Radio Guide

Radio Technology for Engineers and Managers

November 2007

Keeping an Eye on the Entire Transmission System

Inside Radio Guide

The Care and Feeding of Your AM Ground System

Page 4

I am regularly asked several questions about AM ground systems. And in some 14 years of building and working on AM ground systems I have, on more than one occasion, found my eyebrow rising at some of these questions and misconceptions associated with them.

Of course, in the early years of my broadcast career I certainly would have asked many of the same questions, should the same situations have arisen. But over the years, being a ham – and particularly enjoying the antenna-building aspect of that hobby – has significantly furthered my knowledge of the hidden half of our antenna systems.

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Cover Photo

Kevin Kidd, of AM Ground Systems Co., in Lawrenceburg, TN, with the model he has made to display the issues and problems related to building and maintaining a good ground system.

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Radio Waves

by Barry Mishkind – Editor

Most of the time, what a radio engineer does goes unnoticed – at least until something breaks or the program audio drops out. Then all heck breaks out and the engineer is *definitely* under the microscope!

A competent engineer has to be flexible and inventive – expecting the unexpected and able to adapt to ongoing situations while maintaining focus and keeping his "cool." The articles by George Zahn (Page 8) and Ron Crider (Page 12) discuss how this mindset contributes to the success of any station.

Fortunately, in most cases, good engineering and preventive maintenance can help virtually any station attain 99.999% (or better) "uptime." An intelligent budget goes a long way to providing sufficient backup gear, but more than money is necessary – good planning is critical. Phil Alexander's article on Page 36 shows how a slight miscalculation regarding transmitter site air handling can result in lost air time.

Of course, proper planning has to go beyond the things that are in plain sight, such as the half of an AM station's antenna that is usually under the ground, out of sight. For that reason, Kevin Kidd's discussion about ground systems on Page 4 very well may be just what you need.

Ensuring a ground system is in good condition takes more than just reading the transmitter meters once every two months. In fact, just making sure the ground system *is still there* has now become a major issue – copper thefts continue to escalate, in some places surpassing electrolysis as the greatest danger to system integrity.

To paraphrase the popular TV news line: "It is (insert time), do you know where your ground system is?"

We plan more articles in upcoming months to help stations deal with issues from disaster recovery to loss prevention. You are encouraged to share your problems, solutions, and ideas. Please drop us a line. – *Radio Guide* –

The Care and Feeding of Your AM Ground System

The Hidden Half of the Antenna

– by Kevin Kidd –

I am regularly asked several questions about AM ground systems. And in some 14 years of building and working on AM ground systems I have, on more than one occasion, found my eyebrow rising at some of these questions and misconceptions associated with them.

Of course, in the early years of my broadcast career I certainly would have asked many of the same questions, should the same situations have arisen. But over the years, being a ham – and particularly enjoying the antenna-building aspect of that hobby – has significantly furthered my knowledge of the hidden half of our antenna systems.

A MECHANICAL APPROACH

Nevertheless, although few of the questions about ground systems have simple textbook answers, after years of experience, it is easy to see where and how most problems occur, and how best to solve them.

While the science and mathematics behind the ground-mounted vertical antenna and its associated ground system are beyond the scope of this article, thankfully, most of the issues we encounter with older ground systems, or at new site build-outs, have little to do with that math or science.

Indeed, the majority of the problems with older ground systems are purely mechanical: The wrong brazing alloy was used, or someone did not know (or care) that the ground system must be connected to something else to be effective. At new sites, the majority of problems are almost always related to Old Father Time or Mother Nature. What a nurturing pair they are!

INSPECTION TIME

Since most folks have not actually seen a ground system (unless they were there when it was installed, or erosion has exposed the system), it is hard for them to know how often to undertake an inspection, casual or comprehensive, of the system.

A well-constructed ground system in decent soil can be expected to last around 30 years. Furthermore, some soils are very kind to copper and brazing alloys and may allow the ground system to last many years longer.

The content of local soil has a major effect on the useful life-span of buried metal in a ground system or guy anchor.

On the other hand, some soils are very destructive to copper and brazing alloys, often causing a ground system to fail well sort of the benchmark. Poor workmanship or materials selection can cause failure in months instead of years. Incorrect brazing alloy (that is, low or no silver content solder) is one of the more common failures observed. Poor or no overall ground infrastructure is very common as well.

ANALYZING A GROUND SYSTEM

For existing stations, perhaps the key question is: "How do I know if my ground system is performing correctly?" Only another series of questions can answer this one.

To begin, is there something that makes you *think* that your ground system is not performing correctly? Does it seem like you are not getting out as far as you should? Do the antenna parameters and/or performance change dramatically between wet and dry conditions? If it is a directional antenna, are the monitor points wandering and unstable – going too high or too low?

If the answer to any of those questions is yes, then ask: Has the system been damaged in some way? And: how old is the system? A Partial Proof may reveal a loss of efficiency, but most non-directional stations never had an as-built proof to use as a base line.

In all cases, and moreso when you are lacking any benchmark to compare against, the performance of a ground system can best be determined by its quality and physical condition. An inspection – both physical and electrical – is usually the best way to determine that quality.

PREDICTING RESULTS

After I have been asked to inspect an antenna system, the immediate question that most often comes up is: "How much improvement will I see from a repair or rebuild?"

Usually, there is a simple one-word answer: "Some." as in, "You *will* see some improvement depending on the overall condition of the antenna system. You *may* see a tremendous improvement if the ground system has 'issues.'"

Keep in mind that major issues can be caused by small problems. A single missing or broken connection can render an entire ground system useless. On the other hand, completely rebuilding a ground system that is not bad will probably show no net improvement.

NEW SITE CONSTRUCTION

We should turn to new construction for a moment now, as there are some things that should be taken into consideration if you want the ground system to work optimally for as long as possible.

Most station owners and engineers will only build one transmitter site in their career. They learn a lot about it but rarely or never have the chance to apply that knowledge again. On the other hand, we build a couple of turnkey sites and around a dozen towers-worth of ground systems every year. We have discovered numerous ways not to do it – and even have invented a few ourselves.

Unfortunately, the wheel gets reinvented on at least half of those projects – most often because we were not involved in construction coordination. It is so important to give as much attention to the part of your system that is under the ground as that metal stick you are building in the middle of the field. Let us take a look at some of the major points that should be on your checklist.

SITE CLEARING

Never use a grinding machine or stump grinder to clear a site that will be home to an AM station. Both of these techniques leave the stumps and roots in the ground, making it next to impossible to *properly plow* a new ground system through the debris and roots that were left by the grinding.

Worse yet, quite often some of the plants and trees will grow back, stretching and breaking the installed ground system, even growing into the guy wires and causing a whole new set of problems.

I do not know what has caused the sudden upsurge of grinding (it is not cheap) but we have landed on several sites lately that used some version of the grinding process. By the time the site was cleaned up enough to begin construction they could have had the site properly cleared with a dozer.

The roots and debris left from grinding can prevent proper installation of a ground system.

AVOID CALENDAR ISSUES

It seems to be inevitable that every October brings a call from a panicked owner or engineer trying to get a site built before winter arrives. Procrastination is the largest cause of avoidable construction delays that we face.

All too often the delay is not the fault of the station, but that of a tardy contractor or vender. As you might imagine, it is next to impossible to properly build a ground system in low temperatures or with frozen precipitation falling or collected on the ground.

Unfortunately, time after time we see major projects with overly optimistic time lines. In a perfect world, we should be able to schedule everything down to the hour and stick to that schedule. However, in a perfect world there is no room for the imperfect: weather, venders, contractors, government agencies, emergencies, etc, etc.

I have a corollary concerning site construction. *Kidd's Site Construction Delay Snowball Corollary* states that delays in site construction are not only cumulative but also grow exponentially. Every delay causes a ripple of additional delays.

BUILDING A SNOWBALL OF DELAYS

For example: A station has been promised that their CP will be issued on a certain date. The site-clearing contractor is scheduled to arrive on-site for five days beginning on that day. Let us call that date T. The consultant is scheduled to proof the array 60 days later (T+60).

That sounds like plenty of time to build a three-tower array on a decent site. All the contracts are in place. The venders and contractors are scheduled and waiting anxiously.

But wait! Here is how easily it can all fall apart: The CP is seven days late being issued (T+7). The site-clearing contractor has moved on to another project and will be back in 10 days (T+17). Now you are 17 days late (7+10) without turning the first shovel of soil.

IT GETS BETTER

The civil engineering firm was scheduled to locate the tower bases T+6 to give the site-clearing contractor plenty of time to finish site work. They have also moved on to another project and will be back in three days. Now you are at least 21 days behind schedule (T+21).

Then, it rains for two days and the concrete contractors cannot get material to the tower locations for 10 more days (T+33). There were no tower bases so the towers did not go up as scheduled at T+15. It will be T+45 before the tower crew comes back. Since there are no towers, the conduit installation crew did not begin at T+20 as scheduled.

The excavators will be back on T+55. But the building contractor has been delayed again, so the excavators will try again T+60. (Hey – that is the day the consulting engineer is supposed to begin the proof! Not much proofing will be done without the tuning equipment.)

The ATU and Phasing equipment will eventually ship at T+90. The ground systems contractor was scheduled to begin their phase on T+25, but they cannot start until the entire grade and below grade phase is completed. That is then rescheduled for T+65.

NO CRYING ALLOWED

Jump ahead to T+80. The ground system finally is built, the towers are up, but the MegaBank of the Universe is holding payment for the new tuning equipment. They do not know whether Phasor is spelled with an O or an E. It takes 10 more frustrating days to convince the computer operated loan officer that it really does not matter.

(Continued on Page 6)

Impossible Remote?
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The Care and Feeding of Your AM Ground System

The Hidden Half of the Antenna

– Continued From Page 6 –

All totaled up, there has been less than 30 days of actual site work performed in the past three months. The other 60 days of delay were spent lying awake wondering how things got so messed up and probably taking a daily butt-chewing because the site is not on the air, the fall book is approaching, and the GM has a site christening party already scheduled, etc, etc.

Without careful coordination, a spring project can end up in the wrong month.

We have worked on tightly scheduled projects that were to begin early spring and we were to be on-site in early summer. In the end, due to snowballing site delays, we had to work in winter snow and sleet well over six months past the original start date.

Murphy would be proud.

THAWING THE SNOWBALL

Here are a couple of tips to keep the snowball from getting started. First, choose your service and equipment venders early *and* carefully. A great deal is seldom a good value, especially if that great deal fails to arrive in the time frame promised. Verify promised arrival or delivery dates regularly; ask for references and do your own investigation.

Also, remember that with today's unstable metals' markets, many suppliers have limited in-stock inventory. Do not be surprised by longer than normal delivery times for materials. Coax and other copper products have been particularly troublesome in recent months.

BE SURE TO FLAP AROUND

Whether new or rebuilt, there is a large investment of money in the ground at an AM station. The current rash of copper thefts, driven by the higher prices for scrap metals, has created a costly, inconvenient problem for many stations.

Thieves often take a little bit at a time. Stations may not realize the problem before real damage is done – and a few hundred dollars of scrap copper costs a station tens of thousands of dollars. How can a station help protect its ground system? One word: FLAP.

FLAP refers to the four main lines of defense against copper loss – not to mention other results of vandalism. FLAP means: **F**ences, **L**ighting, **A**larms and **P**resence.

• **F**ences and gates *must* restrict site access and individually protect high value targets.

A ground system nightmare: nighttime visitors methodically removing copper.

• **L**ighting should illuminate the tower base and transmitter building areas. Lighting should be dusk to dawn controlled (not motion) and be current monitored to detect light outages and damage.

• **A**larms should encompass controlled access areas such as the transmitter and ATU buildings. Motion detectors can be used outdoors but may produce false alarms. Lighting current monitors should alert station personnel if a lighting outage occurs. Video should be used to supplement hardware alarms. An equipment temperature sensor should alert personnel if the building temperature climbs.

• **P**resence. Someone should visit the transmitter site as often as possible but *at least weekly* to check for vandalism or tampering. Vandalism that is discovered quickly tends to be less severe and the chances of an arrest are infinitely higher.

This may all seem like a lot to digest – maintaining an existing ground system or building a new ground system and protecting it from vandals is not a trivial matter.

However, by giving attention to your ground system you will prevent many problems before they can get started. Stay tuned. In upcoming articles, I will be offering a more in-depth treatment of general ground system maintenance, site security (including FLAP) and site construction.

Kevin C. Kidd, CSRE/AMD is the proprietor of AM Ground Systems Company and KK Broadcast Engineering. More information can be obtained by calling 1-877-766-2999 or visiting www.amgroundsystems.com

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Studio Guide

by George Zahn

Microphone War Stories

No station can thrive without the keen resourcefulness of its staff. Some of the best radio "war stories" come from engineers who have had to improvise with little or no notice to make a remote broadcast a "go" or simply to keep a station on the air until the right parts can be obtained.

There are times when unplanned disasters, or just flat-out bad planning, threatened broadcasts. That is when engineers often have to go to extreme lengths to keep stations on the air or make a microphone out of something that was not a microphone a few minutes earlier. Many times, these stories go unnoticed as they happen behind the scenes.

For this article, I am going to put on my radio helmet and feel like audio's war correspondent Ernie Pyle, reporting from the front. I think you will find these examples are great victories for common sense, but some also might surprise you – and inspire the inner-engineer in each of us.

TALES FROM THE TRENCHES

We start with a simple – and common – microphone dilemma. Last time we spoke of a station whose engineering director was sold on a microphone to replace deteriorating Shure SM5B microphones throughout the plant.

Although we saw how important it is to use the "ears" of your staff to select the right microphones for your station sound, the engineer just decided to buy Heil Sound PR-40 dynamics. However, he did not test them on-air at the station and, when the staff heard them, the new microphones were not a popular replacement.

While for the most part, I doubt most stations would ever get unanimity on microphone choices, it is good at least to have a consensus. When engineers, program directors, and managers are not on the same page when it comes to ordering gear – not even trying a demo or loaner microphone in the home station – the result can be bad. At best, it will produce the headache of debate among the staff over the choice of the replacement microphone. At worst, a station's sound can be harmed.

THEY SENT WHAT?

We found one creative solution to the problem by turning to engineer Jay Crawford. Crawford has worked with stations from Michigan, Kentucky, Ohio, and Indiana just to name a few. Crawford found himself in the middle of a "microphone war" when the corporate office for an FM station for which he worked sent a caseload of Electro-Voice RE-20s to replace the out-of-production Shure SM5Bs.

The SM5Bs had been a really popular microphone with the announcing staff but, as they went out of production and repairs became more difficult, the stations were almost forced to replace them. According to Crawford, "the Program Director's preference was not what corporate supplied, so we had to get creative." Luckily the FM station was part of a plant of AM and FM facilities under the same corporate umbrella in the same city.

Crawford told me about the logistical switcheroo that took place to make all stations in the building happy.

YOU TAKE THESE, I'LL TAKE THOSE

"There were some Shure SM7s still on the AM side in the studios," he said. "We worked a deal in which the FM station grabbed the SM7s for their primary announce microphones in the air and the news studios, which gave a more consistent sound moving over from the old SM5B microphones.

"The shipment of RE-20s went to the AM studios, giving them brand-new microphones, which they gladly welcomed. We filled with some Sennheiser MD 421's in the FM production room."

