise.

AN ELUSIVE RFI GENERATOR

The station had upgraded their RF chain to include an analog and HD interleaved antenna and an all digital STL system.

When the station was running at full power, 100 kW ERP for the analog, the bit error rate on the STL receiver would intermittently increase causing the audio to sound like a skipping CD. At 50% output, the interference would not occur.

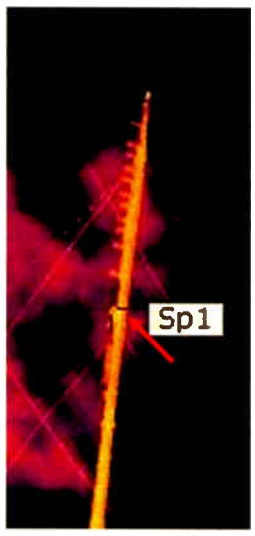
The source of the problem is somewhere up there.

Due to the nature of RFI, diagnosing the problem took many hours of checking the signal chain to determine that the source was on the tower. A crew was sent up to the antenna and looked for any signs of arcing and tightened anything that appeared loose or had incidental contact to the tower. The interference did not reappear immediately but, over time, full power operation was not possible.

USING A FULL SPECTRUM OF TOOLS

The station engineer was hoping I would go up the tower in an RF hot suit while the antenna was running at full power to look for arcing activity. Past experience has shown this procedure to be a long shot at best.

As diagnostic tools, I brought a FLIR long wave Infrared (IR) camera and IFR Spectrum Analyzer, along with an external vertical antenna. After setting up with a 45-degree look angle, I watched the tower at half power with the IR camera, while a second person monitored the spectrum analyzer for noise in the area of the STL frequency. We noted no unusual readings.



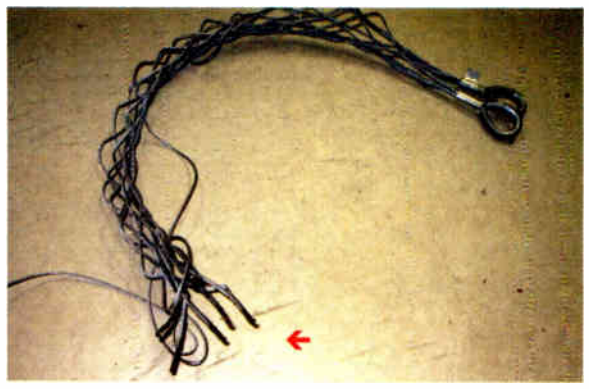
Using Infrared, a hot spot was located on the tower adjacent to the STL dish.

Then, the station's engineer raised the power to full output and, within minutes, both the camera and the analyzer were showing intermittent signals. The IR photo shows the area. The arrow indicates the maximum heating at a point on the tower near the STL antenna, which is mounted just below the FM antenna.

With the station running at reduced power, a climber went up the tower. By watching his heat signature, I was able to direct him to the problem area.

DIRECTED INSPECTION

He was instructed to pay close attention to items that might have incidental contact, such as the connector on the end of the STL line, and look for any cable hoisting grips in that vicinity. His report was that the line connector was in the clear, but a hoist grip for the 1-5/8 inch digital transmission line showed signs of arcing.



A hoist grip proved to be the source of the problem.

This hoist grip was removed and a new jumper was installed on the STL line, just as a matter of course.

When the climber was again situated well below the antenna, the station was put on-line at full power. The STL bit error rate and the IR camera showed no indications of arcing. The transmitter was then raised to 110% and again the camera and STL bit error rate were observed. We were happy to see that the arcing did not return.

WHY IR INSPECTION MAKES SENSE

Each tower with high-powered antennas has the potential for creating RFI noise. Sometimes this noise leads to issues with other tower users or nearby RF systems.

This type of interference has a mind of its own and is intermittent at best. Variations in wind and moisture can cause the interference to increase and decrease, making troubleshooting problematic without the right tools. Years ago, I spent many hours trying to find the source of RFI noise on a tower, without the aid of an IR camera. Experience has shown me how much quicker and easier such tracking can be using IR.

Under the FCC Rules, Parts 73.317 and 73.318, it is the broadcast licensee's responsibility to eliminate spurious emissions that are a direct result of the broadcast signal. In the case of WXPR it appeared they were only interfering with their own operations. However, if harmful interference is caused to other users, this can lead to some significant legal ramifications. The bottom line is the station whose carrier is causing the interference is responsible to eliminate the problem.

Richard H. Wood is the President of Resonant Results, LTD in Cottage Grove, WI. He can be reached at rwoodsky@verizon.net

The Worst I've Ever Seen

A Visual Display of the Good, the Bad, and the Plain Hard-to-Believe

The Mother of All Backup Generators

No one can deny that having a generator to provide a little backup power can save the day during a power outage caused by a storm or some other problem. But this one ... well, take a look:

Perhaps you have seen some large generators in use at different transmitter sites. However, visitors walking into the generator room at the Diesel House Museum in Copenhagen, Denmark encounter a generator that is almost hard to believe.

Built in 1932, this generator was used by the Copenhagen municipality to generate up to 15,000 kilowatts of power. It was the largest diesel engine in the world when it was built – and for the next 30 years. Mark Humphrey shares this picture of the big lady:

The 15 MW generator at Diesel House in Copenhagen.

It has been officially decommissioned since 2003. However, they still start it on the first Sunday of each month.

By the way, in case the enormity of this generator has not quite sunk in as yet, notice the doorway on the left side of the picture. It sort of puts things in perspective.

The engine is a double-acting two-stroke crosshead engine with the following specs:

Production Name: DM884WS-150
Production Year: 1932
Output: 15,000 kW, 22,500 horsepower
Revolutions: 115 per minute
Engine Size: 8 cylinders
Cylinder Diameter: 840 mm (33 inches)
Stroke: 1,500 mm (59 inches)
Fuel Consumption: 2,880 liters per hour (761 gal)
Weight: 1,400 tons
Size: 24.5 meters long, 12.5 meters high (80' x 40')

Want to see this beauty in action? Browse over to http://www.dieselhouse.dk/index_uk.html Click on "The large engine" at the bottom of the page. (Notice where the operator's position is situated.)

NEW!

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Inovonics has packaged four channels of smooth-sounding audio leveling into a single rack space. The four channels may be used separately for microphone and phone-line leveling, or may be selectively linked for dual-stereo or split mono/stereo program audio control.

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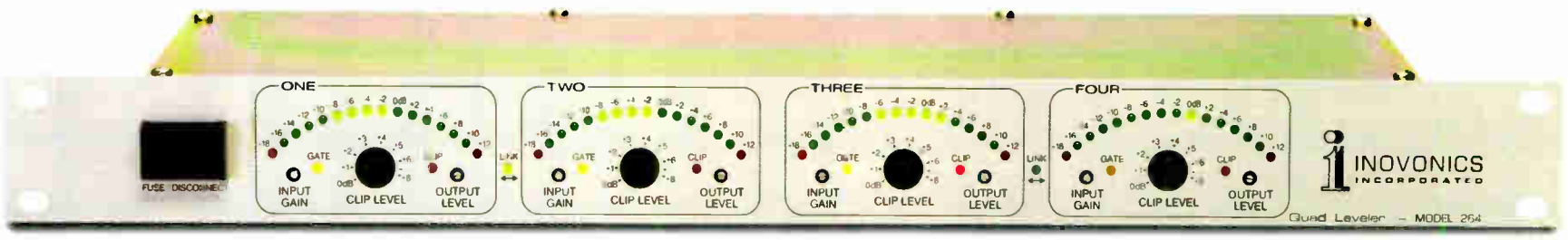
Operation of the 264 is entirely program controlled, and user adjustments have been restricted to a bare minimum for quick, set-and-forget installation. Operating entirely within the analog domain, the 264 utilizes colorless Class-D (PWM) technology for stable and transparent operation.

The 264 also provides alarm tally outputs to signal a 'dead air' or out-of-limits condition for each of the four channels.

Model 264 – $1200

only $300 per channel!