It sounds like a win-win situation. The FM side, where the change in microphone timbre might be more evident, ended up with the older microphones, but still the closest possible replacement for this highly successful station.

Would the RE-20s have made the FM ratings plummet? Absolutely not, but the stations were able to work out a great trade that made the announcers, engineers, and programming staff happy, and that translates to a better on-air product.

The consistency of sound in this case was a nice by-product of a necessary change of microphones as the old SM5Bs needed to be replaced. Moving all the RE-20s to the AM side gave the AM station consistent sound with a bevy of brand new microphones, a good investment for years to come.

OHM MY, WATT'S UP?

That Jay Crawford was part of this benevolent under-the-table swap within the same company does not surprise someone who has known him for years. This is the same resourceful guy who, while trying to repair a transmitter in a remote, rural location, wired a light bulb in a circuit to substitute for a resistor until he could get back to the shop for a replacement.

(Continued on Page 10)

RemoteMix 4

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Survival Guide

by Ron Crider

Bottom Line Thinking

Bob Burnham's August 2007 article, *"The Care and Feeding of Your General Manager"* got me thinking. Over the years, I have been on both sides of that relationship.

When I was a Chief Engineer I viewed the general manager or owner in a totally different way than when I became the Owner or General Manager. The reason is that there are so many different dimensions to the GM's job – things that are not necessarily on the engineer's mind. I do not need to tell you the heartbeat of the GM is tied to the station's signal. No signal, and the GM can instantly turn from Mr. Nice Guy to a totally different person. If he is smart he will not take out his frustrations on you – at least until the crisis is over.

Understanding both ways of thinking helps one to better see the "big picture" – and how to contribute to it – rather than focusing only on one department's priorities. Call it Bottom Line Thinking. To illustrate, let me share several real scenarios that happened to me back in the late 60's. By learning to see the whole situation, I became a better broadcaster.

TROUBLESHOOT OR TALK

At one point, I was the Chief Engineer for the 1580 station in Fort Lauderdale, FL. It was a 10 kW day, 5 kW night signal with seven towers.

Somehow rain penetrated the HVAC system and got into the Gates BC-10P's PA cabinet. The water caused a short and the transmitter tried to destroy itself. Once we got the power turned off if was obvious the blue harness between the power cabinet and the control cabinet had melted together and to the cabinet. It was a complete mess.

The manager notified the owner in Washington DC of the situation, whereupon the owner, a former military man, proceeded to call me every 15 minutes asking what time we would be returning to the air. Quite frankly my first analysis was "maybe never with this transmitter!" After about 30 minutes I realized we most likely could get it going fairly quickly with several hundred feet of zip cord, assuming nothing else had fried.

After numerous punctual 15 minute briefings with the Colonel, I found it necessary to take my overheated frustrations out on my super superior. On his last call for a 15 minute update he again requested the time we would be returning to the air. I informed him I did not have any idea but I did assure him it could happen much faster if he would stop with the calls. There were no more calls.

NOT QUITE THE HERO

The station lost only three hours of air time, but I was not on the promotion list. In fact, the Colonel was a real hands-on owner despite his 1000-mile distance from the station; he also ran the "canning and preserving" department as well. My few choice words had put me very close to the canning list.

I later enlisted in the Marine Corps, and there learned that "discretion is the better part of valor." I was just too young to understand his pain. Being off the air to an owner is like having one of your children in intensive care.

SHOE ON THE OTHER FOOT

A few years on, and *I* was the Owner/GM at a station during Political Season. We had been paid in advance for the advertising. Then the station went off the air. And, no, we did not have a backup transmitter.

The engineer quickly got to the transmitter site and within 30 minutes informed me the plate transformer was dead. "Oh no, this can't be happening!" I said to myself. "There goes the $40,000 I had earmarked for the new transmitter." Worse, the billing would be down for the month because we also bumped some of the usual accounts to make room for the one-time political spots.

Fortunately we lucked out. My engineer, Bob Barnett, ripped the transformer out of the transmitter and pulled it apart, only to discover it was shorted to the case. He isolated it from the transmitter, soldered some wires together and – BAM! – we were back on the air in less than one hour at 60% power. Bob saved the day and the month!

A CLEAR FOCUS

It takes a really good engineer to troubleshoot a dead transmitter quickly. It takes a better engineer to go to the next step and determine why the bad component died. The best engineers come up with a way to solve the problem quickly, until a replacement can be received. (By the way, we immediately purchased a new transmitter and placed the old one in backupservice.)

Here the engineer had only one problem to deal with, albeit a very important problem. As the Owner/GM, I had to deal with the clients (politicians). When would we be back on the air? But I knew from experience that hounding my engineer would not speed things up.

Suppose this had been the weekend prior to the Tuesday election? The situation could have quickly developed into a real serious crisis. Those politicians could actually allege they lost the election because we were off the air. Some local candidates get real grumpy when they do not win.

What time would we be back on the air – not what day – was my concern. I also had to deal with the sales staff who could see their commissions quickly vanish. But I had to let the engineer do his job, knowing that my exercising patience would speed up the process.

LESSON TO BE LEARNED

Today's transmitters have advanced to a state of reliability that is close to 100%. The new solid state transmitters have spare exciters, spare power amplifiers, hot-swapable power amplifiers, and automatic VSWR power reduction. However; most transmitters still have that heavy special transformer that could go at the most inopportune time.

There are also still a few other components in your system that can knock you off regardless if you have a spare transmitter or not. No electricity, no generator, *no broadcasting*. I cannot imagine being in the broadcasting business today without a generator at the studio and transmitter site.

OK, what happens if the AM tower falls down? It could happen! But it is no big deal. Take a breath, call up a local crane company and string up an "almost" vertical long wire. Bam! – you are back on the air. You may need a batch of fence insulators and some copper ground lugs to tie the wires together; these can be purchased at your local Home Depot – or if you are really in the country your local farm supply company will have them.

SOLVE THE PROBLEM, DEBATE LATER

A cracked base insulator is not as catastrophic as the tower falling down, but what if the cracked insulator shorts to ground when it rains? No problem, just ground the tower and shunt feed it with a slant wire.

Recently I was told by an engineer, *"No, no you can't do that.* The FCC will never approve that (slant wire) type of operation." However, I know from experience that those guys at the Federal Candy Company can really be sweet when you are off the air. In fact, generally they will be most obliging.

Do whatever it takes to get back on the air, then send the FCC a "reasonable" request for an STA – you may start operating immediately once you have filed the request. The FCC may grant that STA at different operating parameters than you requested but at least you are *on* the air!

By the way, do not request to operate a DA in the non-DA mode at the same power. It will not happen! Start by asking for 50% power. If your tower site gets blown away do not request to move 75 miles from your city of license and operation at full power. In your STA request, remember it is a "request" not a demand – *ask, do not demand.*

TRY TO KEEP THE GM HAPPY

Here is a situation that really rubs me the wrong way: We GM's really love a loud, clean signal. But, you engineers must stop trying to improve the signal during drive time.

Those new audio processors are neat – they let you sit in your car 20 miles from the transmitter site and twiddle with the labyrinth of settings to make the station sound really good. Yet, here is a flash! Why not do this in the conference room at the station with the GM and the PD? They will really be impressed you included them, and you will not have to change all the settings you spent hours in your car working on.

Of course, I have worked with some GM's and PD's that prefer to do this in *their car* since they perceive the majority of their listeners are listening in the car. Regardless where it is done, do it *with them* since the sound of a station is very subjective. Do not forget the GM, MD and PD's ears are much better than yours – or at least *they think* so.

If they are happy with the sound, you will be too. Lock it down and save it. Fortunately today, once the processor is set and everyone is happy, there is no reason it should be changed. In the old Gates green instruction books there was a wonderful line: "Preventive maintenance is designed to prevent trouble not start it." So be careful how much fixing you do to things that are not broken. It is good to be the Maytag man!

BOTTOM LINE THINKING

Sometimes spending money is a good thing, even if there is a small technical budget.

For example, last year I was hired by a Chicago market owner to look for ways to improve the station's bottom line, primarily in the engineering department. First we installed a new Nautel transmitter with dual exciters and power amplifiers, retiring the Harris MW-5 to backup service. To become more competitive in the market we installed an Aphex Compellor 320 at the studio and a new Omni audio processor for maximum loudness.

A DSL connection gave us the ability to look at any transmitter plant parameter from anywhere in the world (good for me since I travel worldwide frequently). DSL also permitted us to install the Barix Extreamer 100 to be used as a backup audio source for the Marti STL. A Broadcast Tools ACS 8.2 plus switcher permits selecting audio from the Marti and Barix. The switcher can also switch any audio source at the transmitter to a return link through the Gentner VRC2500.

The end result of this is a real win: This Chicago area station saved more money on engineering this year than the entire cost of the upgrade! Now, all that money will go to the bottom line in this new fiscal year 2007/2008. The further bonus is that there was zero down time during the past 12 months compared to a cumulative 14 hours the previous year. This single move builds listener confidence, client loyalty, better cash flow and a stronger bottom line on the balance sheet.

Ron Crider has a varied background ranging from engineering to equipment sales and from station ownership to consulting. Contact Ron at criderron@aol.com

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Transmission Guide

by Randy Davis, Freeland Products

Protecting a Solid State FM Exciter in Your Old Tube Transmitter

Solid state exciters have been around for a long time. However, sometimes when replacing an exciter or tuning a transmitter the match from the exciter to the PA (or IPA) can do some strange things, from degrading the AM noise level to damaging the exciter. Randy Davis offers some help in making your transmitter a more efficient system.

Solid state exciters can be difficult to match to the input of your tube transmitter.

Although most tube FM transmitters have interstage tuning adjustments, many engineers have found that sometimes there is no position on the tuning controls which will provide a decent enough match to the new solid state exciter to prevent it from going into a "fault" condition.

Furthermore, even if the exciter does not fault, most solid state exciters will protect themselves by folding back their output power when they perceive the VSWR is too high. This can lead to conditions of underdrive or even exciter muting, causing hassles with the PA output.

FINDING A GOOD MATCH

Sometimes this match can be improved by simply adding or removing some inductance from the input tank. But if the input tuning circuit can be tuned through resonance and the VSWR is still too high at its lowest point, then re-tapping the input circuit may be required in order to shift the input impedance closer to 50 Ohms.

Eventually, in most cases, the right combination of the transmitter's input tuned circuit adjustments can be found which will provide a sufficiently low VSWR to satisfy the exciter's output circuitry and generate the proper amount of drive needed for stable operation.

However, the real question is whether our making the exciter happy with a low VSWR component is enough to ensure trouble-free operation. As our experience shows, the answer is: perhaps not.

BAD RESULT DESPITE A GOOD MATCH

Within our plant here at Freeland Products, Inc., we have several different transmitters dedicated to RF testing our tubes and klystrons before they are shipped. The transmitter we use for RF testing our 4CX15000A rebuilt tubes is a Harris FM-20K.

Not too long ago, while I was in the process of connecting a new PTEK solid state exciter to our transmitter, an issue of concern developed with the output FET in the exciter – it was shorting. Even though the VSWR presented to the exciter was acceptable – and the exciter was operating well within its power rating – it would intermittently blow an output FET.

This problem is not likely unique just to the Harris FM-20K nor the PTEK exciter. Neither is the solution. Therefore, the fix I have devised for the transient issue will provide additional exciter protection for any brand of transmitter with the same exciter substitution issues. The following will explain what I did and why.

PROBLEM BACKGROUND

As mentioned above, the last test performed on our rebuilt 4CX15,000A tubes is an actual RF operating test using the Harris FM-20K Broadcast Transmitter running into a dummy load. We test every tube for correct operation in this FM broadcast transmitter before they are shipped and, as a consequence, the transmitter gets plenty of use.

I recently purchased a new FM exciter for this transmitter which was, of course, solid state. This exciter had plenty of reserve power to drive the transmitter and the match to the exciter was good. Yet, in spite of that good match and the considerable reserve power available from the exciter, I was blowing those output FETs in the exciter at an unacceptable rate.

While investigating the problem, we also noticed that when the Harris transmitter would overload from the loss of drive, it would also occasionally blow a bias supply fuse. This had nothing to do with the exciter except that the output FETs in the exciter were shorting as a result of a transient being sent down the coax back to the exciter.

It turns out that the blown fuses were simply a result of intermittent shorts within the IPA tubes which happened to be a pair of 4CX250Bs. The blown bias supply fuse strongly suggests that the grid of the tube was indeed at least partially involved when the tube arc occurred. Obviously, the plate and screen power supplies provided the power to create a healthy transient.

DIAGNOSING THE PROBLEM

What was happening had a relatively straightforward explanation: the IPA tubes were arcing internally on an intermittent basis. These sort of arcs are not unusual for a gassy or failing tube. In fact, a tube can be perfectly useable following an internal arc simply because the contamination causing the arc was burned away from a critical area.

These arcs, however, can create resultant high-level transients which are not good for the interconnected solid state devices. At least some of the tube's internal arcs involved the grid and input circuit of the IPA which was directly connected to the exciter output, the output FETs on the exciter were compromised by the transient traveling from the input of the transmitter to the exciter.

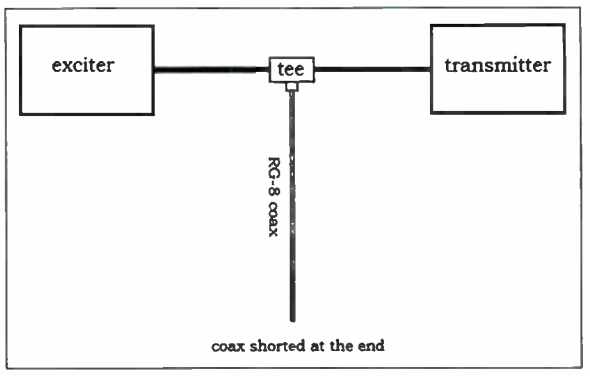
The transient developed on the input circuit of the transmitter because of the internal arcing within the IPA tube and the resulting transient was easily capable of destroying the exciter's output FET – and it did just that. At the same time, circuit resistance and capacitance act to lengthen the rise time of the transient developed by the arc, and this helps in keeping the energy generated by these arcs low in frequency.

This determination suggests that a filter would be effective in squelching the destructive transient. The filter needs to be installed between the exciter and the transmitter's input.

DEVISING THE SOLUTION

The filter I decided to use is a quarter-wavelength, *shorted* coaxial stub. This filter has several good qualities. It is:

- Simple to construct,
- Inexpensive,
- No tuning required,
- Very low loss,
- Will not change the VSWR,
- Has a very low impedance at low frequencies (which will squelch the transient), and
- Can be connected between the exciter and the tube IPA with a coaxial tee.



A shorted coaxial stub.

The quarter-wave, *shorted* coaxial stub exhibits a very high impedance at its resonant frequency and a dead short for DC and low frequencies. This stub filter works because the stub is connected directly across the feedline between the exciter and the transmitter with a coaxial tee.

Because the stubis a high impedance at its resonant frequency, RF travels completely unimpeded across it. On the other hand, the lower-frequency transient energy is effectively shorted out because of the stub's properties at DC and at frequencies below a few tens of Megahertz.

A working FM-20K is used for testing the rebuilt 4CX15000A tubes under real operating conditions.