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by Greg Friesen, DragonWave

Common Unlicensed Link Interference Issues and Ways to Harden the Systems

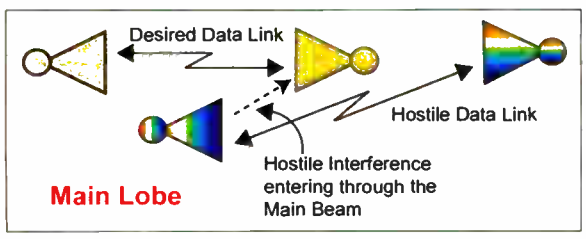
Finding frequencies in the 950 MHz band is difficult in many areas, forcing stations to seek alternatives, including the use of the unlicensed areas in the 2.4 GHz and 5.8 GHz bands. Greg Friesen discusses some approaches to reduce or eliminate concern over possible interference from other users.

A vast number of unlicensed systems have been deployed over the past few years to provide low-cost, high data throughput links. However, many of these unlicensed bands, such 2.4 GHz and 5.8 GHz, have become cluttered with multi-point, point-to-point and consumer devices, such as cordless phones, wireless LANs, and garage door openers.

There are two types of interference that may have to be handled: static interference and dynamic interference.

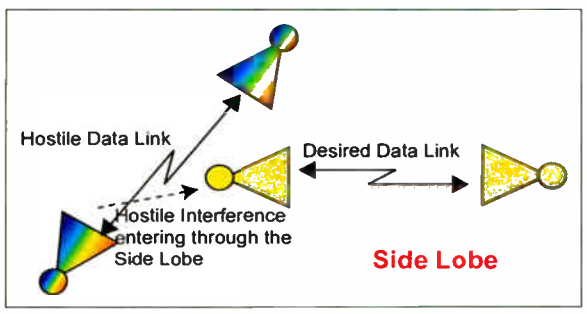
STATIC INTERFERENCE

Static interference is caused from static sources such as point-to-point links, multi-point systems, wireless LANs. The figures show these three common scenarios that cause static interference:



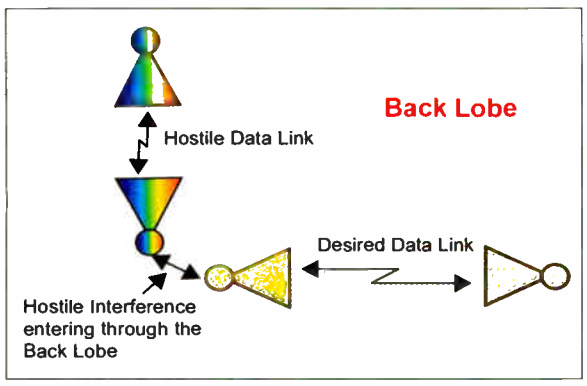
• **Main Lobe Interference:**

The interfering source is within the main beam. This can cause throughput and availability reduction at distances up to 100 km away. As the source gets closer, throughput gets further reduced, until it may not be possible to establish a link.



• **Side Lobe Interference:**

The hostile transmitter can be within 10 km and still be a source of interference reducing throughput and availability.



• **Back Lobe Interference:**

The hostile emitter can be within a 1 km circle and still be a possible source of interference which may cause data rate reduction. This is much larger than any roof-top, making co-location of links potentially problematic.

Most commonly there are multiple instances of all three sources combined to result in the entire interference scenario.

EFFECTS TO THE LINK

Sometimes this interference can be coordinated against. However, the large amount of ambient interference makes it very difficult to find a channel in the unlicensed bands. If a link can be established, there will often be reduced receive levels. This will result in a link with the following characteristics:

• **Reduced Throughput** – The link will have to reduce modulation to cope with interference. This results in reduced throughput and can take a 30 Mbps link down to a few Mbps throughput.

• **Reduced Availability** – Static interference will reduce the fade margin and therefore the resistance to dynamic fade events such as rain or dynamic interference. This will drastically reduce the link availability.

If acceptable performance can be achieved, there is still large future risk that additional static sources will be added, which can further reduce the performance of the link or cause the system to be unusable. The operator's only recourse is to send a technician to the area to do a frequency sweep and try to identify the interfering source – and co-ordinate with that interferer – or find an alternate channel.

DYNAMIC INTERFERENCE

The other source of interference is dynamic interference, which is even more difficult to deal with. Dynamic interference is caused from sources such as cordless phones, baby monitors, garage door openers, and key fobs.

These sources are constantly changing and therefore can not be coordinated against. As these sources cause interference, they can cause loss of service, reduced bandwidth, and increased delay and jitter. This makes it impossible to guarantee a signal's availability and throughput.

OPTIONS

There are a number of options to handle interference in these systems. The first can be to deploy gear in the new low-interference unlicensed bands, such as the 24 GHz ISM band, which provides the rapid, low-cost characteristics of the 5.8 GHz band without the interference.

The following characteristics help avoid many of the problems of the 5.8/2.4 GHz bands:

• The 24 GHz ISM Band is limited only to point-to-point microwave and medical uses.

• There are tight beamwidth limitations, resulting in only very narrow sources.

• Strict power limitations prevent the drowning out of other links.

The combination of these characteristics, make the 24 GHz ISM band well-suited for last mile application with ranges under five miles. This range is due to the output power restrictions of the band. Rain fade in some areas may further reduce the range.

LICENSED SYSTEMS

Deploying licensed systems (in the 11 - 38 GHz bands) is also becoming a more attractive option, as licensing costs and lead times are being reduced. Additionally, the cost of licensed equipment is rapidly becoming more affordable.

A license in the common carrier bands in the United States costs less than $3,500 for a 10 year license and can be acquired on per link basis. Licensing times are typically 30 days. For wider deployments, area licenses such as 28 and 38 GHz can often be acquired from 3rd party license holders, at comparable costs. In addition, licensed systems offer extended ranges of up to 50 miles.

Both licensed and 24 GHz unlicensed systems offer the following additional system benefits vs. an unlicensed 2.4 or 5.8 GHz system:

• Increased Capacity – Up to 500 Mbps full duplex committed information rates.

• No capacity variability.

• Ultra-low delay – 0.1 ms per link latency vs. seconds of latency with 2.4/5.8 GHz.

• Zero delay variability.

• Very deterministic and high availability – availability can be calculated, well understood, and reliably engineered at commissioning.

COST COMPARISON

Although there is a small initial cost-premium for a licensed link, in the long term it becomes much more cost-effective.

It avoids the cost of a future replacement link, troubleshooting costs, and time and manpower to replace the existing link. More importantly, in the long run it ensures better, stable system performance with reduced outages. A typical cost curve is shown here.

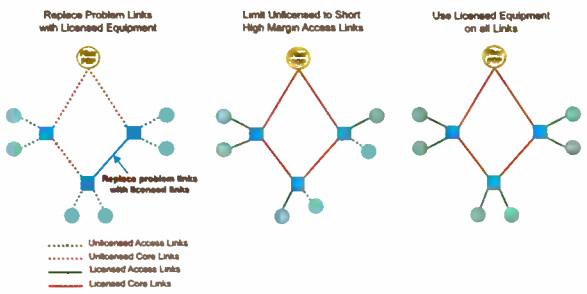
Unlicensed solutions have low initial cost, but typically a higher long-term cost when operations and interference are accounted for.

Cost Comparison for Interference Mitigation

HARDENING AN UNLICENSED SYSTEM

In many cases, including feeding several transmitter sites, a hybrid system may make the most sense. Using licensed systems in the core can eliminate self-interference and can also extend the size of the core, enabling smaller access cells, which are less prone to interference. Either the 24 GHz ISM band or a licensed system can be used to harden the 2.4 and 5.8 GHz unlicensed systems.

There are three common deployment options to harden an unlicensed system:



• Replace unlicensed links with licensed links as they become degraded by interference. This is a reactive approach which is quite expensive and results in poor system quality until the fix is implemented.

• Deploy licensed links in the core system and use unlicensed links on short access links with low interference and more than ample fade margin. This is an approach which results in medium service quality, but will still be prone to some interference on access links that have been deployed with 2.4 and 5.8 GHz systems.

• Utilize a 100% licensed system. This arrangement will result in the highest quality services with minimal outages. This will allow reliable service levels of availability, delay, and throughput.

SUMMARY

These options present a variety of solutions to handling interference. The chosen solution will depend on how much equipment has been deployed, required service levels, budget, 2.4 and 5.8 GHz use in the area, and desired throughput.

The good news is that interference issues can be solved without a large cost premium. In addition, with proper planning, a high-quality system can be deployed from day one, avoiding future unnecessary costs and maximizing system performance.

Greg Friesen is the Director of Product Management at DragonWave Inc. in Ottawa, Canada. Greg can be contacted at gfriesen@dragonwaveinc.com

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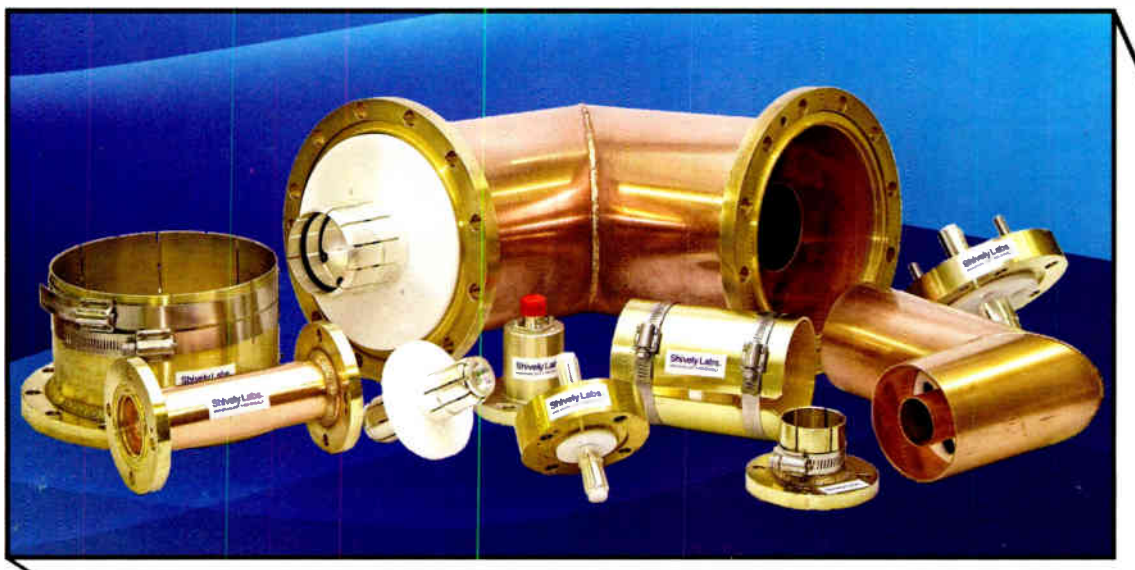

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Transmission Guide

by Phil Alexander

The *Radio Guide* Transmission Seminar

For three days last month, a group of engineers meet in Orlando, Florida to enjoy a unique opportunity to learn many of the ins and outs of AM Transmission.

The meeting, the first ***Radio Guide*** **AM Transmission Seminar** was held February 14-16 near the Main Gate to Disney World. The attendees and sponsors all agreed the program was a success and had given them even more of an education about AM systems than they had expected.

SEEING A NEED

It all began with a phone call from Alan Alsobrook, a fellow ***Radio Guide*** writer. He caught me in the office on a late summer night last year while I was trying to clear my e-mail inbox.

Alan and I often bat technical topics around in the wee hours of the morning as he travels around Florida, working on various stations. We both share an interest in AM and usually chew over the latest problem one of us has found. This time, however, his question was not about one of the usual tech topics.

"It sure seems like there are a lot of folks out there that do not really understand AM networks and transmission. What would you think about us doing a program on it?" I think he also mentioned doing it during the winter, when my part of the world is frigid, saying something about balmy weather in Florida being a nice break from the snow of the mid-west. It was a point with which I could not argue.

We talked a few more times about the basic idea of a program that would be useful for engineers wanting to add AM systems to their primary FM and audio experience/skill set, traded a few e-mails, and soon our intrepid Editor had ***Radio Guide*** fully involved to coordinate and sponsor the event.

GETTING IT TOGETHER

While Alan searched for a venue with a good-sized meeting room and reasonable overnight hotel rates, I began working on a rough outline of topics for the program. In August, Ron Rackley agreed to join in for a day and help us with his keen insight into directional antenna systems. His support would be exactly what we needed to fully answer the DA questions the group generated.

After the first ad for the seminar appeared in the November 2006 ***Radio Guide*** registrations began to arrive and before long we were sold out with a waiting list. That surprised me a bit, because I am always hearing how AM is dying and no one seems to be interested.

Fast forward to February 10th. As with most such projects, the program was not completely finished, but most of it was workable. Alan has this shop that houses a collection of all the stuff anyone working with AM could ever want, so a dash to Jacksonville allowed me to spend a few days with Alan, put some finishing touches on the program, taking pictures we could edit into Power Point slides, and head on to Orlando.

FILLING THE NEED

For the Seminar, we had built a program which progressed from basic electrical laws and circuit components to RF networks and how to tune them, then onward to the networks of directional antenna systems.

The pictures from Alan's shop helped visualize all the components represented by the symbols on schematic slides and made many things clearer for the attendees. Special attention was paid to the Antenna Tuning Units found at the base of every AM tower. Phasetek kindly supplied us with two T Networks, ensuring that everyone could see exactly what made the impedance and phase transformations in their system.

Anritsu Company kindly brought their new 2721B Spectrum Analyzer and Gary Minker of Radio Works RF Consulting came with his test gear, including a network analyzer. Along with the various components, signal generators, bridges, and analyzers brought by the instructors, we had a room full of nearly everything needed for looking at an AM system.

MAXIMIZING THE TIME AVAILABLE

All this was a lot to cover in only three days, making the course very concentrated, but we were able to get everything included by scheduling evening lab sessions for the actual hands-on work with networks and additional one-on-one sessions. This way we managed to telescope nearly four days of work into three very full days.

When Alan and I arrived at the seminar site Tuesday afternoon, we were pleased to see our intrepid Editor (Barry) had the situation well in hand. He had set up the conference room with a projector for the

(Continued on Page 30)

"My Number One Codec Rental is Zephyr Xstream"

-Steve Kirsch, President Silver Lake Audio

"When ISDN equipment rentals began in the early 1990s, we started with an equal number of different companies' codecs. Today, Silver Lake has over 100 Zephyrs in stock, ten times more than any other brand." says Steve Kirsch, owner of Silver Lake Audio.

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Transmission Guide

by Phil Alexander

Continued from Page 28

computers and a video camera so we could show close-ups of the demonstrations. This way, everyone had a "front row seat."

On Wednesday morning, the room was full. (Three people could not make it down, due to airline cancellations.) After we overcame a few butterflies in our stomachs, the program started to flow more or less as originally envisioned.

Alan Alsobrook (r) discussing field strength measurements. Phil Alexander is seated at the left of the screen.

As we went along, everything seemed to fall into place, and the questions from the group indicated we were hitting the right topics.

AUDIENCE APPRECIATION

At most of the programs I have attended there always seem to be people wandering in and out of the room, taking cell phone calls, checking on the problems left at home, etc.

But during our presentations, there seemed to be almost none of this, just intense concentration and very good questions on the part of the audience. A quick survey confirmed that relatively few trouble calls had come during the program.

One point that was especially satisfying was a comment by one of the group Thursday evening that he had gained enough knowledge in the first two days alone to save his employer thousands of dollars by preventing mistakes in a project they now had in the planning stages.

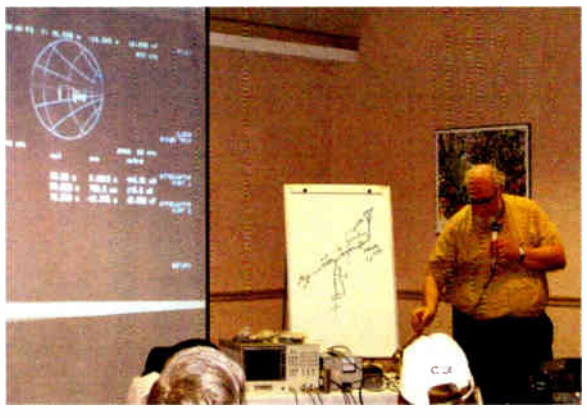
Another thing that stands out is the amazing ability of Ron Rackley. Ron arrived Thursday afternoon. After the session ended, asked what we wanted him to do the next day. I told him I thought a working demonstration of his directional antenna measurement system would be very interesting. I also asked if perhaps he could help us with the pattern bandwidth item on our agenda. Ron said he would see what he could put together.