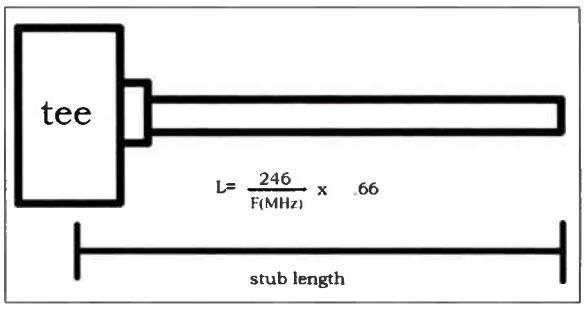
Many transmitters, including the Harris FM-20K, utilize a quarter-wave, shorted stub on their output. The Harris FM transmitter uses 3-1/8" hard-line for this stub and its function is to short out the second harmonic. This type of stub also exhibits very low impedances across it at even multiples of its resonant frequency.

MAKING YOUR OWN STUB

If you have run into difficulties when connecting solid state exciters to tube transmitters such as the Harris FM-20K, then you may be suffering from some of the very same difficulties I encountered. And, you may want to give that exciter a little added protection by placing the quarter-wave stub between the exciter and the IPA as I have done. To build your own quarter-wave stub, you will need the following parts:

- 1 - Type "N" coaxial tee. (Amphenol UG-107B/U or equivalent)
- 1 - Type "N" barrel connector (Amphenol UG-29B/U or equivalent)
- 1 - Length of solid poly coax (Belden RG-8U or equivalent)
- 1 - Type "N" coaxial connector (UG-1185A/U or equivalent)
- 2 - Adapters or jumpers to connect the "tee" to the exciter and to the transmitter

Of course, the exact type and size of the adapters or jumpers required will depend on the type of connector you have on your exciter's output and the transmitter's input.



Calculating the stub length (be sure to use the correct velocity factor for the coax you employ).

(Continued on Page 16)

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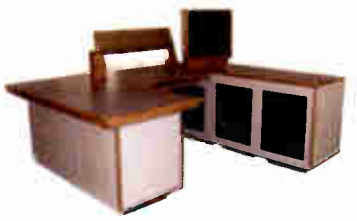

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Transmission Guide

Protecting a Solid State FM Exciter in Your Old Tube Transmitter

by Randy Davis

– Continued from Page 14 –

Making your own quarter-wave stub is simple. You start by calculating the necessary length for the entire quarter-wave stub. The formula is to divide 246 by your frequency in MHz and multiply the result times the velocity factor of the coax. In our case, the velocity factor is .66 The number derived from this formula will be the length of the line in feet.

Because of the velocity factor of the coax, the electrical length of the stub *is not* the same as its physical length: the electrical length will vary depending on the type of dielectric the coax. As an example, solid poly coax usually has a velocity factor of about .66 (it does not change with frequency), so a quarter-wave stub using solid poly coax would be about 1.84 feet at 88 MHz or about 1.5 feet at 108 MHz.

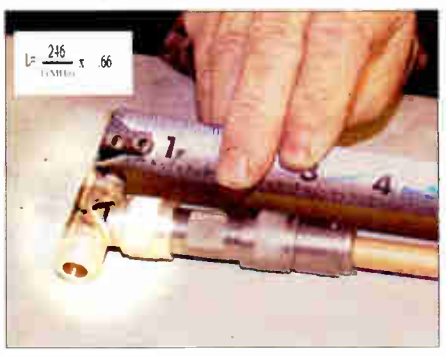
At 88 MHz: (246/88)(.66) = 1.84 feet
At 108 MHz: (246/108)(.66) = 1.5 feet

The coaxial cable manufacturer will provide the velocity factor information, if you are not sure what it is.

INSTALLING THE STUB

The length of the stub is not super critical for our purpose. If you get within an inch or so you should be okay. You know you are close enough if the VSWR does not change when you insert the stub into the circuit.

Referring back to the last picture, you will note that the stub length is the total length between *the junction of the connection within the tee and the short* at the end of the coaxial cable. This total length includes the length of the barrel connector (if used) as well as the added length of the tee connector itself. As a Rule of Thumb, for N connectors you can figure about 1-1/4" for a barrel connector and about 1/2" for the tee.



Be sure to factor in about 1-3/4" if you are using both an N barrel and tee with the stub.

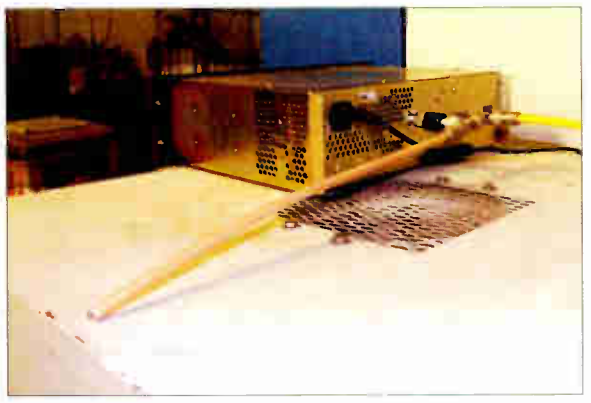
To make the stub even more effective, if you have sufficient drive power, a 3 dB pad may be placed between the exciter and the tee. On our test setup, the 3 dB pad was selected because it provided an additional healthy impedance between the tee and the exciter and I had more than double the required drive power available from the exciter. The amount of reserve drive power available from your exciter will be the determining factor in selecting pad attenuation should you decide to use one.

If you do this, also make sure your attenuator pad is rated sufficiently to dissipate the power coming from your exciter; a 3 dB pad will dissipate half the power put into it and this could get quite warm! Other pad attenuations may be used depending upon your specific situation.

In the final picture, I have removed the exciter from the transmitter's rack and set it on top of the power supply to make the stub and attenuator visible, so you can see exactly what I did.

The good news is that since the installation of this simple stub between the exciter and the IPA, I have not blown any FETs in the exciter.

If you have any questions implementing regarding this technique, you are welcome to contact me directly by telephone or email.



The stub attached to the back of the exciter. Note, too, the 3 dB pad between the exciter and the tee.

Randy Davis is the Plant Manager for Freeland Products, Inc. in Covington, Louisiana. You can contact Randy at 800-624-7626 or by email at randy@freelandproducts.com

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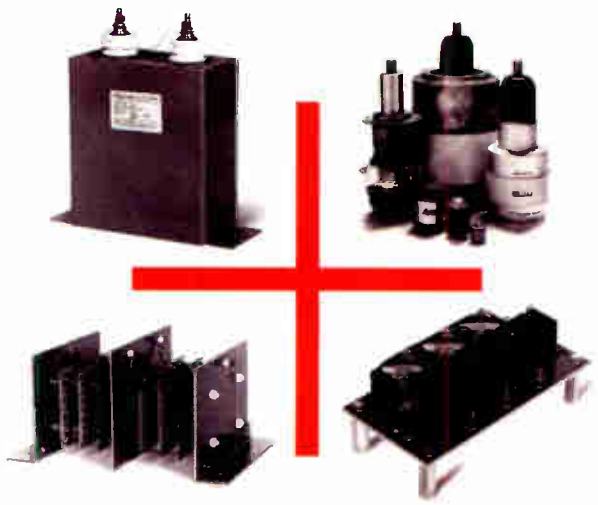

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Transmitter Shack

by Phil Alexander

Keeping Your Transmitter Cool

The heat was a physical force that attacked instantly as I opened the door. The transmitter shelter was stifling. The air conditioner was silent and the transmitter was dead except for the fault light and a few readouts, all of them well beyond their normal operating temperature.

This was not the first time nor would it be the last that this remote site crashed during a late afternoon in August. A new fuse in the air conditioner and about 30 minutes to cool everything to normal temperatures would get the station on the air again, but something more fundamental was wrong.

A LONG-STANDING ISSUE

I had taken over the contract from another engineer a couple of months before this transmitter's "hot flash," and had only indirect information from non-technical people at the station who told me it was a repetitive problem.

A quick look at the specifications of the transmitter and air conditioning unit disclosed no problems. In fact, it appeared the unit was oversized for the job for closed loop cooling of the transmitter shelter.

The cooling for the shelter was rated at 40,000 BTU/h. The transmitter environment was closed loop cooling, which is another way of saying the air was drawn out of the transmitter shelter, passed through the air conditioner and returned to the space. This way all airborne contamination issues were minimized to the very small amount of air that might infiltrate the building when high winds blew across the site in a remote agricultural area.

The real question was; "How much cooling does the transmitter shelter really need?"

THE EQUIPMENT HEAT LOAD

The main transmitter was a 5 kW solid-state FM that had a nominal rated efficiency of 80%.

Some of the group that came off the assembly line may have produced efficiency that high, but on a good day, this one was about 75%. That difference may not sound like much, but 5 kW TPO at 80% requires 6.25 kW input while 75% boosted that by over 400 watts. Additional loads such as a large blower in the transmitter and the usual rack of equipment plus an auxiliary tube type transmitter on hot standby meant a total equipment heat load of about 3 kW.

Cooling ratings are based on BTU/h (British Thermal Units per hour); at 12,000 BTU/h/ton of rated cooling capacity. A kilowatt hour equals 3412 BTU/h.

Energy Conversion Factors:

1 kilowatt/hr =

3412 BTU/hr =

1.341 HP/hr =

0.2843 Ton/hr (cooling)

Thus each rated cooling ton can remove 3.517 kW of heat from the environment. It is easy to calculate that the heat generated by the equipment amounts to less than one ton of rated air conditioning capacity. However, there is a catch. In fact, there are a couple of them.

MORE THAN THE EQUIPMENT

First, the cooling rating assumes an ambient temperature of 100 degrees Fahrenheit. With the hot sun beating down on the cooling unit, as it was in this case, the cooling air temperature instead became the "cooking air temperature" as the air conditioner sat there and cooked all day.

Second, the equipment is only a fraction of the cooling requirement in a small station like this one. The heat gain of the shelter was the main heat source.

This particular shelter is about ten feet by twenty feet, and approximately eight feet high. Typical of an equipment shelter of fifteen or twenty years ago, it is Utility Green in color to blend with its surroundings and has no shade for natural cooling. The shelter is oriented with its front toward the southwest which means that as heat is peaking in the late afternoon, the maximum wall area is in direct sunlight. Previous experience showed the cooling required by solar load was about 30,000 BTU/h during a typical hot summer day in August.

NO ROOM FOR ERROR

It is easy to see there was almost no safety factor in the design. Any reduction of transmitter efficiency or air conditioner efficiency would cause a slow buildup of heat inside the shelter which, in turn, would place a greater load on the air conditioner which would ultimately cause a transmitter temperature fault.

On most any extremely hot day the station could count on a failure in the middle of afternoon drive time. Clearly, a change was needed.

Management suggested the possibility of using fan cooling rather than air conditioning. They thought it might be cheaper. It was the beginning of a wild goose chase, but a very instructive one because some plants can benefit from cooling fan systems, especially where the load is unusually large and the temperature extremes are mild.

ANALYZING THE HEAT LOAD

The first consideration for a fan system is the design-maximum outdoor ambient temperature. That is a fixed factor you can do nothing about. In this case, we selected 105° F based on weather records.

The next consideration is the maximum acceptable temperature in the ventilated area. Based on the fact that the transmitter began automatic power reduction at 120° F – and shutdown completely at 125° F – we selected 115° F as our maximum temperature. In other words, we had to maintain no greater than a 10° F differential above the outdoor temperature.

Based on the air conditioning data, we decided we would use a heat load of 48,000 BTU/h as the maximum load to give a small safety factor in the design.

THE AIR FLOW FACTOR

Of course, once you reach the maximum cooling load for the air conditioning system, the only way to remove heat is via air flow. In other words, we needed to know how much air must flow through the transmitter shelter to keep the temperature at or below 115° F when the outside air temperature (OAT) is 105° F.

To make that calculation, you must first know the density of the air in fractional pounds per cubic foot and the specific heat of air. The combined gas law formula sounds complex and difficult, but the reality for finding air density is a simple calculation.

The formula which combines the effects of Boyle's Law and Charles Law says PV = mRT, where

- P is the absolute pressure in pounds per square foot of air (PSIA x 144),
- V is the volume in cubic feet (in this case = 1),
- m is the mass in pounds, R is the gas constant for air (in the English system = 53.3), and
- T is the temperature in degrees Rankine (F + 460).

All we need to do is divide both sides by R x T and our formula for the density for a cubic foot of air becomes m = (P x V) / (R x T).

For various conditions the specific heat of air, or the energy input required for increasing the temperature of one pound of air one degree Fahrenheit is 0.24 BTU/lb/F. Thus, one BTU will raise the temperature of one pound of air slightly more than 4° F – or more exactly 4.167° F. Put another way, 2.4 BTU's will raise the temperature of one pound of air 10° F.

FACTORING THE DENSITY

At this point, the numbers are easier to handle and the air flow volume is easier to visualize if we convert from units per hour to units per minute by dividing the heat load by 60. Thus, 48,000 BTU/h becomes 800 BTU/m.

Dividing that heat load by the specific heat of air says we need 3333.33 lb/min. air flow for a 1 degree rise, or 333.33 lb/min. for a 10 degree rise.

Useful Conversion Factors

Absolute air pressure at sea level:

14.696 PSIA =

29.92 inches Mercury (Hg) =

1013.5 millibars =

759.968 mm Hg

(Air pressure correction for altitude: At elevations from sea level through 5000 feet AMSL the correction is subtracting 1.0 inch of Mercury from the sea level barometric pressure for each 1000 feet above mean sea level. For example, the absolute pressure at 4500 feet would be 29.92 - 4.5 = 25.42 inches of Hg.)

The transmitter site is about 1000 feet above sea level so the average true barometric pressure will be about 28.92 inches of Mercury. Converting this to PSIA is done by dividing by 2.0359 (29.92/14.696), resulting in 14.205 PSIA or 2045.52 PSFA.

Since we are finding the volume of one cubic foot, the P x V part or numerator of our equation is 2045.52. The design outdoor temperature is 105° F, making the absolute or Rankine temperature 565 R. Thus, the R x T part or denominator of our equation is 53.3 x 565 = 30114.5, making the density 0.06724 lb/ft3.

This shows we would need about 4,907.4 cubic feet of air per minute for keeping the shelter at or under 115° F when the outside air temperature is 105° F. To simplify, round that up to an even 5,000 CFM fan or blower capacity.

MAKING SENSE OF THE CALCULATIONS

However, with that much flow in hot weather the entire air volume of the shelter will change slightly more than three times per minute. In other words to achieve the cooling we need, the transmitter shelter becomes a wind tunnel with air moving through at roughly one foot per second! In addition, automatic controls on the intake filter panels will be necessary because winter outdoor temperatures below -10° F are not uncommon.

Would it be better, perhaps, to duct the air directly through the transmitter? That might work, but the rack-mounted equipment would get too hot because, except for the transmitter, the shelter would become an oven. In this case, it is not practical because ducting to the transmitter would prevent access for maintenance.

For efficient operation and low pressure drop, velocity through the filter media should be no more than about 350 feet per minute, and slower is better. Also we need about 50% excess for extending the time between filter cleaning. Dividing 5000 by 350 and multiplying the answer by 1.5 gives a filter media area of 21.4 square feet, minimum. Increasing that to something that will fit means building a filter panel six feet by four feet, or something similar.