DA TOPICS COVERED

The next morning he had a complete presentation on pattern bandwidth showing the reasons DA patterns do not necessarily perform the same way at sideband frequencies as they do at carrier frequency and examples of changes that can be made to correct the problem. I thought it was as comprehensive an explanation of the problem as I have ever seen.

The amazing thing was that Ron did it all in about two hours before breakfast Friday morning. It was easy to see the joy Ron Rackley gets from sharing his knowledge of AM networks.

During the question and answer session we had a lull in questions from the audience so I asked him for an explanation of skirted unipole radiators. That led to about fifteen minutes of one of the clearest discussions of the value of skirted radiators – and some of the fallacies that surround them – clearly showing why a high skirt impedance does not automatically translate to better radiation and coverage.



Ron Rackley demonstrated how a network analyzer can display and help solve problems.

LOOKING BACK

We really appreciate the great support the Seminar received from Phasetek, Anritsu, and Radio Works RF Consulting. In addition to the equipment demonstrated, these companies, along with Continental Electronics, rfSoftware, and SystemsStore provided lunches and refreshments during the Seminar. No one walked away hungry or thirsty!

As the program concluded, a few things were clear. There is no question that there is a high interest in learning more about AM engineering and that the program we put together – even with the glitches that are almost inevitable in a first attempt – helps fill that need.

Judging from the reaction of those in attendance, as well as those who have contacted us afterward, the first ***Radio Guide* AM Transmission Seminar** will not be the last. Stay tuned to ***RG*** for more information.

Details about next AM Transmission Seminar may be found at: www.radio-guide.com/seminar

Feature packed.

(Kind of like our ads.)

Go (con)figure • The folks at MPR say they really love being able to configure and administer an entire building full of consoles and routing equipment from the comfort of their own offices. Put an Internet gateway in your Axia network and you can even log into Element (or any other part of an Axia system) remotely from home — where there's plenty of Cheetos and Pepsi. Great for handling those 6 P.M. Sunday "help me!" phone calls from the new weekend jock.

Who are these guys? • ... from Axia? Element was designed by ... team of ex P... Engineers ... who know ... and Axia is a division of Telos, the D... P... people.

Perfect timing • You can't have too much time. That's why Element's control display contains **four different chronometers**: a digital time-of-day readout that you can slave to an NTP (Network Time Protocol) server, an elapsed-time event timer, an adjustable countdown timer... and there's also that big, honkin' analog clock in the center of the screen (Big Ben chimes not included).

Screen play • Use any display screen you choose, to suit your space and decor. Get a space-saving 12" LCD or ... big 21" monster. (This is Dave Ramsey's favorite Element feature, by the way. Anyone want to bet he bought his ...)

Lovely Rita • LED program meters? How 1990's. SVGA display has lots of room for timers, meters, annunciators and more — enough to show meters for all four main buses at once. Reboot to 5.1 surround mode and the light show is even cooler, with surround audio and associated stereo mixes all going at once.

Memory enhancer • We know how forgetful jocks can be. That's why Element remembers their favorite settings for them. Element's Show Profiles are like a "snapshot" that saves sources, voice processing settings, monitor assignments and more for **instant recall**. Profiles are easy to make, too: just have talent set up the board the way they like it, then capture their preferences with a single click for later use. (Hey, make *them* do some work for a change.)

Black velvet • Some things **just feel right**. Like our premium, silky-smooth conductive plastic faders and aircraft quality switches. We build Element consoles with the most durable, reliable components in the industry — then we add special touches, like custom-molded plastic bezels that protect on/off switches from accidental activation and impact. Because we know how rough jocks can be on equipment. And nothing's more embarrassing than a sudden case of *broadcastus interruptus*.

Swap meet • Element modules hot-swap easily. In fact, the **entire console** hot-swaps — unplug it and audio keeps going; an external Studio Engine does all the mixing.

Split decision • No, you're not seeing double: Element gives you the choice of single frame or split frame configurations of **up to 40 faders**. Perfect for complicated talk or morning shows where the producer wants his own mini mixer, or to give talent space for copy, newspapers and such. Solomon would be proud.

Stage hook • This button activates the emergency ejector seat. OK, not really. It's the Record Mode key; when you press it, Element is instantly ready to record off-air phone bits, interviews with guest callers, or remote talent drop-ins. One button press starts your record device, configures an off-air mix minus and sends a split feed (host on one side, guest on the other) to the record bus. Like nearly everything about Element, Record Mode is **completely configurable** — its behavior can even be customized for individual jocks. Sweeeet.

How many? • How many engineers does it take to change these light bulbs? None... they're LEDs.

Talk to me • Need some one-on-one time with your talent? Talk to studio guests, remote talent, phone callers — **talk back to anyone** just by pushing a button.

The Busy Box for jocks • Element comes standard with a lot of cool production room goodies you'd pay extra for with other consoles, like per-fader EQ, aux sends and returns and custom voice processing by Omnia®, enabling you to quickly build and capture compression, noise gating and de-essing combinations for **each and every jock** that load automatically when they recall their personal Show Profiles. Context-sensitive SoftKnobs let production gurus easily tweak these settings, while simultaneously satisfying their tactile fixations. (Don't worry: for on-air use, you can turn off access to all that EQ stuff.)

Missing features • Did we forget something? Program these **custom button panels** with any macro you want, from recorder start/stop to one-touch activation of complex routing and scene changes using PathfinderPC™ software. You could probably even program one to start the coffee machine (black, no sugar, thanks).

Mix-plus • If constructing a complicated mix minus on the fly brings a big grin to your face, you're excused. But if you're like us, you'll love the fact that Element does mix minus **automagically**. Forget using all your buses for a four-person call-in, or scrambling ... last-minute interviews. When you put remote codecs or phone calls on air, Element figures out who should hear what and gives it to them ... as many custom mix minus ... faders.

Great Phones • With Element, jocks never have to take their eyes or hands off the board to use the phones. Element works with any phone system, but really clicks with the Telos Series 2101, TWOx12, and new NX-12 that connects four hybrids plus control with a **single Ethernet cable**. Status Symbols (cool little information icons) ... at a glance whether a line is in use, busy, pre-screened ... on air ... Even dial out with the built-in keypad.

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Element

Shown: 16-position split-frame Element, nicely equipped, $12,558.00 U.S. MSRP. Not shown but available: 4-, 8-, 12-, 16-, 24- and 28-position Element. Dual exhaust and whitewalls optional at extra cost.

Tower Guide

by Scott Cason

Replacing Incandescent Lamps with LEDs

In 1998, I worked with the city of Macon Georgia in the city's traffic signal shop. While I was there, we heard whispers and rumors that – some day – LEDs would be used in the signal heads and that maintenance costs for the new signals would drop like a rock.

THE LED AGE ARRIVES

Seven years later there has been an explosion of LED lighting technology and not just in traffic signals. You see them in cars and truck taillights, aircraft and airport navigation lights, lights on emergency and law enforcement vehicles, and from flashlights to lanterns. They are everywhere.

The Commonwealth of Kentucky just completed a multi-million dollar project to replace all the incandescent traffic signals with LEDs. The difference is astounding; LED traffic signals are brighter, since they fill the entire red, amber or green face. LEDs also last longer – keeping maintenance people out of traffic and reducing traffic tie-ups. Kentucky officials expect to see a conversion savings of $1.6 million per year on power and yet another $1.5 million per year on maintenance.

With such potential savings, LEDs are starting to take over the market for obstruction lighting on towers and other related broadcast areas, just as with traffic signals.

COMPARING POWER LOADS

LEDs are just as attractive to tower owners for the same reasons that Kentucky replaced all of their incandescent traffic signals – the cost effectiveness of LEDs over incandescent lightning.

LEDs draw less current for the same amount of light, therefore lowering the electric bill. In fact, LED beacons on the market now consume only 10% of the energy needed to light an incandescent beacon.

For example, a typical incandescent beacon running two 620-watt lights at 120 Volts uses 10.3 Amps. An LED beacon with the same lumens as the incandescent beacon will only use 1.2 Amps. Figure a tall television tower with five beacon fixtures at three levels and the cost savings add up rapidly.

And, that is not counting the sidelights. Plus, as the LED lamps draw less current, you can use a smaller gauge wire, reducing tower loading.

MAINTENANCE CONSIDERATIONS

LEDs also have lower maintenance costs. While incandescent lamps may last about 5,000 hours, LEDs have shown they can last for well over 100,000 hours. Most are guaranteed to maintain FAA specified luminance for a minimum of five years. Imagine having to replace tower lights once every ten years instead of once every other year!

In general, LED fixtures are immune to the environmental issues that kill incandescent systems. Extreme temperatures can damage the glass envelope of an incandescent bulb. Filaments can be damaged by power surges and vibration endured by nearby lightning strikes. Towers located near large bodies of water can suffer corrosion of the contacts due to moisture and salt.

Other advantages to LEDs are that they are clustered tightly inside a beacon or sidelight. Should one fail, the entire fixture will not go dark. LEDs are better focused to direct more of the light where you need it, out the sides of the fixture. Very little, if any, light is wasted out of the top and bottom of the fixture. This makes the light brighter and will stand out in an overcast or hazy sky.

LEDS AND STROBES

Owners of strobe lighting systems also are realizing the cost effectiveness of LED systems over strobe systems. Compared to an incandescent or LED system, a strobe lighting system is complicated and expensive.

There are more parts to fail and strobes seem to be prone to surges due to lightning strikes more than are LED systems are. Additionally, the maintenance of a strobe system also runs several times that of an LED system because parts and labor are much more expensive.

A GOOD TIME TO SWITCH

Incandescent system replacement makes sense when parts for old beacons and sidelights become costly or unobtainable.

Greg Hahn, chief engineer with Cox Radio's Louisville stations, told me he replaced his old incandescent system with an LED system two years ago when parts for the old beacon were no longer available. The beacon and sidelights from Dialite dropped right in place of the old fixtures.

The only change Hahn needed to make was to increase the sensitivity of the beacon current sensor for remote monitoring on his Sine Systems remote control to account for the lower current draw of the LED lamps. He said the power bill has dropped an average of about $50 – and maintenance has dropped to zero.

When about replacing other incandescent lamps, Hahn said, "Yes, it's a no brainer. You ought to switch to solid state everywhere because it's a decision that pays for itself, not only in electricity costs but also in the cost of having the lamps replaced every year or so."

As an aspiring pilot, I could not resist noting Louisville International Airport recently replaced their taxiway lighting with LED fixtures. According to Rande Swann, the airport authority will realize a cost savings of over a million dollars over the next five years due to reduced power consumption and reduced maintenance costs.

I would say that LED technology has been the most explosive technology in a very long time. I do not recall anything else being this well received anywhere, much less by broadcasters. After seeing the low power consumption and near zero maintenance costs, it is perfectly understandable why LEDs have been embraced in nearly every place we need cool, cheap, reliable lighting.

A 15-year veteran broadcast engineer, Scott Cason is a contract engineer based in Louisville, KY. He can be contacted at scott@lagrange-com.com

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Radio History

by Barry Mishkind

A Race in the South

As the year 1922 began, fewer than two dozen authorized "broadcast" stations were on the air. Although most of the fledgling stations were in either New England or California, that "newfangled thing" called radio was starting to be noticed all over the country.

INTEREST STIRS

Wireless enthusiasts scrambled to be among the first in their area to have a piece of the new radiotelephone service. Curiously, in those days, it really was easy to get a license. Essentially, all you had to do as ask for one.

Of course, they needed backing. Getting a useable transmitter was no trivial matter in those days. Equipment was difficult to obtain and not cheap.

But demand was strong. Indeed, before the year 1922 would end, the infant industry of broadcasting would "explode" from one side of the country to the other, with a total of 570 stations being authorized.

RADIO COMES TO GEORGIA

Among those in the southeast who were interested in broadcasting was an ex-Navy man who had served during the First World War as a ship's wireless operator. After discharge, Walter Tison wanted a job doing something he enjoyed and figured he would put his naval experience to work.

Calling on Major John Cohen, Publisher and Editor of the Atlanta Journal, Tison was determined to sell him on the idea of putting a station on the air.

Tison discoursed enthusiastically on the reasons why the Journal should build a radio station. Depending upon which history you read, Cohen was either a quick convert, seeing the potential public service uses for a radio station or, although truly interested, kept putting young Tison on "hold." The truth was likely somewhere in the middle

Walter Tison

John Cohen

Courtesy: www.wsbhistory.com

Of course, this did not happen in a vacuum. The rival newspaper, The Atlanta Constitution was also working on a transmitter, in an attempt to "scoop" their competition.

THE RACE IS ON

Learning that the Constitution was nearly ready, Cohen was determined to get his station on the air first. Equipment was ordered. As the second week of March 1922 ended, both companies had filed requests for licenses for their stations and were eagerly awaiting word from the Department of Commerce in Washington, DC.

The Journal did have one problem: the transmitter manufacturer failed to deliver the unit on time. Expecting their license at any moment, Major Cohen arranged to purchase a transmitter from a local ham and immediately had it installed by Tison and station director George Iler.

Cohen's timing was perfect. A collect telegram arrived on March 15, 1922 and The Journal's new station – WSB – went on the air that very same night, the day before The Atlanta Constitution received its authorization for station WGM.

Being second apparently was an impossible burden for WGM. It was deleted from the Federal List of Broadcast Stations less than a year and a half later, the transmitter donated to Georgia Tech.

ON THE AIR

Pictures of the early transmitters, long before the FCC's Good Engineering Practice (GEP) Rules were put into place, are interesting to see. It is amazing that there was no "epidemic" of electrocuted broadcasters.

Exposed wires, tubes, batteries, generators, microphones, and all sorts of knobs and dials were everywhere. Performers, visitors, engineers, and "Danger!" signs all shared the cramped makeshift studio/transmitter room.

The performer (Alma Gluck) with her head nearly in the transmitter at WSB. Walter Tison (l) and Ephraim Zimbalist look on. Note the "Danger!" sign.

Courtesy: Special Collections Dept., Georgia State University

WSB was not exactly a powerhouse upon its debut. The 100 Watt transmitter was pushed to its limit in transmitting the opening night's programming,. According to an employee, to produce the necessary voltage, "fruit jar chemical rectifiers with a lead and zinc-with-Borax solution" were used.

(Continued on Page 36)

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Radio History

by Barry Mishkind

Continued from Page 34

SODA JERK SAVES RADIO STATION!

According to the story, due to the large current being drawn, the batteries began to "boil over."

Fortunately a drug store was down on the street, five floors below. The Journal staff got the soda jerk to agree to stay open so they could run down periodically for ice, which then was packed in the transmitter to keep it from blowing up. Fortunately, the opening night ceremonies ran out before the ice did.

A cartoon recalls WSB's first night on the air.
Courtesy: www.wsbhistory.com

Radios in the Southeast crackled to life with the greeting "Good evening. This is the Radiophone Broadcasting Station of the Atlanta Journal." Telegrams, letters and telephone calls verified that WSB was being heard from Canada to the Panama Canal.

Not unexpectedly, the Journal ran many stories about its new station, initially eschewing all commercial interests. Even before the Federal Radio Commission issued its mandate for broadcasters to operate in the "public interest, convenience and necessity," official WSB policy was that the "station will be operated purely for the benefit and enjoyment of the public."

VARIETY RADIO FOR THE SOUTHEAST

True to its word, WSB made its microphones available to anyone who sought airtime. And sure enough, as all sorts of Georgians walked though the doors, WSB programs became examples of true variety. Listeners might tune in to enjoy all sorts of things: talks, musical instrumentalists, singing groups, even whistlers.