While a fan may sound less expensive, it is easy to see that a design that will actually get the job done is more expensive than a larger air conditioning unit. A correctly-sized filter also carries a rather high maintenance cost, especially in an agricultural area where farming activities sometimes drown the transmitter site in huge clouds of dust reducing visibility on a clear, sunny day to less than 200 yards.

ON THE OTHER HAND ...

The happy ending to this story came with a new and more enlightened GM taking the helm and almost immediately ordering installation of a 60,000 BTU/h air conditioner. Since then the building has stayed well within temperature limits. Problem solved.

A frequent contributor to Radio Guide, Phil Alexander, CSRE, AMD, is a contract engineer based in Indianapolis, IN. Contact Phil at dynotherm@earthlink.net

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Tech Tips

by Steve Brown

Some STL and Transmitter Troubleshooting Tips

Even reliable equipment from well regarded manufacturers can develop issues that Tech Support has not seen. Steve Brown shares a few tips from his service notebook that might help you.

Both Harris and Moseley have excellent tech support departments, but they have not observed every sort of erratic behavior you might experience in the field. They also have a lot of good information on their websites (the Harris Premier page requires registration, but it is free). Nevertheless, troubleshooting can be fun.

DIGITAL STL PROBLEMS

If you are experiencing high post-correction bit-error rates or receiver faults on your Moseley SL9003Q system, *before* you send riggers up the tower to check STL feeds, here are a two things you need to know.

First, the transmitter power output meter can lie. One SL9003Q transmitter showed about 1.2 Watts of forward power, but using a Bird Thruline Wattmeter with a 2.5 Watt slug, I observed less than 100 milliwatts of power.

The Bird does understate the actual power output a bit because it is calibrated for continuous wave signals. However, a known good Moseley transmitter, showing just over 1 Watt on the front panel meter, will indicate about 800 milliwatts TPO on the Bird.

RECEIVER GOING "DEAF"

At the receive end, I have seen two of the SL9003Q receivers "go deaf." For example, one receiver lost a couple of dB of signal per month and, when it read below -73 dBm, the fault tallys started climbing, particularly during lightning storms.

With a spectrum analyzer connected to the coax drop from the STL antenna, I read about -63 dBm. When the receiver was repaired by Moseley and put back into service the spectrum analyzer still showed about -63 dBm, but the receiver meter read -53 dBm. It appears that using the analyzer this way understates the actual received signal by about 10 dB.

Another failure was solved using a known good spare. I was able to swap out the RF modules in the receivers, verifying that it is the RF module that loses sensitivity. Kevin Wynn at Moseley recommends sending in the entire receiver for service, however, because part of the RF path continues in the next module.

THE BUZZING HV CABINET

If you have buzzing noises coming from your Harris FM25, HT20 or HT25 transmitter power supply cabinet, likely it is not from bees.

Harris uses a voltage bucking transformer to supply power to the "drop solenoids" that short the high voltage when interlocks open. This seemed curious, because the coils are rated at 220 Volts and the bucked voltage is around 130 Volts. Apparently if 220 Volts is applied to the solenoids they move so quickly and violently that they crack ceramic insulators!

Harris has now come up with a simple modification to re-wire the solenoids for higher voltage to stop the buzzing or intermittent problems. Their Service Bulletin **FM-560-JK** addresses this.

MORE POWER SUPPLY ISSUES

Another issue in the HT20 and HT25 power supply cabinets involves loose connections. Those big power contactors not only make you jump when they activate, they make wires wiggle and screws turn. So, if you are having intermittent problems that lead into the power supply cabinet, remember "righty tighty, lefty loosey" and check *all* the screws – *after* you have opened the disconnect.

In some FM25 or HT20 and HT25 transmitters a problem with the regulated 12 Volt power supply may be traced back to the power transformer that supplies voltage to the regulator. Measure the unregulated voltage on the filter caps of the supply, which should be around 18 Volts. If it is closer to 14 VDC, read on.

The power transformer for this supply has a dual primary and is wired for 240 Volt AC input, but if your incoming AC power is 208 Volts the output of this transformer may be too low to keep the regulator happy and odd things happen on the output, like oscillations and voltages that vary with the load.

The solution is to re-wire the primary of the transformer for 120 Volts, an easy wire change, but remember that you need to extend a neutral wire into the transmitter from the service disconnect so as not to let the ground wire carry any of the current drawn by the transformer modification.

CONTROL CIRCUIT FUN

I would love to have a photograph of the person who designed the control circuits for the Harris HT30 and HT35 transmitters. I suspect he is wearing both a belt and suspenders, but that they are attached with duct tape. These transmitters are very reliable, but too often the failures that do occur relate to the control circuits, not the transmitter operation itself.

For example, you can blame that person when your Harris HT30/35 is off the air with a tripped circuit breaker, but the status indicators on your remote control show that both plates and filaments are on. For some reason the controller circuit was designed with status outputs to be logic low when the plates or filaments are on, but they are also logic low when the power is removed from the transmitter.

This undocumented feature is not readily apparent from reading the transmitter manual. The solution is to add a relay to the status outputs in such a way that the relay is powered when the plates or filaments are on, but will not pull in if the primary power to the transmitter fails.

TALLY LIGHT FUN

Another control circuit oddity in the HT30/35 transmitters (and the Quest transmitter) is the unwanted and confusing "latching" feature on the external interlock tally light on the front panel. Mark this one down, because it gets confusing when you are playing with interlock wiring in the middle of the night.

If the external interlock opens, the transmitter will go off the air, and when the interlock is closed again the transmitter will operate normally – but the "interlock open" tally light remains lit until reset.

BYPASSING A $2,000 EXPENSE

Harris HT30/35 transmitters are now shipped without a pre-amplifier stage that follows the exciter. A quick fix for a failed preamp module in an older transmitter is to use the Flexpatch bypass, but a permanent fix is a bypass kit, available from Harris, that gives you proper status readings on the front panel LEDs and handles power ramp up at plate on.

The cost difference between the bypass kit and the preamp module is very great. Be a hero and tell your boss that the preamp failed but that instead of spending nearly two thousand bucks to replace it, you can spend less than $200 and make things good. The Field Service bulletin for this kit is **FM-544-JRK** and is *not* listed on the Premier website.

RECOVERING FROM FAULT 24 OR 25

Fault Code 24, which states "the plate voltage remained below 6 kV for 300 ms during step sequence" has a nasty habit of rearing its head when there is a power bump at the transmitter site. The problem is that this fault shuts the transmitter down, but does not recycle it, so you (or jock or program director) need to turn the transmitter back on. When the transmitter power supply is "tapped down" for lower than the full rated power output this fault occurs often enough to be real annoying.

The Harris suggested solutions that may work are:

1. Retap the power supply to bring the plate voltage back up.

2. Increase the pot on the 3-phase voltage monitor to closer to 200 Volts, rather than the recommended 190 VAC.

Harris: why not re-write the code to increase the time constant to 500 milliseconds? Give me an adjustment knob, not hard coded firmware!

Finally a discussion of the un-nerving "Fault Code 25" display on the list of faults on the HT-30 and HT-35 transmitters. It is not in the manual, and it apparently relates to a log of when the external interlock, main cabinet or high voltage cabinets, were activated. I'm trying my best to ignore it.

Steve Brown, principle of Radio Rangers, LLC, is a longtime engineer in the Minneapolis market. Contact Steve at radioranger@comcast.net

IT Guide

by Chris Tarr

Combating Bloatware

The UPS truck rolls up. The driver brings in the box you have been anxiously waiting for: your new computer! You rip open the box, hook up all the cables and press the power button.

And you wait. And wait ... and ... wait.

SOURCE OF ANNOYANCE

You are then greeted by a desktop chock full of icons: "Try AOL free." "Install Anti-Virus." "Connect to Joe's ISP!"

Ah, yes, Bloatware – those free (and not so free) programs that come on new computers. Usually trial versions of full software, the computer manufacturers call it "value-added software." In reality, software makers pay big bucks for placement on the desktop, and it has become a pretty decent source of revenue for the manufacturers.

Fortunately, a good portion of those programs are not fully installed on your machine. Some icons just point to installer packages on your hard drive. But that still means a good amount of precious hard drive space is being eaten up by those nasties.

PRUNING THE VINE

What to keep and what to delete? Generally my answer is to keep nothing. 99% of the programs are either free, stripped-down versions of more expensive software, or trial versions that expire in 90 days or so. Unless you really want to pay for the upgrades, it is better to get them off of your machine now.

Once you have decided, it is time to do some surgery. First, go in to "Add or Remove Programs" in the Windows Control Panel. Remove any program listed there that you do not want. Be careful, though, only remove things that you actually can verify is a program you do not need! There may be manufacturer programs installed that are helpful.

After you have done that, check your "C:" drive. Often there is a folder labeled "installers" (or something like that) containing the installer files for the unwanted programs. Delete the folders containing unwanted programs. Again, be careful. *If you are unsure, do not delete.* A good policy is to leave the deleted files in the trash for a few days before emptying, just to make sure you did not need them.

Finally, remove the icons from your desktop. Congratulations, you have removed the bloat!

BUYING WITHOUT BLOATWARE

Now, I have a dirty little secret for you: you *can* avoid the bloat – and it is pretty easy, too! Simply order your computer from a company that sells business computers, such as Dell, CDW, or Zones. They may not always have those "deals of the week" like the Big Box stores, but if you are really serious about a new computer, you are probably better off not buying from them anyway.

When you go to these on-line business sites, use searches like "desktops for small business" or "business notebooks." You will be presented with lots of low-cost computers. The upside? 99.9% of the time the computer you order will be shipped bloatware free! These companies understand that us IT types do not want to mess around with "de-bloating" every desktop we purchase. If a vendor did that, we would take away our business faster than you can say "Click here to try Joe's ISP!"

Typically, the prices on the small business computers are pretty competitive. I recently bought some very nice HP desktops for just under $400. These had large hard-drives, a decent amount of memory, CD-RW drives, and Windows XP Professional. As a bonus, I do not have to do any bloatware extraction when they get here.

A MORE BASIC APPROACH

There is one other option, but it is a little more involved. If you have a legitimate copy of an operating system on your computer, you can reinstall it with a basic install disc without breaking the rules. However, often using the factory install disc to reinstall your OS will automatically reinstall the bloat.

The workaround is to use an original OS install disc. When it is finished installing, you will have nothing but the basics. A word of caution though: the factory drivers will not be installed, so you may not have a fully functioning machine. Be sure to check with the computer manufacturer's web site to see if they have updated drivers available. I usually download them and burn them onto a CD first *before* doing a fresh install.

Most of the "value-added" software has proven to be little more than stuff that fills hard drives and eats CPU cycles. Use some of these hints and free yourself from the bloat!

Chris "Doc" Tarr, CBRE, CBNT, is the Director of Engineering for Entercom in Milwaukee and Madison, WI. Contact Chris at ctarr@entercom.com

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FCC Focus

by Gary Timm

DIRS Goes On-Line

Whether hurricanes, tornadoes or the wildfires afflicting the American Southwest, broadcasters are called upon to provide information to their communities in times of disaster – even when their facilities might be challenged or even crippled. Gary Timm offers us a look at a new FCC program designed to help stations deal with such crises more easily.

The FCC recently launched a new program called DIRS, the Disaster Information Reporting System.

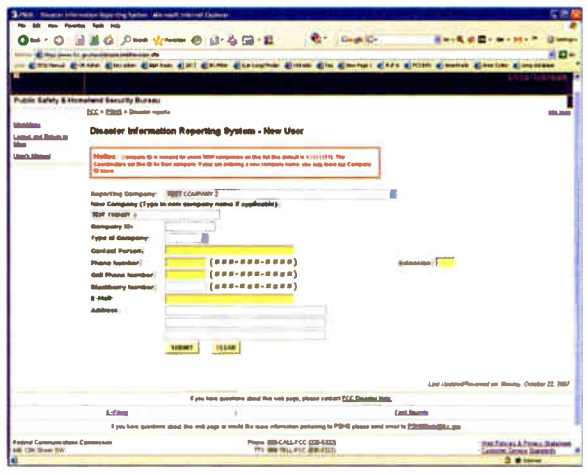
DIRS has been created to allow communications companies to report the status and needs of their operations to the FCC during times of crisis. Although you may not have heard of DIRS before, all broadcasters and cable operators should register on the DIRS website now. The URL for the DIRS is https://www.fcc.gov/nors/disaster/

Once registered, you will be contacted by the FCC if DIRS is activated in your area during a disaster. At that point, stations and cable operators will be requested to report their on-air/off-air status on a daily basis, as well as any needs they have.

SIGNING UP FOR DIRS

Some aspects of the DIRS program are not immediately evident when visiting the DIRS Website. To gain valuable insight from those who have gone before you, you are encouraged to read the two-page primer that I produced for the SBE Chapter 24 site. It is located at: http://www.sbe24.org/eas/dirs.asp (Look for the link in the middle of the page).

After reading the primer, you can follow the instructions while accessing the DIRS Website to register for DIRS.



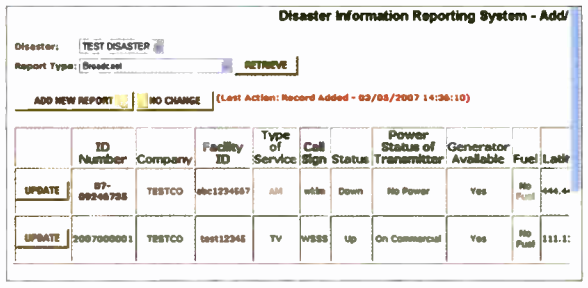
The DIRS new user signup page.

If you are with one of those companies that were involved with the Beta test of the DIRS site and had previously registered there, you will need to access the new, final Production Version of the site to obtain a new password. Note that it is critically important that you now access only the new operational site, not the original Beta site, or your reports will not be received.

Once you have registered on DIRS, it would be a good idea to read the FCC's DIRS User Manual, located at: www.fcc.gov/pshs/disaster/disaster_manual.pdf However, please be aware that there are errors in the current August 3, 2007 version of the User Manual. Where they differ, use the instructions from the Guidance Document.

PREPARING TO USE DIRS

By following the instructions in the Guidance Document and the DIRS User Manual, you will be able to specify the Coordinator for your facility, change passwords, define user levels, and understand better how the system will help when you need it.



A sample of the Broadcast report page on DIRS

One important point: When the time comes to fill out a Broadcast Disaster Report, users will need their FCC Facility ID number and their transmitter site coordinates expressed *in decimal form*. Coordinators in particular might want to gather these details ahead of time for all facilities in their company. To convert minutes/seconds coordinates to decimal coordinates, use the conversion utility on the FCC site: www.fcc.gov/mb/audio/bickel/DDDMMSS-decimal.html

We had been waiting for the FCC to correct some errors and omissions in their User Manual, but it appears those corrections will not be made any time soon. For that reason, remember to rely on the Guidance Document where there is conflicting information.

STAY UP-TO-DATE ON DIRS

In order to make sure you have the correct up-to-date information and the latest version of the Guidance Document, check the DIRS page on the Wisconsin EAS website from time to time (http://www.sbe24.org/eas/dirs.asp). This page is being updated often, to reflect any new information and/or instructions from the FCC to help stations use the system.

Gary Timm, an engineer at Journal Broadcast's Milwaukee cluster, is the Broadcast Chair for Wisconsin's EAS Committee.