While there was ample evidence that WSB was being heard around the country, the station primarily wanted to serve the Atlanta area. Since radio receivers were selling for $600-700 at the time, it was felt necessary to take steps to ensure the audience would be more than just the very rich.

For example, a truck equipped with a receiver and loud speakers was taken all around Atlanta and surrounding communities. Also, regular evening classes were set up to teach people how to build their own crystal receivers. After demonstrating how to construct the set, it was given to someone in the class.

Perhaps you may have heard the letters WSB stand for "Welcome South, Brother." While they originated as a random sequential call sign when issued, WSB ran a listeners' contest in 1922 to put a slogan to the call sign. "Welcome South, Brother" was chosen for its warm inviting sound, and it stuck over the years.

FROM 100 to 50,000 WATTS

As WSB's fame grew, Cohen and Tison apparently had a falling out, and Tison was dismissed. He would turn up in the Tampa Bay, Florida area and was responsible for constructing a large number of Tampa AM, FM and TV stations over the years, including WGHB and the first directional station in the US, WFLA-WSUN.

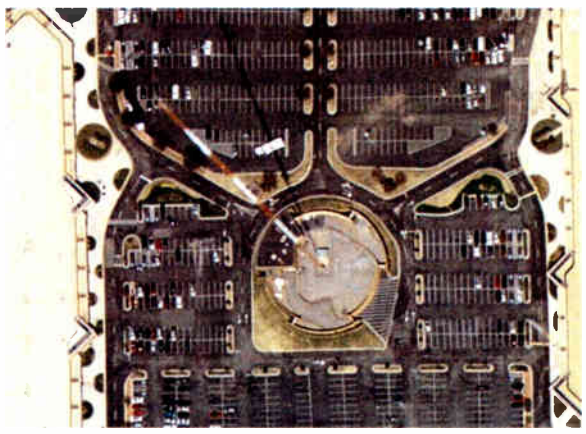
Meanwhile, WSB grew to 200 Watts, 1,000 Watts, 5,000 Watts, and in 1933 reached 50 kW. The station developed as a true voice of the South, moving several times from its original 833 kHz spot on the dial to finally land all by itself on the Clear Channel (I-A) of 750 kHz in 1941.

WSB moved physically, too. The power increases helped them reach more people, but also generated complaints of overpowering local listeners. The solution was to move away from the center of town. Due to the poor ground conductivity around Atlanta it was not necessary to move too far.

SURROUNDED!

This led to a different problem, affecting many stations in what used to be in rural areas: city growth caught up with the transmitter site. The value of the land was a large part of the station's value in the early 1980s, so owner Cox Communications sold off the surrounding land to a shopping center developer, with the proviso that the transmitter and antenna would remain in place.

Today, WSB is surrounded by the Northlake Tower Festival shopping center. With careful engineering, the station coverage was largely kept intact, while avoiding shocking the local shoppers.



Today, WSB sits in the middle of a shopping center parking lot.

Now 85 years old in 2007, the Southern Belle, WSB, continues serving the southeast from Atlanta, welcoming listeners to enjoy its southern hospitality. It kind of makes you thirsty for a Mint Julip! – *Radio Guide* –

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Tech Tip

by Bob Groome

When You Should Take Up the Trombone

Your transmitter and antenna have seemed to work happily together for years, ever since the initial installation. But any time you add a filter, coax-switcher or something else to the system, it is always possible for the resulting change in line length – even small ones – to destroy the original match. Bob Groome helps explain what could be the problem and how to cure it.

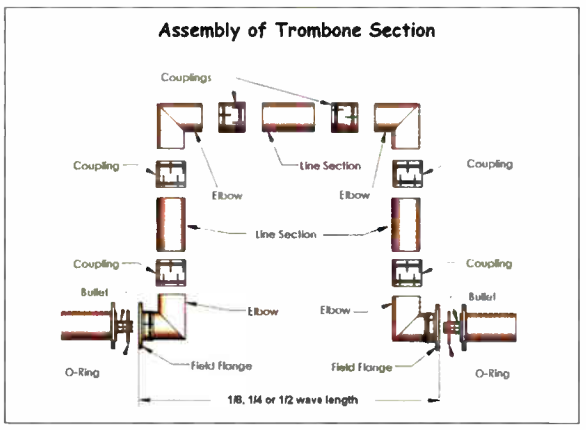
When a match between transmitter and antenna should be good but shows up bad, a Trombone Section may be the best solution.

A HEATED SITUATION

The symptom: Before a combiner, filter or injector was inserted into the run, the transmitter worked fine into the antenna. Now there is a standing wave and/or there is a heat rise at one of the elbows or flanges in the line run.

The problem can occur if the resonant point (minimum voltage, maximum current) is moved more than a wavelength from the output circuit of the transmitter and ends up right on a flange or bullet. Due to the nature of flanges and bullets as non-rigid components, a heat rise can occur, raising the temperature above the point where the components can break down.

Usually, this is noticed first on the VSWR meter or by maintenance checks with an infrared (IR) thermometer. The line may discolor and/or feel very warm to the touch. A wonderful tool to solve the problem is the insertion of a trombone section, made up of a few rigid line components, between the transmitter and a star-point type station combiner, filter or HD injector.



Jampro ProLine Trombone

Some of the older models of Gates, RCA, Collins, Rockwell, Continental and similar transmitters have a typical turn around of 3 dB in their output network. (Newer transmitters run more like 10 dB and are less susceptible to this problem.) For the heat rise, you may have accidentally chosen coax lengths that place a multiple of a wavelength right on a flange. The trombone just moves this nicely for you.

You could play with the lengths of rigid lines to reach the same result, but the trombone takes less space and allows quicker adjustments until you reach where you want to be. At most sites it is best to cut the line between the transmitter and the filter/injector/combiner. Hang the trombone up near the ceiling where it is out of the way.

LOCATING THE PROBLEM

With a decent network analyzer, you can see the problem on the Smith chart display. However, this is an expensive tool and may not be available. In that case, you may try using your transmitter VSWR meter.

If you are fortunate enough to have a step reducer (such as a Jampro RCTR series) and a programmable exciter, you can route the exciter through the RCTR to the load and change frequencies as needed. Using an additional 45 degrees or less of transmission length might be all you need to reduce the heat rise on a flange or bullet (the maximum heat is now is moved away from the critical point). For filters/combiners/injectors, 90 degrees might be better. Figure the total length in inches of line to insert, use 984 divided by your FM frequency times 12.

The best way to do this is to move your exciter frequency up or down a bit and see which way the VSWR reacts. If the lower frequency looks better, lengthen the trombone a bit until you reach a VSWR dip. The trombone will rotate on the Smith chart and solve the problem. If you do not have a programmable exciter, you must run "on" carrier and carefully adjust the trombone only 1/8 or 1/4 of an inch at a time.

Normal lengths are 1/8, 1/4 or 1/2 wave total length for the total trombone section. Make it a tad longer and trim for the desired result.

For further information you may go to: http://www.jampro.com/tech/trombonesection.pdf,

A long-time broadcast and sales engineer with major manufacturers, Bob Groome has helped many stations solve matching problems. Contact Bob at bobgroome@yahoo.com

Radio War Stories

by Jim Tonne

The Do-it-Yourself Ratings Survey

This is a true story about something I did a number of years ago to verify our station's ratings. I hope you will find it interesting and amusing.

A TEAM EFFORT

At the time, I worked at a radio station whose owner encouraged team efforts by the staff. As a result of the efforts of this team we had good programming along with good sales; good engineering supported those. (The station owner referred to this situation as his "three-legged milk stool.")

We all worked together quite well and enjoyed the work. The team effort lead to the station getting about 75% of the local radio advertising dollar in spite of competition from three other stations plus a fourth that was not really local. The advertisers got results. They knew that the high prices on the rate card were worth it.

The station had not only 75% of the advertising dollar but similarly it had about 75% of the listeners. Still, it was nice to be able to point to some documentation showing that the station did have a high listenership. The station subscribed to a survey – used by all the local stations – which confirmed the listenership aspect. I think the survey was done via telephone.

PROVING THE RATINGS

At the time one of these surveys was being taken I had the idea to see if I could somehow check its accuracy. I implemented my idea, wrote down the results – it only took an afternoon to do – and gave it to the station manager.