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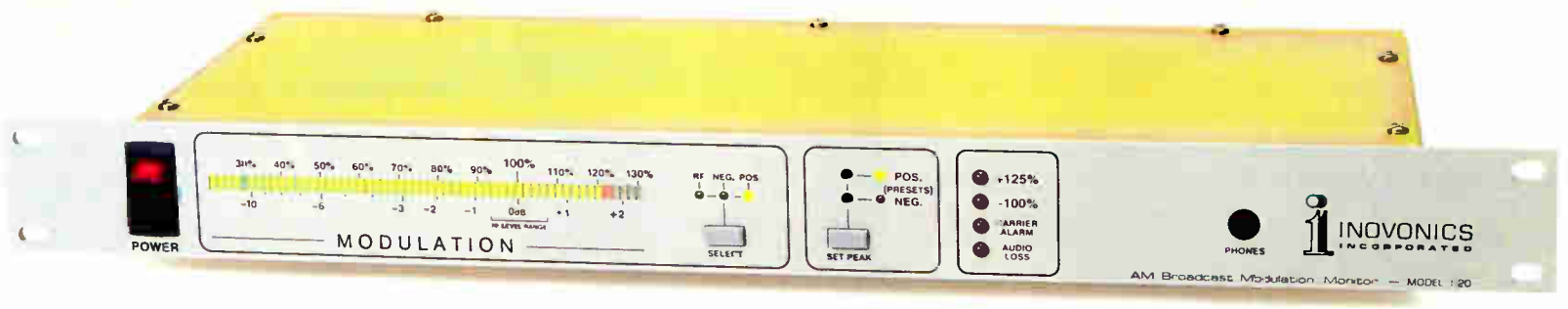

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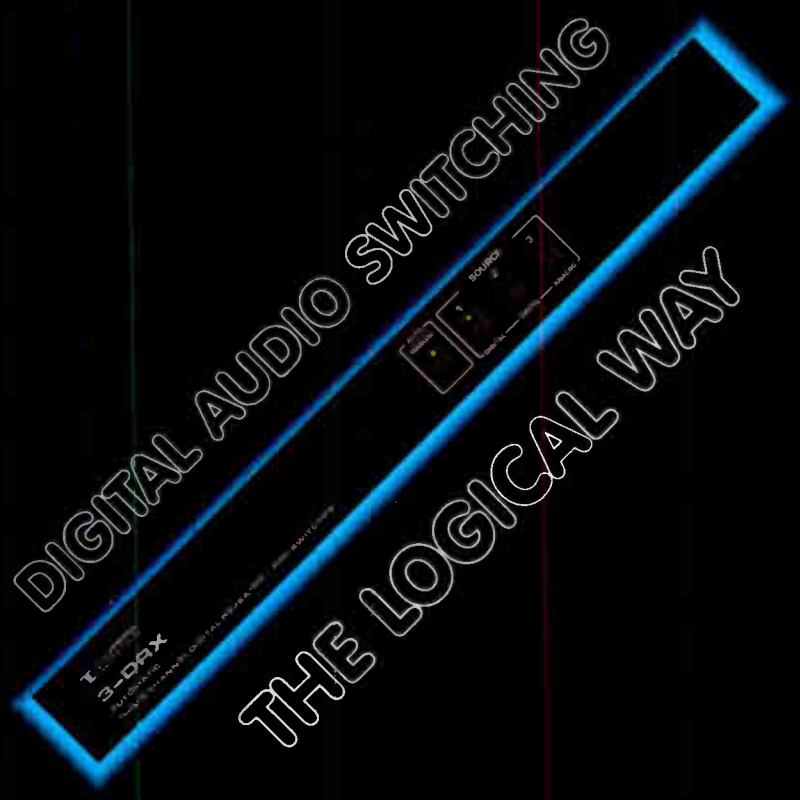

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The Worst I've Ever Seen

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

Temporary Shortcuts That Never Seem to Die

Often, it seems that there is hardly any project at any station where the engineering department is not under pressure to get something done yesterday. And almost every engineer with more than a few years' experience has found himself asked to install a transmitter or move a studio (or studio complex) over a weekend – or overnight.

It does not help that engineering staffs are stretched to the limit in many places, even in large markets, working long hours to keep the existing plant running well. The projects just keep on coming!

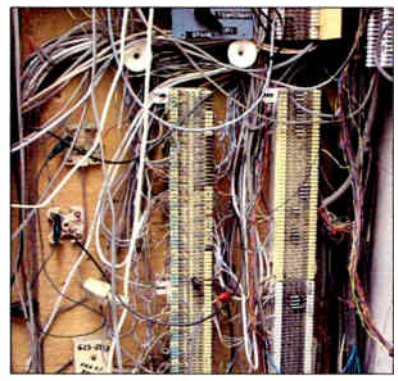
HOW NOT TO GET IT DONE

Sometimes the problem is poor planning. A manager either underestimates the time it takes to do the job or is trying to save money by not paying rent on two sites simultaneously – even for a few days. Other times, the engineer is subject to constraints such as ratings periods, which will not wait for manufacturing and/or shipping delays, or trying to finish despite missing parts.

The result is that months, years – decades (!) – later, many of the shortcuts that were taken to get the job done are still very much in evidence.

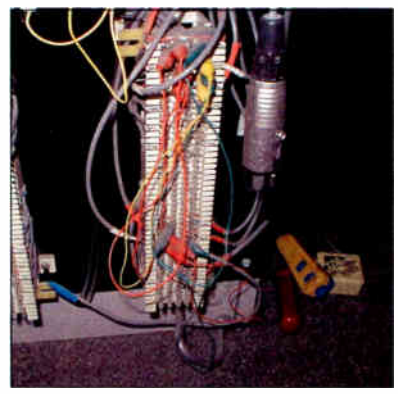
One of the most common places to see this used to be in the Phone Room. As new lines for phones or remotes are installed, sometimes the engineer will use clip leads for a quick connection. But many of those "quick fixes" stayed in place, even after they have caused intermittents a time or three.

Under the studio consoles is another place we often find clip lead engineering. The thick layer of dust on the leads quickly makes it obvious these connections were not set up over the last weekend.



Part of a phone room – *after* a good bit of cleaning up the wires.

The most creative use of a clip lead might be one we do not have a picture for: Connecting the output tank of a transmitter to the coax. We will leave that for you to imagine!

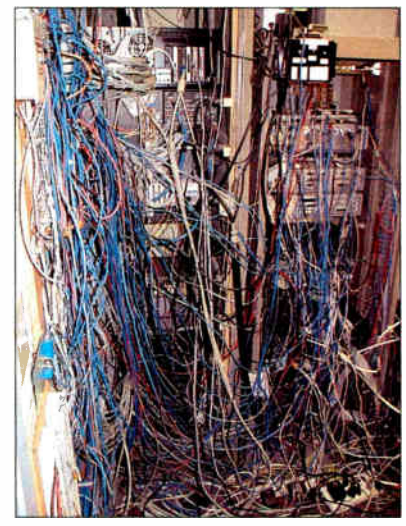


When installed, these clip leads probably were used just to get through the night (note the film of dust).

A good place to see the result of "let's get it connected now, we'll clean it up later" is often in the clutter of wires around the LAN routers. With so many connections, and wires of varying length coming from all over, routers often look like a jungle.

But usually it is behind the racks – a place few outside the engineer ever venture – that you find the worst scenes. Some of them just can take your breath away.

Of course, rarely does anyone start out to create what we see in the next picture. More often, it just sort of "grows" one wire at a time, while an overloaded engineer tries to handle the "crisis of the moment."



A spider could not have done a better job of setting a trap for unwary visitors.

As you can image, just pulling on the wrong wire could result in a lot of dead air while someone works through the spaghetti. In this case, the station had issued strongly worded instructions to the cleaning crew not to go in the room, much less turn on the vacuum cleaner.

As usual, the exact stations and their locations remain unknown to protect the silly. Please share with us some of your pictures of the strange things that go on out your way. Send them to editor@radio-guide.com

Facilities Guide

by Brad Hart and Gary Nakashima

Lincoln Financial Denver Consolidates and Relocates

As consolidation has progressed, many stations find themselves squeezing more into overcrowded facilities. Some times remodeling works, other times the only answer is a new facility. As Brad Hart and Gary Nakashima explain, when the Engineering Department has the opportunity to build from scratch, it permits planning and execution of ideas to make the facility operate more smoothly and efficiently.

Lincoln Financial Denver recently moved its operations to a new 30,000 square foot facility. The move consolidates the five station cluster (KYGO-FM, KJCD-FM, KQKS-FM, KEPN-AM, and KKFN-AM), previously spread out at two sites, into one location for the first time.

A NEEDED MOVE

The move was as much a business decision as a technical decision. The previous ownership, Jefferson Pilot, built the main facility in the early 1980s. Repairs were rampant, from cosmetic aspects such as roofing to more operationally-driven elements such as HVAC in the technical operations center.

The residential location of the main facility also became less attractive as the sales and operations staff expanded.

Growth was also a challenge for the technical operation. The technical design and facility architecture was initially based on two stations. The operation quickly grew to four stations, creating a space deficiency that compounded technical issues as the years moved forward. Technical changes to the studios began to require a tremendous amount of work. The installation of a single piece of equipment would turn a simple wiring project into a full-fledged chore.

Until now, there had been little choice beyond keeping the fifth station offsite. The distance naturally spread our engineering sources thin, creating new headaches in time management. Fortunately, the ownership jumped at the chance to relocate when the current space became available. The ability to merge the entire business and technical operation into one space was sure to solve many problems, while also providing more room to breathe with HD Radio plans around the corner.

NEW DIGS

Lincoln Financial Denver is now the sole tenant on the top floor of a four-story building in Greenwood Village, near the Denver Tech Center and just south of the city. It offers an immediate improvement in departmental communications over the two-story operation of the previous facility, bringing management, sales, programming, engineering, promotions, and operations together in what feels like an all-inclusive environment.

It should be noted that Tom Giglio, Vice President of Engineering for Jefferson Pilot at the time, provided guidance in all aspects of the project. Tom offered suggestions based on his decades of radio experience, negotiated with the major equipment vendors, attended weekly design team meetings, spent more time in Denver than with his wife Lynn in Atlanta, and ensured that the project was first class all the way.

The technical operation occupies the entire south wing of the floor, which comprises approximately 10,000 square feet, or one-third of the overall space. The complete operation includes five on-air studios, six production studios, a technical operations center (TOC), a network operations center (NOC), two talk studios, a shared news booth, and a live performance area.

Although consolidating a cluster in one facility, a good environment for the entire staff was the focus.

INTELLIGENT DESIGN

The facility was scraped to the concrete, absent of walls, electrical work and the other basics. This allowed us to start from scratch and design the facility to our inclinations. The studios were built and arranged in an L-shape pattern, with the TOC and NOC fitting comfortably on the open space along the outer edges of the studios.

The TOC is the engineering core of the facility, featuring twelve racks of equipment. Each rack is outfitted with specific equipment to clearly represent certain elements of the operation: inter-facility routing, audio processing and distribution, satellite reception, STL, and metering/monitoring equipment are among the technology installed in TOC.

Staff and Visitors can see right into Lincoln Financial's TOC.

The Harris VistaMax is the heart of the TOC, and the technical operation in general. Two fully-loaded VistaMax frames handle the enormous volume of signal sources racing throughout the facility. The VistaMax system ties to a backboard system through a series of terminated XLR connections and 50-pin Kintronics cable assemblies; routing to and from other components is centralized from that backboard system, where every signal in the building arrives for routing to its studio destination.

Both analog and digital signals come into VistaMax and leave as AES digital en route to the designated studio console. These include Telos 2101 on-air phone systems, StarGuide satellite receivers, Telos ISDN systems, and various remote broadcast sources.

GIVING IT ITS DUE

The NOC sits behind the TOC and houses the backbone of the Prophet NexGen automation system, along with ProTools and Adobe Audition online editors for production. This centralizes the IT operation and separates it from the very different engineering requirements of the TOC, offering a dedicated, secure environment for the computerized aspect of the facility.

Multiple PCs are rack-mounted in the NOC for on-air automation, recording/production, and to provide network hubs for connectivity. KBM extenders are used for connectivity to the keyboard, mouse and monitors in each studio. This avoids interrupting the basic on-air and show production operation, as well as minimizing fan noise in the studios.

Spots are recorded on ProTools prior to ingestion; other spots that come into the facility as MP3 files are directly ripped to NexGen. Data streams for FM RBDS artist and title input also originates from the NOC, utilizing a NexGen output for streaming to VistaMax.

The NOC machines are networked together, so data is not lost if a session is started on one machine and finished on another – the user simply logs into another machine to recall the session. Once loaded into NexGen, the spots are scheduled and routed over VistaMax from the TOC to the designated studio console. Traffic and billing handle the start and stop dates, removing the spots from the NexGen schedule as necessary.

The TOC and NOC take up approximately 1,500 square feet and were built out on top of a raised floor. Each room features a separate HVAC system. The racks are well-vented and produce low heat even when fully loaded. The VistaMax system specifically runs cool, which eliminated the need to duct the room and direct it up through the racks. An ample tonnage of cooling is available and used for the room, but only a conventional air dump is required to keep the equipment in premium operating condition.

THE STUDIO NEIGHBORHOOD

The studio layout is unique compared to other multi-station facilities we have visited. The architectural firm cut out ample room for each studio to build its own "neighborhood," each with its own on-air studio, production studio, program director's office and music director's office. Some, like the KYGO neighborhood, have a designated news area or talk studio as well.

Each neighborhood is painted and outfitted to take on the appearance of its format: KYGO resembles a country atmosphere, while KQKS is outfitted with hip-hop culture (and a separate live mix studio featuring turntables and a PC interface for live on-air mixing).

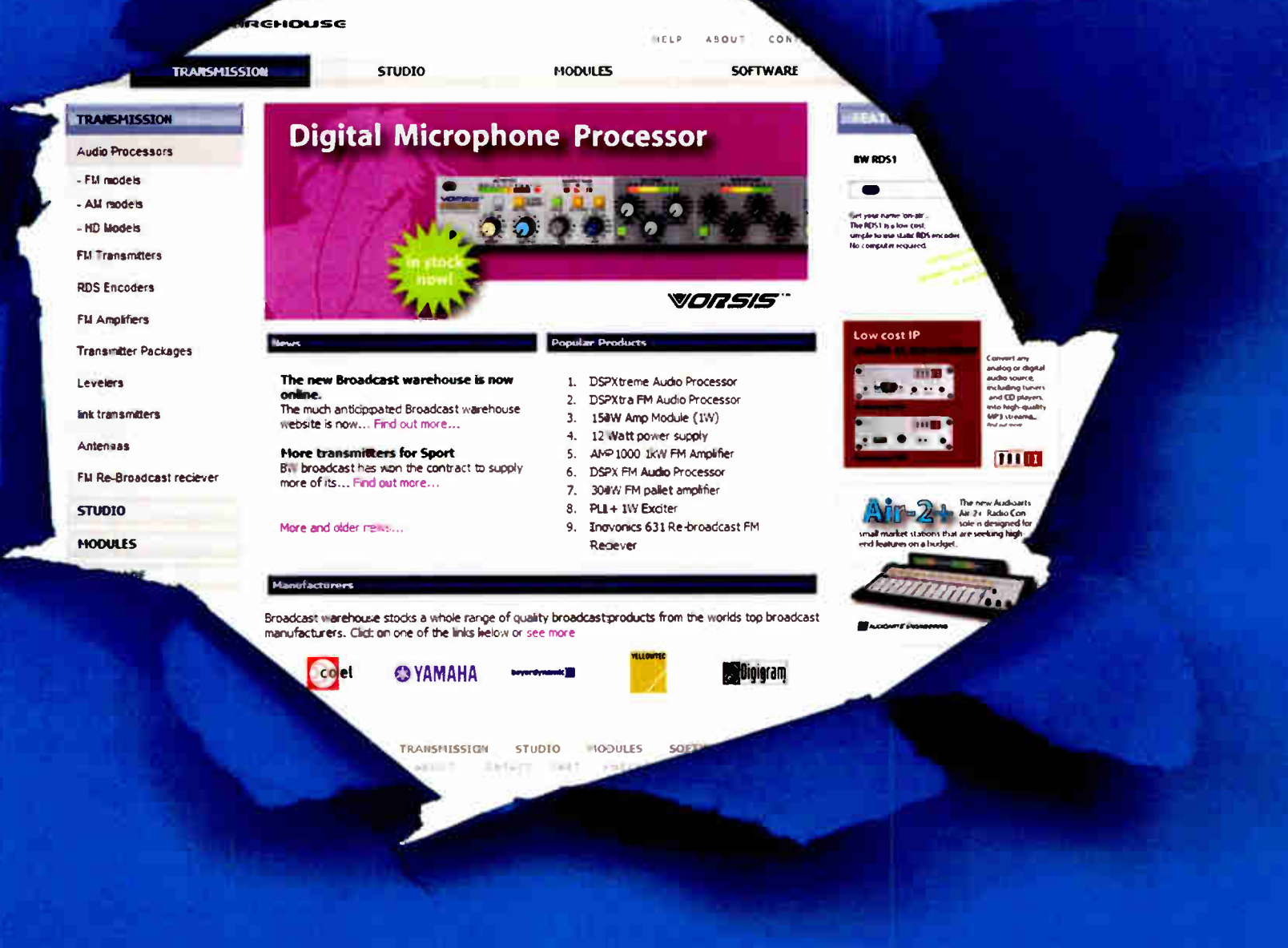
A custom studio for KJCD, Smooth Jazz 104.3

The significance of this strategy is locating the station's music and program directors in the same area. Rather than spread the programming operation throughout the facility, they remain clustered with their operations to benefit the on-air characteristics of the stations.

(Continued on Page 32)

Take a peep

at our new website



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Facilities Guide

Continued from Page 30

Lincoln Financial Consolidates and Relocates in Denver

ROCK SOLID PROGRAM CHAIN

Harris RMX*digital* 20-channel consoles were selected for the on-air studios. This console was the right size for each studio, capable of handling multiple sources, digital and analog audio, and mix-minus features. The lack of a single point of failure was highly valuable to a consistent on-air output, offering three redundant separate paths through the air chain.

A Titus 3-DRX switcher monitors the three redundant paths, including two analog and digital feeds from the main audio networking system (the 3-DRX switches to a Henry Engineering mixer for the third level of redundancy). This sends the analog signal downstream directly from Prophet. This keeps the station on the air in the event of audio networking loss, with program sources (as well as EAS and analog audio delays) bypassing as much of the system as possible on the way to the transmitter.

The signals exit the air chain and are transported over the Harris Intraplex T1, 5.8 GHz Western Digital, and Moseley Starlink 6-Channel STL systems. Each station utilizes at least two of these three STL systems – one as a primary and another as a redundant backup – which carry the same material in a bidirectional manner between the TOC and transmission facilities.

FLEXIBLE AUDIO ROUTING

Most on-air consoles feature the same assigned sources: NexGen automation, four microphones, ISDN, satellite feeds, remote feeds, CD and MiniDisc players, VoxPro and PC Internet. Any on-air console can call up any production console via VistaMax.

KKFN is a slightly different animal; it is an all-sports station and the flagship outlet for the Colorado Avalanche NHL and Denver Nuggets NBA teams. KKFN's on-air console has mostly ISDN and satellite assigned sources. Operators in this studio rely heavily on VistaMax on Game Day to deal with multiple sources for both the local feed and the uplink facilities. The feed is either produced on-location at the Pepsi Center or fed to KKFN as a raw arena feed for production in one of the studios before distribution to uplinks and the KKFN transmitter.

Each station's Program Director was given full autonomy for studio design, which naturally eliminated the cookie cutter feel of many multi-station facilities. Our team reviewed the final design to ensure that all the necessary equipment for a complete operation was present, but the look and feel of each studio is quite different.

All of the studios use Harris Smoothline furniture, custom-built to meet the program directors' requests. Some studios use turrets to store CD players, delays and other pertinent systems to the on-air operation. Others preferred a plain countertop with a clean view of the console and PC monitors, opting to store source and delay units below the countertop.

STUDIOS FOR PRODUCTION AND PERFORMANCE

The production studios are shared between all stations and similarly designed, although slightly smaller, than the on-air studios. Each production room features a 12-channel RMX*digital* console and a NexGen system. Local machines and production equipment are the same, although the production studios also lack EAS machines.

One of the six Production Rooms

EAS triggering over the Sage ENDEC system is at the operator's fingertips in each on-air studio, and it is up to those operators to trigger the required

(Continued on Page 34)

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Continued from Page 32

Lincoln Financial Consolidates and Relocates in Denver

weekly tests. This is perhaps the biggest difference between production and on-air, and the main reason we have fully equipped our performance studio as our preferred backup on-air studio.

The performance studio was designed to bring in outside acts for live or recorded performances to air later. It is equipped to handle a solo artist or small group ensemble, with headphones for the performers, direct boxes for electric instruments, and plenty of microphones for acoustic equipment. There is also room for a small audience. A 12-channel Mackie mixing board feeds into a 20-channel RMX*digital* for live-to-air performance or production purposes.

NEWS AND TALK STUDIOS

The two talk studios are similarly designed with input from program directors figuring into the final product. Smoothline turrets are filled with clock timers and headphone systems. The host and co-host positions feature a profanity delay dump button, an intercom, and headphone controls; guest positions are limited to microphone on/off buttons, cough buttons and headphone jacks.

The newsroom is a small booth featuring a four-channel mixing board and Adobe Audition to trigger sound bites. The operator can monitor the appropriate stations for sports and news updates via external amplifiers on the monitor bus and go live with the simple punch of a button. KKFN broadcasts live sports updates every 20 minutes.

KKFN's Program Director was intimately involved in the design of the station's talk studio.

The session function of VistaMax is utilized to eliminate the need to create a feedback loop while listening to pre-delay audio over headphones. This perfects the on-air timing of the updates without the pre-delay audio monitoring annoyance.

READY NOW – AND READY FOR THE FUTURE

The new Lincoln Financial Denver facility has done much to simplify our operations. For example, we have employed a single APC UPS source to power the on-air operation for 15 minutes before handing it off to a 135 kW generator, instead of the dozens of small UPS sources scattered throughout the facility as we had before.

Overall, what is most remarkable about the new site compared to the older main facility is the reduction of clutter. VistaMax provides a centralized routing system that allows the entire facility to take advantage of every source in the building. Each channel has essentially become its own router, and any operator can sit at any console to dial up any source from his position. There are no longer any limitations of something being tied to specific consoles; changes to studio equipment are as simple as adding wires to the console or mainframe.

The new facility also is ready for the future, including HD Radio broadcasting. KYGO-HD was ready to go on the air at press time, with no diversions from the core technical design being required to accommodate the HD stream.

The design and integration teams from Harris have set up a foolproof system that has experienced very few errors since we started migrating stations last year – an impressive feat considering the thousands of connections throughout the facility. The fact that it is well equipped to handle an HD Radio broadcast and multicast future means we are well set up for the future.

Brad Hart is the Director of Engineering and Gary Nakashima the Assistant Chief Engineer for Lincoln Financial in Denver. Contact them at brad.hart@lfg.com or gnakashima@jpc.com

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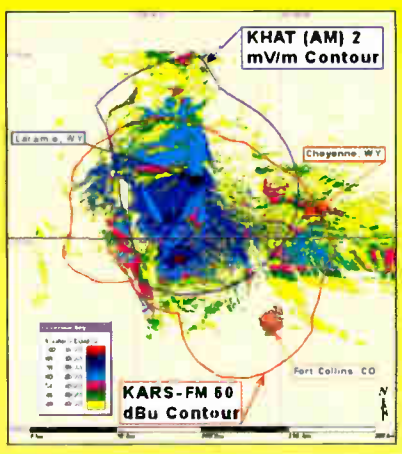

rfInvestigator is a tool for analyzing FCC spacing, FCC contours & much more! Population data, LULC data, terrain data, Longley-Rice models, Topo! maps & drive test data can all be displayed in **rfInvestigator.** It offers a host of advanced features, many of which are not found in similar programs or are offered as expensive additions, like a terrain profile tool and our antenna design tool that can automatically calculate your antenna pattern for you. Add our DB-Builder program and *never* buy another FCC database! Ever!

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Analog Guide

by Ted Alexander

Can AM Be Saved from IBOC?

It is still very early in the AM IBOC nighttime experiment, but I would like to toss out an idea so that we do not toss out AM radio.

24/7 IBOC OPERATION BEGINS

Since September 14th we have seen and heard what happens at night to the IBOC signals of some of the 50 kW clears.

In Cleveland, I have measured WJR (760) at close to 5 mV day and night. Yet IBOC sidebands from first-adjacent stations (WSB 750 and WABC 770) have made WJR unlistenable here at night. I presume that in similar situations near New York, WABC has also suffered from the same type of interference, as Citadel had WJR and WABC turn the IBOC off at night. On the other hand, for some stations, like WOR, power, pattern and adjacent-channel buddies (except for WLW) work *for* them.

We do not as yet have any similarly conclusive reports for the regionals and locals. However, on a 5 kW regional station running IBOC here in Cleveland, the first-adjacent's IBOC signal interfered enough with the local station that an Accurian radio was not able to switch over to IBOC even in an area where the analog was quite listenable.

In my observations and opinion, nighttime IBOC coverage on most stations of less than 50 kW and/or those surrounded by significant first-adjacent signal levels just do not play well enough to convince the public to go and buy an AM IBOC radio.

FLOATING TED'S BIG IDEA

Having heard a good deal about the difficulties and expenses of AM IBOC, I have this idea that has been percolating for some years now. I am sure others have thought of (and experimented with) this in the past, but perhaps this is the time to run it up the flagpole now and ask if anyone else thinks it is viable.

Remember when C-Quam encoded its L-R information by FM'ing the carrier with a narrow modulation index signal? Well, what if we simultaneously modulated that carrier with AM and FM? We would keep the modulation index low enough to keep distortion in the AM envelope detectors tolerable, limiting the negative AM modulation to 90% to give the FM limiters enough carrier to work with.

It would be mono AM, but it would offer less noise and better frequency response than we have now, and the quality would approach mono analog FM. Since it would not be wideband FM, it would not be as noise free as the 88-108 FM band, but it would be much better than plain old AM.

EASY IMPLEMENTATION

The guys in the labs would have to determine the modulation index that would be the best compromise, but that should not be too much of a burden. Audio would be linear, no data reduction necessary. Very little modification to the transmitter would be needed, just a new "FM'd" oscillator.

Furthermore, you would not have to force the transmitter into being a linear amplifier like we did with C-Quam. You would not have to tweak most antenna systems. And the RF mask would still fit or be close to fitting into 20 kHz.

On the receive side, we would be able to decode either the amplitude or quadrature component via groundwave or skywave. DSP would be built into yet-to-be-designed chips in the receiver. Maybe the receiver could limit out the AM component, multiply the IF frequency a number of times, and demodulate it on a wideband detector, etc. Costs of receivers would be little more than what the analog receivers are now.

Yes, we would give up stereo, but we would keep the ability of AM to be compatible with a billion radios already out there. The public could hear AM in decent fidelity as receivers became available and, as noted, costs of transmitter conversion would be minimal.

POSSIBLE?

So, guys and gals out there, am I dreaming? Am I crazy? Am I too late? Or is there just not enough money to be made with this idea?

Let IBOC develop on FM, where we have the bandwidth to play with. In my "impossible dreams," we would have the high-band VHF area vacated by analog TV signals reassigned to digital radio, but that is not going to happen.

Let us keep – and hopefully save – AM as an analog service. The uniqueness of that set of frequencies just begs them to stay analog. Or am I just thinking like an old coot who likes AM and the AM band? This is just an idea, but what do you, my fellow broadcasters, think of it? I have my flame suit on, so let 'er rip. I will report back later on your thoughts.

Ted Alexander is a well-experienced engineer and voice talent in the Cleveland market. Share your thoughts with Ted at AMFMTV@aol.com

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The AES-302 Digital Audio Switcher/DA/D-to-A Converter

The ***AES-302*** switches between two AES3 sources automatically upon loss of feed. Features include a four-output AES3 DA and balanced stereo analog output. The unit triggers on silence, loss of clock or other user determined digital error flags. The ***AES-302*** is remote control compatible with position status.

The CDS-300 Composite Audio Switcher/DA

The ***CDS-300*** is a basic two input composite audio switcher distribution system. The unit switches between two composite base band signals. Features include D.C. coupled signal path, low impedance output drivers that can drive long capacitive lines without instability. Another exclusive feature is an RBDS loop through to lock 57 kHz sub carriers to pilot and distribute to all outputs simultaneously. The ***CDS-300*** also has an accessory port for adding the **CTD-1** ***Composite to AES output module*** providing two AES3 outputs derived from the incoming composite signal. The CDS-300 is great for upgrading composite STLs and processors to digital output. Feed composite in and get AES3 output in addition to three composite outputs.

The CDS-302 Automatic Composite Audio Switcher/DA

The ***CDS-302*** is a two input composite audio switcher distribution system with silence sensor for automatic switchover operations. The ***CDS-302*** has all of the features of the ***CDS-300*** above including accessory port for adding the ***CTD-1 Composite to AES output module***. Provides complete confidence that audio will get to the transmitter in the event of a link failure.

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The CMP-300 Composite Audio Mixer/DA

The ***CMP-300*** provides a means of combining up to three base band signals such as FM stereo, SCA, and RBDS signals. Each input has provision for level control and each of three outputs has a level trim too. Applications include combining signals to feed to exciters with only one base band input or for feeding a common base band signal to up to three locations. The ***CMP-300*** allows you to manage base band audio signals in one convenient package. Each input features a high quality D.C. coupled instrumentation amplifier and each output features a 50 ohm impedance line driver suitable for driving long capacitive cables without instability.

The CTD-300 Composite to AES Converter

The ***CTD-300*** converts base band composite FM stereo into two AES3 pairs suitable for application to digital input exciters. Whether you are adding IBOC or upgrading to a digital exciter, like its CDS series cousins the ***CTD-300*** becomes a cost effective alternative to replacing a composite STL or processor. Or use the ***CTD-300*** as a high quality stereo decoder for studio applications. Connect to your base band modulation monitor and the ***CTD-300*** can output AES3 or with a simple jumper selection, balanced left and right stereo suitable for driving an air monitor system.