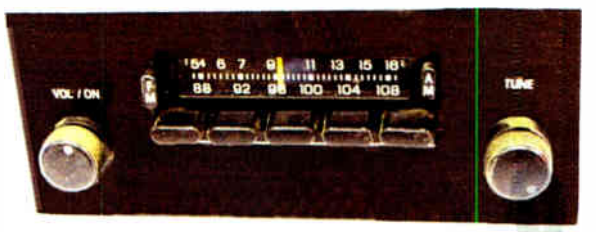
When the results of the paid-for survey came in, the manager was amazed to see that my percentages were very close to the paid-for survey. I was asked how I did it. Did I know the survey people? Did I have some kind of connection with anyone there?

I just smiled and said I had a scheme and I would check it again the following year when the next survey was to be done.

WHAT MADE IT EASY

What enabled my remarkably accurate survey was a set of unique circumstances, which have long since passed into oblivion. But for me, in that era and that location, they worked quite well. In those days – now I will tell you that the year was 1963 – the radio receiver dials were always the "pointer on a string" kind – the so-called "slide-rule" type. That type of dial was what we today would call non-volatile memory; it would clearly show where the radio was tuned – even with the power off.

It is true that in areas with high radio station density you could not tell for sure which station was tuned in. However, in our case – out in the boondocks – we only had stations on 910 (our station), 1230, 1320 and 1430. Another station was on 990 but was located about 40 miles away and was of no serious concern listenership-wise and of no concern at all dollar-wise. To top it all off there were no FM stations of concern.



It used to be easy to know where a radio was tuned.

Therefore, it was actually a pretty sure thing that you could tell which station from that short list was being listened to, simply by looking at the front of a radio. For us, it was even easier: our station's frequency was far removed on the dial from the rest.

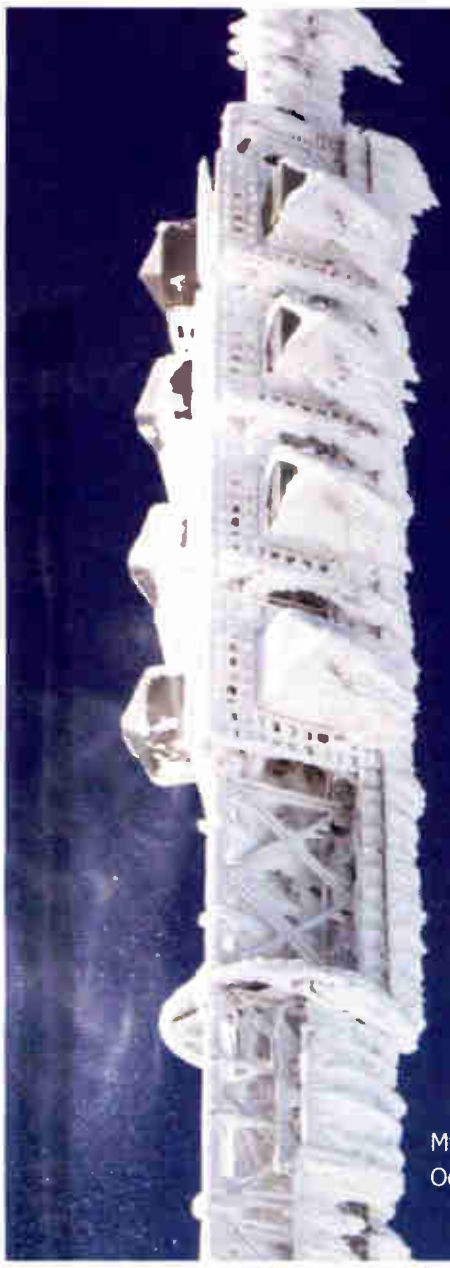
HOW IT WAS DONE

What I did for my survey-on-the-cheap was to take a clipboard with pencil and paper and walk the entire downtown business district (we are talking small town here!), look into people's cars, and note the settings of the car radio dials. After a couple of hundred entries I called it a day.

After the second year of this scheme I revealed to the station manager and owner what I had done. It was of course quite informal, unofficial, and of no business use but it did confirm the paid-for survey in a sense. It certainly brought smiles to the faces of those in the know!

Meanwhile, I have always wondered: did the paid-for survey people also do it *my* way?

If we tell you Jim was the engineer at KBIM in Roswell, New Mexico from 1961 to 1965, can you guess which station was #1 in the 1963 Book? Contact Jim at sales@tonnesoftware.com



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Gear Guide

March-2007 Buyers Guide

BEXT

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The Bext TX 10000 is the first unit of a new generation of hot-pluggable, solid state FM Transmitters which will include the TX 10000 (to be introduced at NAB 2007), the TX 20000 and TX 30000.

The main features include: modular architecture, hot pluggable PA modules, dual (redundant) exciter with auto changeover, and stainless steel enclosures.

The TX 10000 is a very compact size transmitter for a 10 kW FM unit. Housed in a 19 inch standard rack cabinet just 55 inches tall (30 rack spaces high), the unit is designed to be highly energy efficient, with approximately 70% overall efficiency for the entire transmitter, which keeps heat generation to a minimum.

The multiple PA modules allow the transmitter to remain on the air at reduced power even in the event of loss of one of the PA modules.

RS 485 and USB connections for PC readings and control are standard, as are also the more traditional analog-type remote control connections for power readings and control.

Proportional auto foldback is standard for excessive VSWR, and the transmitter is protected against circuits overloads.

The Bext TX 10000 is available for three-phase as well as single-phase operation, to be specified at time of ordering. An optional built-in RDS card is available.

Both the PA and the exciter sections come with digital displays showing all the operating parameters and a simple user friendly menu allows quick user interface and control.

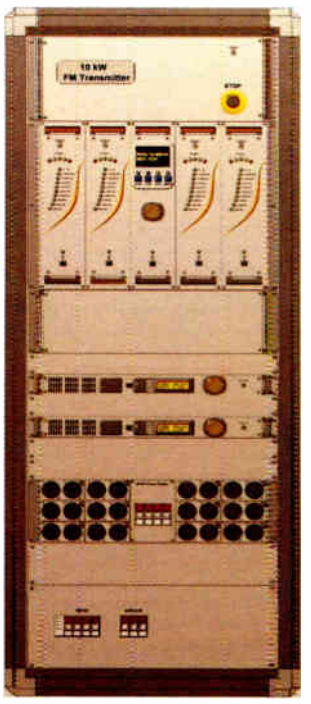
The transmitter comes with a standard, built-in stereo generator that can be either activated or bypassed by the user.

The exciter section is frequency programmable and the PA is totally broadband, making frequency reassignment an easy task.

The Bext TX 10000 can also be used as a smart backup unit for multiple stations as it allows the possibility to preset a number of frequencies of operation and call up any one of the presets from remote, making the unit come on the air on the frequency of the station that happens to be down at the moment.

A harmonic/Low Pass Filter is built-in and the transmitter complies with all FCC requirements.

The new Bext TX Series of FM Transmitters offers broadcasters unprecedented compact size, flexibility of use and unmatched energy efficiency, all backed up by the rock-solid Bext reliability, warranty and customer service .



Nautel

V Series FM Transmitters

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Nautel, a North American manufacturer long known for its reliable, efficient transmitters, is expanding options for HD Radio transmission.

Nautel's V series of digital-ready FM transmitters provides a full range of power options for FM and FM+HD. The V series now offers 10 models: the new V1, V3.5, V7.5 and V15 join the existing V5, V10, V20, V30 and V40 transmitters, addressing power needs up to 40 KW.

Every transmitter in the V series was designed for long-term reliability and easy maintenance. The products redundant modular design features hot-plugable RF power modules and power supply modules; each module has its own DC powered cooling fan which is also on-air serviceable. High overall operating efficiency results in low power consumption; compact, lightweight construction allows installation at sites with space and floor-loading constraints.

For HD Radio operation, the V series transmitters are combined with Nautel s M50 digital exciter. The M50 exciter continuously monitors RF output; its digital adaptive pre-correction circuitry dynamically optimizes performance to ensure compliance with spectral limits. "Our adaptive pre-correction has been very appealing to stations moving their operation to HD Radio," said John Whyte, Nautel Marketing Manager. "We've seen examples where customers have saved tens of thousands of dollars because the adaptive pre-correction lets them avoid the purchase of expensive filters."

V Series transmitters provide intuitive user interfaces with an advanced alarm system, 100-events log and on-board real-time clock. They can all be remotely managed using Nautel s new NxLink web-based remote management solution.

Space constraints are also addressed by Nautel s V series. The new ultra-compact V1 transmitter, when combined with Nautel's M50 exciter, provides a complete HD Radio solution in only 9 rack units of space.

Whyte notes that the V15 transmitter is an ideal solution for stations that are upgrading 10 kW TPO analog systems to HD Radio. "The V15 gives customers a compact solution that provides an outstanding efficiency of 50% at 10 KW hybrid mode. Other transmitters may provide only 35 or 40% efficiency," Whyte said.

The V series will be highlighted at Nautel s NAB booth, N8111 along with other key products. In addition to the V series for FM HD operation, Nautel offers the XR series for AM HD transmission. Full information on Nautel s digital broadcast solutions is available at the Nautel website: www.nautel.com.

Harris

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WVIJ, Port Charlotte, Florida Installing Harris ZX2000

When non-commercial WVIJ-FM, Port Charlotte, Florida, received its construction permit to increase power three-fold to 1.9 kW, President, General Manager and station founder, Dan Kolenda, was thrilled. "This will help our fringe area reception in important areas like Englewood and North Port, while at the same time, improves our building penetration locally."

WVIJ has been broadcasting Christian programming since its inception in 1987.

Kolenda adds, "Being a listener-supported station, we have always managed to raise what we need for operations and special projects like this. I was looking for a transmitter to satisfy this new power, and came across the Harris ZX2000. At first I thought Harris would be outside my budget, but this model was very competitive and looks very easy to service with plug-in modules and power supplies. What really sold me was this investment would take us into the future for HD Radio™."

All Harris ZX series transmitters (available in 500 watts to 3.5 kW) are Tri-Mode and can operate in analog, analog + HD Radio, or in pure digital HD Radio. "We're not ready for HD Radio today, but I sure don't want to have to replace a new transmitter when we are," said Kolenda. "We simply add the FlexStar™ exciter and exporter and we're on the air in HD Radio."

Dan Kolenda is a very unique station manager. He is Pastor of Port Charlotte Calvary Assembly of God where the station is located, and he serves as station manager and underwriting sales person. But he is also the station's chief engineer, IT manager for the church, the station and the co-located Christian School, and manages the church's rebuilding program (Hurricane Charley very badly damaged the church sanctuary, school and radio station building in 2004). "I had to learn this stuff because we simply had no money to hire people to do all these things," said Kolenda. "I enjoy computers, and I've gone to some classes to learn how to repair and configure them. It seems the tech side of radio today is all about computers and transmitters, not audio consoles, tape machines, turntables, cart machines or CD players like when I started in the business." The radio station operates with BSI Wavestation automation and other than the live church broadcasts on Sunday mornings, is 100% automated.

March-2007 Buyers Guide

Continental

816HD Analog+HD Transmitter

www.contelec.com • 800-733-5011

In competitive radio markets, engineers are pressed to find the fastest, easiest and most cost effective way to launch their stations into the digital marketplace. The first surprise that engineers often encounter is how much space is required to implement the most obvious solutions.

The most "obvious" solution is to install a separate IBOC transmitter and a second antenna. The obvious solution assumes that the station's antenna site is large enough to accommodate a second tower and enough space in their transmitter room to accommodate the required additional equipment. If the site is big enough to accommodate the expansion, then there are the hearings, permits and often pounds of paperwork necessary to get the parallel facility built.

If a different HD-only antenna site is required, the engineer faces a completely new headache. In many (most?) urban markets, building a new antenna or acquiring a new site in a suitable location might be next to impossible.

In either case, the station engineer must deal with considerable construction costs and technical headaches.

A high-level technique where the two signals are joined in a combiner would eliminate the need for a second antenna. Still, this scheme requires an analog transmitter and a separate HD transmitter, thus necessitating more floor space. This system also requires 11% more analog power, which may not be available from the existing analog transmitter. The station may have to buy a new analog transmitter along with its HD transmitter. In either case, this system generates substantially more heat requiring either a larger AC service or a separate room for the combining system load, to keep both transmitters cool enough to operate.

When Continental Electronics' engineers began the process of designing its own IBOC solution, they considered all the available options, just like a station engineer would. They quickly understood that obvious solutions were not the fastest, easiest or most cost effective way to go digital.

Continental's designers realized that broadcast engineers needed a reliable "plug and play" solution for implementing analog and digital simulcasting that could deliver a strong, clean, clear signal – without substantial facility upgrades. The result is Continental Electronics' 816HD.

The 816HD is a single tube Analog+HD FM transmitter capable of power outputs of up to 22kW in a single box. Combining two transmitters allows output power levels of up to 45kW. This transmitter combines analog and HD signals at the exciter level in one cabinet that is no bigger than the analog-only box. The 816HD uses the same amplification path for both signals, eliminating the need for an expensive high power combiner, additional antenna, additional transmission line or AC modifications.

Last fall, Continental shipped an even higher power version of the 816HD, the 816HD-28L. This transmitter incorporates a liquid-cooled PA tube and is capable of TPO's of 28kW and higher from a single transmitter, and 55kW in a 3dB combined system.

The initial savings from implementing Continental's 816HD solutions can be more than $100,000. With Continental's reliability, the overall operational cost savings can add up to thousands more over the system life.

Armstrong

FM-20000T2 Transmitter

www.armstrongtx.com • 315-673-1269

Choosing an Armstrong Transmitter

Rob Enders, Director of Engineering
Blackburn Radio – Wingham, Ontario

In 2004, Blackburn Radio received approval from the Canadian Radio-Television and Telecommunications Commission (CRTC), Canada's version of the FCC, to launch a new Class C1 FM service for Midwestern Ontario. We have successfully operated a 10,000 watt AM station and another 100,000 watt FM station for many years and were very excited about this new service. Our existing FM transmitter was a Continental 816R series and had given us 20 reliable years of service. But with this new project, would also be replaced.

The criteria used to make our transmitter decision was based on three requirements: 1. A basic tube-based FM transmitter with grounded grid, capable of 20 kW. 2. Cost effective operation. 3. Floor space conscious, limited to 48 inches of width per transmitter.

During a previous trip to NAB, I had demonstrations of all the North American-based FM transmitters. This was when I first met Ernie Belanger of Armstrong Transmitters. He spent a fair bit of time with me, showing all the innards of his FM-20000T2 tube transmitter. Being of European design, it had a number of features that I had not seen in transmitters before, such as an emergency kill switch that shuts down the transmitter instantly. It also utilizes a LCD panel for telemetry and control. The LCD-100 exciter complements this transmitter with full digital and CD quality analog audio inputs.

Our engineering staff is small (one person), so having a basic design means that training requirements are minimal. A grounded-grid design makes tuning up this transmitter an already familiar process.

It was a pleasant surprise when the quotes came in showing considerable savings if we chose the Armstrong product.

Our new transmitter room was limited in size with much of the floor space consumed by our Sira combiner system. We opted to design our plant using the N+1 layout where the two main transmitters share a single frequency agile standby. The Armstrong transmitters only need 48" each so we actually ended up with enough space for a desk.

Our distributor for the Armstrong product in Canada is Don Smith of Capella Telecommunications. He was my contact with the factory and helped ensure a successful install.

A couple of minor issues came up with the installation; one was that I had intended to remotely locate the exciters in the STL/audio racks. The exciter would not power up. It was due to another European feature, the exciter's line voltage was 240VAC when installed inside the transmitter. A simple change of the line connector to 115VAC and we were on the air. The other issue was a bad PA tube that the Armstrong factory replaced overnight without question.

The Armstrong transmitters have now been on the air for 2-1/2 years with zero issues.

All is well in Midwestern Ontario, thanks to Armstrong Transmitters.

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www.oabok.org

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www.pab.org

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www.njba.com

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