The ACS-300 Six Channel Audio Control System

Originally designed for the rigors of six channel television sound, the ***ACS-300 Audio Control System*** provides six channels of balanced I/O where each channel or groups of channels can be remotely turned on, off or dimmed by a pre determined level. Uses include monitor muting for consoles that lack this feature or for paging applications where audio dimming or muting is required. Of course, the ***ACS-300*** is well suited to six channel audio surround applications too. Each input is differentially balanced and can provide up to 14 dB of gain. All outputs are differentially balanced 600 ohm impedance. Use any time audio needs to be turned on or off and line amplification is desired.

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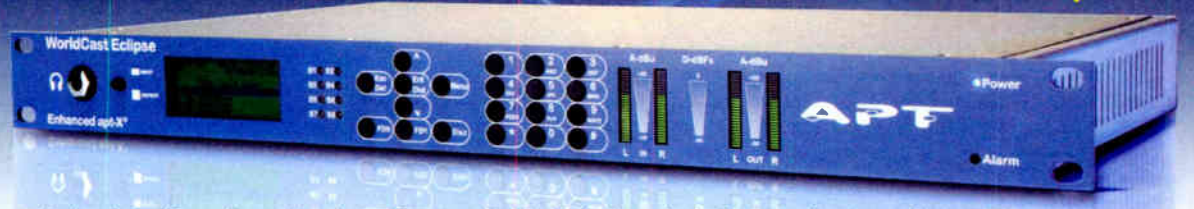

At last! An IP audio codec that offers a reliable, DSP-based platform and automatic back-up for 24/7 reliability.

APT's WorldCast Eclipse is the ultimate in flexibility and choice offering IP, X.21/V.35 and ISDN interfaces and a selection of popular coding algorithms including Enhanced apt-X, MPEG Layer 2/3, MPEG 4 AAC, G.711 and G.722

All the features you expect from a professional broadcast codec are supplied as standard: analog and AES/EBU I/Os, adjustable silence detection, alarm ports, contact closures, speed dials, embedded auxiliary data and many more...

Configuration and control of the WorldCast Eclipse is straight-forward and simple thanks to APT's powerful and intuitive Codec Management System (CMS). Offering extensive real-time management of multiple codec units, the CMS enables alarm monitoring, logging and performance monitoring as well as configurable user and audio profiles.

To see the full functionality of CMS, download a trial version from www.aptx.com.

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Tool Guide

Test, Tools, Tips and Applications

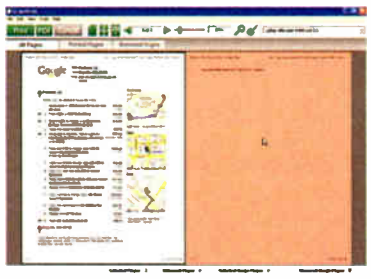
GreenPrint Saves Trees – and More

One of the unfulfilled promises of the Computer Age was that it would create the "Paperless Society." However, all you have to do is walk around any company to see the opposite has happened. One might say that it is just too easy to hit "Print."

Radio stations are heavy users of printers. The endless stream of sales materials, program logs, news, sports, incoming faxes, and show prep, seems to deplete those expensive ink and toner cartridges (some ink costs more per ounce than champagne or perfume) and paper supplies almost as fast as the business manager can replace them.

A WAY TO COPE

GreenPrint may provide a win-win situation for your facility by eliminating waste before printing, saving paper, ink, and millions of trees.



A two page document from a web site.

For example, how often do you find the last page you print contains merely a URL, banner ad, logo, or legal jargon? Here, a web page would print with only one line of text on the second page.

GreenPrint analyzes each page of documents going to the printer, looking for typical waste characteristics, and makes significant savings in ink or toner. The red hue indicates it is already marked the second page – with no useful text on it – not to print.

PRINT ONLY WHAT YOU WANT

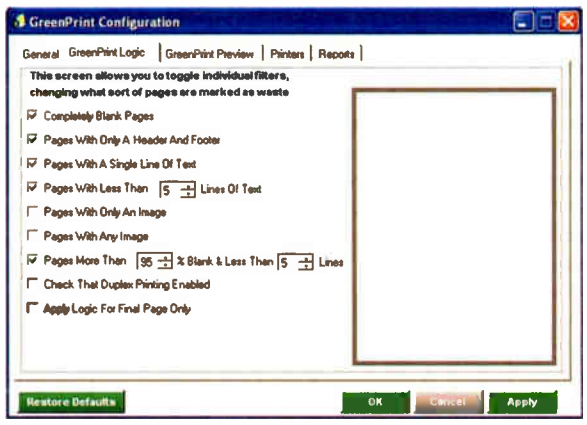
Perhaps you also would like to cut out all those annoying banner and popup ads and other graphics that appear on so many web pages, obscuring the text you want to save? The application can be set to automatically delete pictures or allow users to remove any of the pages – or images from a page – manually with a quick click.

In this case, the pictures are not needed, so only the text from the one page is passed to the printer. In addition to saving paper, GreenPrint then saves the ink that would have been used for the unwanted pictures.

The brown hue indicates graphics have been deleted.

For even more savings on paper and ink, or for archival purposes, users can opt easily to turn their selection into a PDF file, by clicking on the PDF button.

By using the Configuration screen, you can set the parameters (how many lines to ignore, picture deletion, etc) and GreenPrint software automatically highlights and removes the unwanted copy.



You decide how to handle page printing.

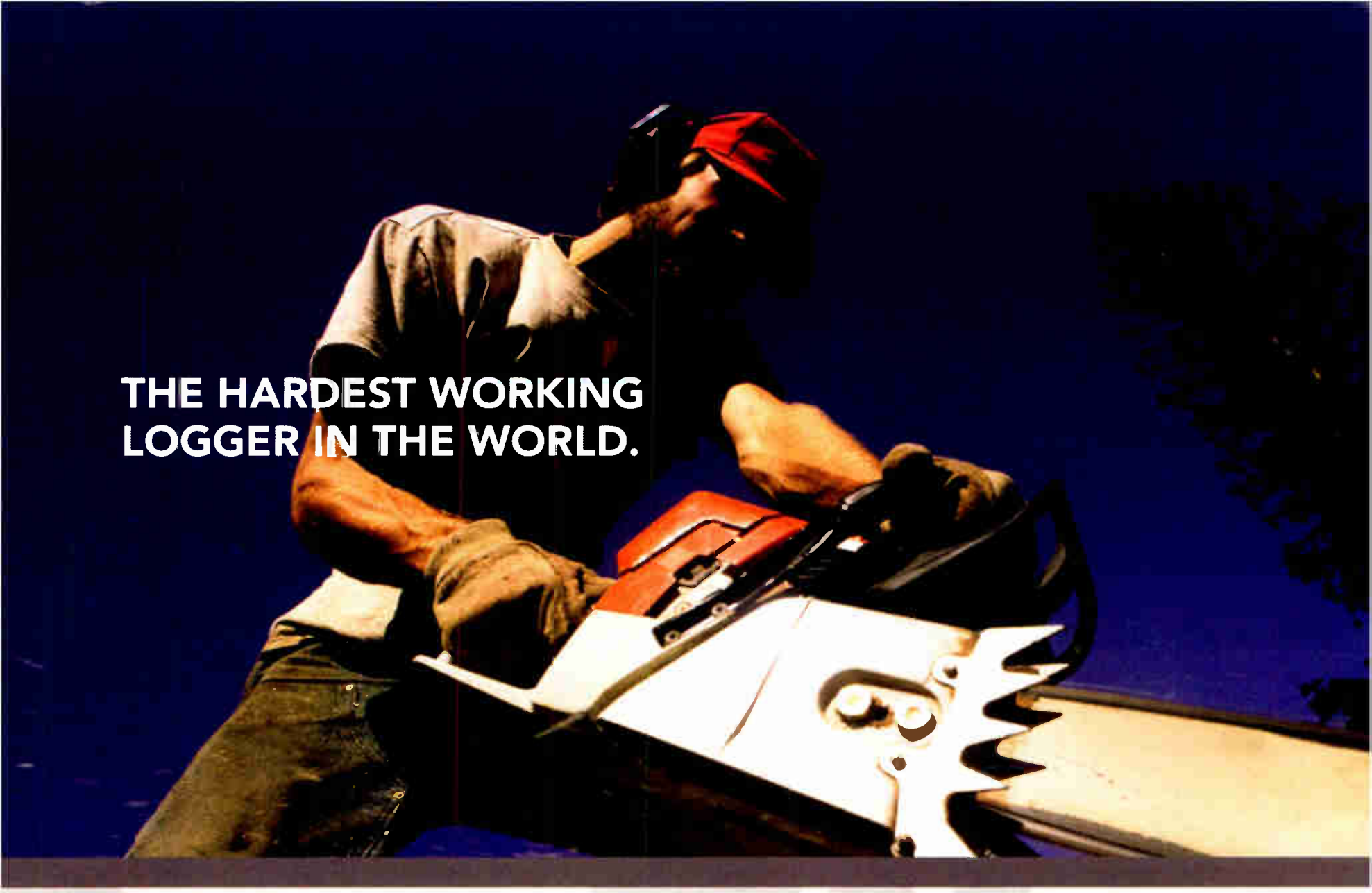
The GreenPrint viewer also lets you zoom in on a page before deciding if it is wanted. For example, incoming faxes can be read easily, and you can select and print exactly the pages you need, ignoring the others.

GREENPRINT SAVES GREEN

According to the company's studies, using GreenPrint can save each average user over $90 and 1,400 wasted pages per year – and who in radio is not above average? That is pretty fast payback.

There are a couple of additional ways to save cash. One is the Evergreen font, which GreenPrint says stays readable while further reducing paper use as much as 20%. And, if you are in the process of buying a new printer, GreenPrint Enterprise software now comes free with some of the new Xerox solid ink color printers.

For more information on GreenPrint and Evergreen, check out www.printgreener.com And to learn about the Xerox/GreenPrint offer, please visit: www.xerox.com/greenprint



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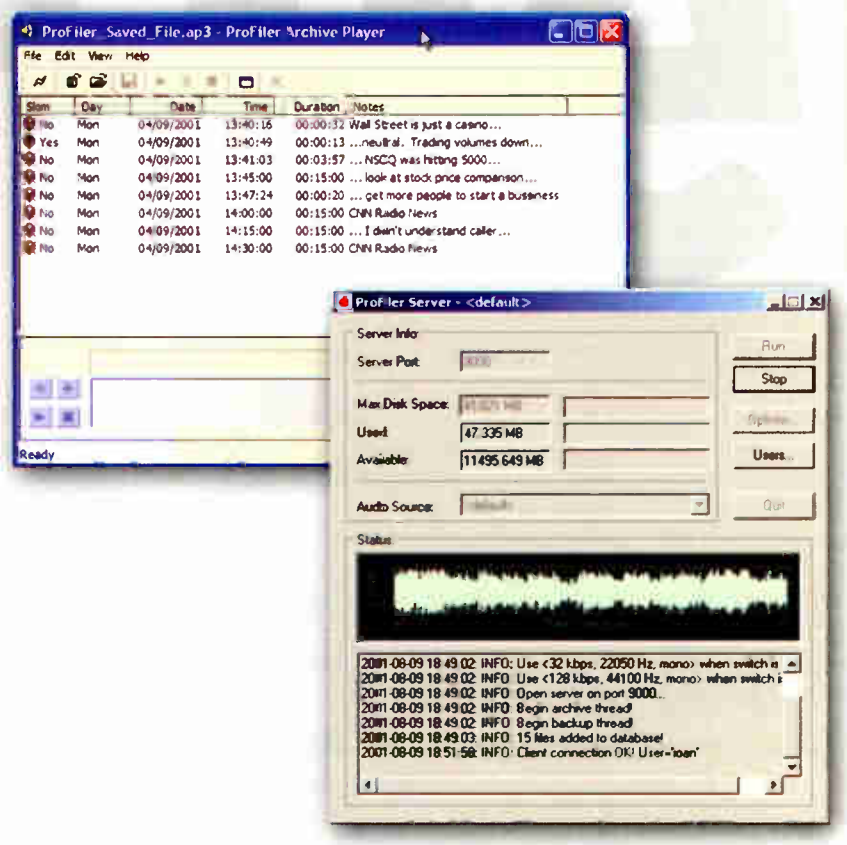

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The Omnia ONE – Digital Processing for Small Stations

by Mike Erickson

For a long time, digital processing was only available to larger groups or radio stations that could afford the hefty price tag. What is a small broadcaster to do?

Well, the stars have aligned. There is, finally, a great sounding domestic box with domestic support and domestic dealers at a price point that does not break the bank.

THE BUDGET DILEMMA

All too often, smaller and educational facilities have had to get by either with older analog chains that consisted of four or five pieces of gear in a rack, cheaper versions of digital processors from big names that had similar features to the big boxes but not the same sound, or inexpensive offerings from overseas that sounded good, but did not have tech support or approved vendors in the United States (if you are at a school or university, you know the problem).

The Omnia ONE

However, Omnia has stepped up and delivered a remarkable box. The Omnia ONE is an FM or DAB audio processor for under $3,000 that finally combines the sound you expect from an Omnia box with the clean clipping you could only get in the past from the high end Omnia boxes.

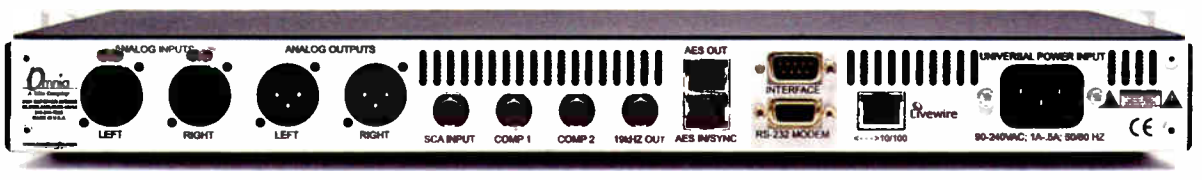
The box is also available preloaded with two modes. Right now, FM and Multicast are available, with AM on the way soon (for all of you out there who like *real* radio).

FOUR BANDS, NO WAITING

Four bands of processing, in my opinion, is the minimum you should use for FM. Every one of the best sounding, classic FM airchains (from the Optimod 8100 with 4-band Prisms to CRL's with the 4-band compressor) used a 4-band design or better. Four bands allows for more definition and detail (especially with the bass frequencies).

The original Cutting Edge Unity 2000 used a wideband AGC, a 4-band leveler and a 4-band limiter. Sound familiar? The layout of the Omnia ONE is very much reminiscent of the Unity 2000, which provided excellent spectrum control – and was obviously the first box that was truly Frank Foti's design from end to end.

This is not to say that the ONE is a repackaged Unity. Many advances in the 16 years since the Unity was introduced pack a lot more punch into a box that is literally 1/4 the size of the original Cutting Edge offering.



The rear of the Omnia ONE.

To my way of thinking, this is the "have your cake and eat it too" feature with the Omnia ONE: it is a low-cost processor with 4-band processing. In both FM and Multicast mode, the processor has a wideband AGC and 4-band leveler, followed by a 4-band limiter.

INSTALLATION

My ONE arrived in a standard Omnia box; it is a one rack-unit high piece of gear. Placing it on the air and getting it going with a preset was easy.

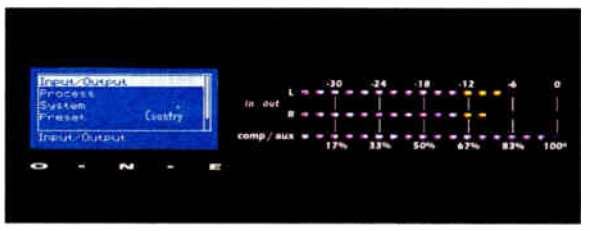
Our situation has the processing at the transmitter, being fed with audio over fiber. The audio inputs are using standard XLR connectors for analog and RJ-45 plugs for the AES/EBU input and output. (Radio Systems' STUDIOHUB+ supplies RJ-45 to XLR adaptors to interface, but the Omnia ONE manual also supplies a pin out so you can wire this connector yourself.)

On its rear, the ONE has two composite outputs so we were able to feed the main and backup transmitters from the one processor. Each composite output had its own drive level in the software menu.

PUTTING THE ONE TO WORK

The boot-up sequence is one of the few complaints I have about the box: it can take anywhere from 20 to 30 seconds for the box to boot from "power on" until audio appears at the output, analog or composite. I recommend users make sure the box is on a good UPS supply; you will restrict your experiences with the long boot-up to only scheduled downtimes.

We chose the Country preset and tweaked it out from there and were happy with the results. Digging in to the clippers to trade off loudness and dynamic range, I found the clipper "silk" setting to help, but overusing it took detail out of the highs. A setting of 5 or 6 (out of 10) was about where we were happy with it.



The Country Preset provided a good starting point.

The composite clipper was very clean – possibly the cleanest of any processor I have heard in awhile – and I would not be surprised if it was borrowed from the latest Omnia 6 software. Those who really like to rock and roll can go pretty far with this. The ONE does a good job of suppressing subcarrier junk even with high levels of composite processing, but it is always a good idea to play off any composite processor control with your terrain, subcarriers and checking for multipath.

Other enhancements in the ONE for FM include a bass clipper, which allows you to clip for "girth" or "tightness" of bass. We liked the girth clipping better, since it gave the audio a more rounded bottom end. The final on-air product was very polished and to trained ears sounded very close to the more expensive audio processors, which was the goal.

WEB STREAMING, TOO

After the on-air demo, it was time to see the other end of the processor – its use as a Multicast processor – this time using it for streaming with Omnia's SENSUS technology, which optimizes audio for the intended streaming codec.

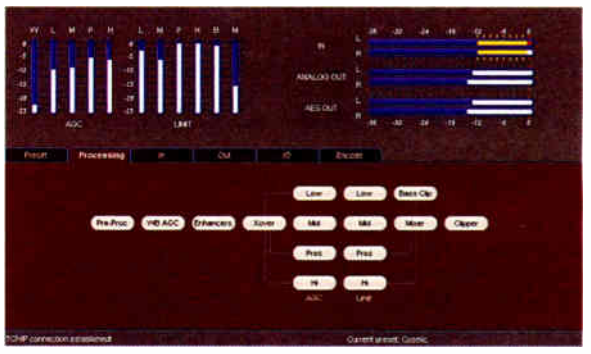
In this case, we set up a Shoutcast MP3 stream using Oddcast as the encoder with the streaming PC as the server, streaming in stereo at 32 kHz at a sample rate 44.1, and listened back using Windows Media Player 11 on a standard built-in, run-of-the-mill Dell soundcard (the PC we used to send the stream also used a standard onboard soundcard. We wanted to see how "bad" we could make it).

We chose the preset "Music 64 kbps" and, with a few EQ changes and some adjustment to the SENSUS control, found that the processor sounded a lot cleaner and more open than the previous brand name processor we had demo'ed against it, especially when it came to brass instruments and voice (anyone streaming a jazz or classical format should have this technology, no matter what bandwidth you have to use).

We tried the SENSUS technology with a bunch of different styles of music, from classical to rock to oldies to metal and everything in between. Each time, tweaking the SENSUS made the audio stream at the other end sound better than if we set the SENSUS level to zero and virtually bypassed the feature.

REMOTE CONTROL

Saving presets and navigating the box from the front panel is easy, connecting it to a computer and using the built-in web interface makes it even better. As with all other processors, you can save and recall presets (there is no day-parting feature) as well as adjust other things like pre-emphasis (FM version) and trim for the right input to achieve life's balance.



The Omnia ONE can be controlled easily from your car or living room.

The processor itself has been very reliable. We have used it on air since July; there have not been any issues with downtime. The only real drawbacks are the above mentioned boot time (something, again, that can be cured with a good UPS supply – which should be standard in any rack), and the fact that you have to reboot the software to change from the FM mode to the Multicast mode (also not a big deal anyway, since the box was not designed to do multiple modes at once).

As the product matures, I hope the software upgrades provide slightly more flavor in the 4-band limiters for FM. They sound really good and the processing is very loud, but a touch more depth would add some tasteful, user defined "color" to the audio for the FM side. On the multicast side, there probably is no better box for streaming.

Mike Erickson, President of Long Island Broadcasters Wireless Inc., is an experienced New York City engineer with a passion for audio processing. Contact Mike at wirelessmedia@gmail.com

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1967
First Orban product sold to customer: a stereo synthesizer sold to WOR-FM, New York.

1972
Bob Orban's first of 24 patents issues (U.S. #3,670,106, "Stereo Synthesizer").

June 2007 ❖
SCMS acquires assets of Major Broadcast Equipment Supplier

2005
Orban Optimod 8500 Third Generation of Digital Processing is released and takes audio processing to a new level of industry setting standard.

1975
OPTIMOD 8000 audio processor introduced for the new FM format. Bob Orban and partner, John Delantoni, set up Orban Associates as a privately held company.

2003
OPTIMOD-FM 8300 is introduced at NAB in Las Vegas. OPTIMOD-PC ships. World's first audio PCI Sound Card with Optimod-class DSP for broadcast signal processing.

1976
SCMS founded by Bob Cauthen

2007*
Orban begins shipping the new Optimod 6300 high-quality, multipurpose stereo audio processor for digital radio, digital television, netcasts, STL protection, satellite uplink protection, and digital mastering.
Orban also introduces the all-digital 9300 Optimod-AM audio processor for monophonic AM shortwave, medium wave and long wave broadcasts.

Orban Optimod 6300

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1. A no-compromise processing chain for digital transmission and media
2. A studio AGC (with peak limiting for STL protection)
3. A talent headphone processor

2000
Orban Optimod 8400 Second Generation of Digital Processing is released to immediate great reviews and becomes the new industry standard.
Orban Inc. is purchased by CRL from Harman International.

1978
OPTIMOD-AM 9000A offers AM stations a more "FM-like" sound quality and reduced interference.
In modified form, the receiver equalizer and low-pass filter ideas form the basis for the NRSC-1 standard issued in 1987.

1996
First low-priced, all digital processor for FM introduced, OPTIMOD-FM 2200.
The DSE 7000FX introduced with new DSP engine offering on-board effects like reverb, equalization and compression.

1983
OPTIMOD-TV Model 8182A introduced. Adds Hilbert-Transform clippers and a CBS Loudness Controller to the original 8180A.

1991
Orban leads the transition to digital with the first successful DSP-based FM audio processor, OPTIMOD-FM 8200. Thousands on air around the world.

1987
Orban's first product using micro-processor technology is introduced. The 787A Programmable Mic Processor incorporates equalization, compression, and de-essing in a digitally-controlled analog signal path.

Here for the Long Haul!

* Go to http://www.orban.com/about/timeline/ for a full look at Orbans timeline

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Building a Radio Station for a Convention Using Orban's 8300 Processor and OC-7400 Opticodec

by Robert Reymont

Not everyone has the opportunity to build a short-term, low power FM station for a convention at a hotel. KANA Radio was created to provide a dedicated Radio station at the ANA "Masters of Marketing" Conference at the Arizona Biltmore in Phoenix, AZ, October 11-14, 2007.

REACHING A SPECIFIC AUDIENCE

It all started with a phone call from the Wendy Frech, Vice President of Marketing of the Radio Advertising Bureau (RAB), asking if I knew a possible FM frequency that could be used to put a station on the air to cover all the rooms used by the RAB and ANA Conference being held at the Biltmore.

The broadcast reached the approximately 800 guest rooms at the Biltmore, along with the hundreds of conference attendees who walked past the KANA broadcast station each day. KANA was devised and produced by the Radio Advertising Bureau (RAB) in partnership with the ANA. Frech was the project director.

KANA provided ANA with additional opportunities to strengthen its relationship with conference attendees and enhance Radio's natural power for portable, relatable, sponsored audio content. KANA was also used as a promotional platform for a widespread Radio industry growth initiative marketed under the name "Radio 2020" and used to demonstrate Radio's ability to serve the local community.

A REAL BROADCAST STATION

I decided to use 95.9 MHz since there used to be an FM translator there that was no longer in operation. KANA was granted STA approval by the FCC to broadcast as a low-power FM station, operating exclusively during the ANA conference, October 11-14. (KANA was simulcast on the hotel in-room cable system.) The scheduled broadcast hours were: October 11th from 1 to 7 p.m., October 12th and 13th operations were from about 7 a.m. to 7 p.m., and on Oct 14th from 7 a.m. to 1 p.m.

There were more than 1200 attendees at the four-day conference, and the plan called for broadcasting the audio from all the conference sessions and a number of interviews recorded during the conference. In addition, other programming came from an RPU system that brought audio from other areas of the resort for use on the air. RAB members in Phoenix, Clear Channel, Bonneville, and CBS each provided programming and equipment for KANA.

The KANA Studio in the Arizona Biltmore

A custom studio cabinet was constructed in New York and shipped to the Biltmore in Phoenix and was set up on a riser across the lobby from the Frank Lloyd Wright Ballroom where most of the ANA conference was held.

Borrowed equipment from RAB members adorned the studio cabinets. Studio equipment included a Mackie DFX6 Mixer, Sennheiser and AKG headset microphones, SM-58 guest microphones, a Denon 951CD player, headphone and power amplifiers, and two rented Apple laptop computers.

In addition, Tempe-based Orban/CRL Systems Inc. provided two OC-7400 Opticodec units to get the analog audio over the Biltmore Hotel's IP network to a roof office. There it was decoded and sent to an Orban 8300, which sent a composite signal to the Continental 802A exciter – set at one Watt – and finally to an Armstrong FMA-707A-1 single bay antenna on the hotel roof.

The station was on the air for a total of 31 hours over four days. We also used the off-air audio taken from an old Sony AM Stereo radio to feed the cable system's information channel in case attendees were not able to adjust the clock radio in the rooms.

ASSEMBLING THE GEAR

Setting up the system was very easy. To test, I set up all the pieces of the audio chain from the console to the transmitter on the patio of my house. I used my home network to test the OC-7400 Opticodec connection and network addresses. It was simple to setup and connected the first time, every time.

When the system was moved and set up at the Arizona Biltmore, setup was just as easy. The IP director provided the IP address for each OC-7400 to use so it would not conflict with any devices within the hotel. Since we were behind the hotel's switch, bandwidth was not an issue – we were able to use unlimited bandwidth – although I finally settled on 32 kHz. When we accidently put in the same IP address in both Opticodecs, it let us know immediately about the error on the LCD screen.

The Orban Opticodec and Optimod-FM played key parts making KANA a success.

The Orban 8300 was the only processor used on KANA. It was selected for quality audio. Most of the sound was from the conference stages and from guest interviews. Although there was quite a lot of background noise from all sorts of sources, the 8300's smart gating reduced the noise floor and provided good, clean, loud audio. It was ideal for the mostly talk format of KANA.

When there were no interviews or conference programs, Clear Channel provided MP-3 sample programming of their five Phoenix area HD-1 and HD-2 stations, running pop music formats and classic jazz. The 8300's five-band processing handled the variety of material perfectly.

Out of the box, the only adjustment I needed to make was setting the composite output to match the Continental 802A exciter. However, regardless of your choice, the 8300's optimized technology ensures unusually high average modulation and coverage for a given level of subjective quality.

The OC-7400 Opticodec, Optimod 8300, and 802A exciter were placed in the office of the Biltmore's Audio Video Services, located on the second floor about 30 feet from the roof. With 50 feet of double shielded RG-8 coax, the exciter was connected to an Armstrong FMA-707A-1 single-bay antenna.

The KANA transmission system was set up close to the roof.

The hotel's cable head-end was three floors down in the basement, where normal FM reception was not possible, but with the transmitting antenna only 150 feet from the satellite downlinks on the roof, enough of the signal penetrated the concrete building.

LIVE FROM THE PHOENIX BILTMORE

Highlights of KANA included live host Doug Zanger, Founder of Xhang Creative/One Partners, and co-host Kyle O'Brien, the Creative Director at Entercom Denver. (Zanger had spent six years at Rose City Radio and three at Entercom as Creative Director.)

Together, they presented music programming from Clear Channel's Phoenix stations along with the participation of CBS Radio. On-air interviews were conducted throughout the broadcast run with speakers at the ANA conference, who represented major marketers such as Procter & Gamble, Anheuser-Busch, and Microsoft, as well as reporters from publications including Advertising Age and The New York Times.

The hosts also interacted with attendees at the conference, as the KANA station booth was positioned directly across from the main ballroom.

To complete the radio display, iBiquity provided a new Sony table model radio programmed to all the HD stations in the Phoenix Metro Market. iBiquity was concerned that in the Biltmore, an outside antenna would be needed, but Phoenix is "Class C" country, where most stations are 100 kW stations from the same mountain top. They also demonstrated the Polk Audio tagging system for IPODs. (This is the system where you can mark songs you hear on HD radio and download them from iTunes.)

With the perfect weather we had in Phoenix, I was convinced that some of the attendees even were listening to the conference from the golf and tennis tournaments instead of attending the sessions.

Longtime broadcast engineer Robert Reymont is President of Double R Consulting in Tempe, AZ. You can contact him at robert@reymont.com

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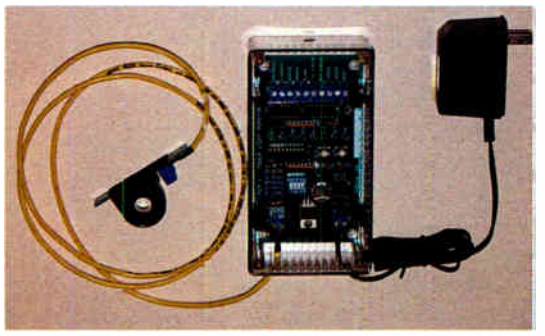

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WVRC-8 Web & Voice Remote Control System

Pro-Mix 12

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SRC-16 Serial Remote Control

ADMS 44.22
Analog/AES Digital Matrix Switcher

The ADMS 44.22 is a four input stereo AES and four input stereo analog matrix switcher with two independent stereo analog and AES outputs in a 1-RU profile. Each input is equipped with a three band EQ, five types of filters and a leveler function. Any or all of the inputs may be mixed, faded, dimmed to either or both output pairs. Additional features include; selectable stereo VU meters; headphone amplifier; powered monitor output; 16 x 16 GPIO port and RS-232/USB port.

WVRC-8
Web & Voice Remote Control System

The WVRC-8 provides a cost-effective, eight channel solution for web based and/or recordable voice response dial-up transmitter site control. Each analog, status, silence sensor, temperture sensor and power failure input can be configured to email up to four individual email addresses, allowing different input alarms to be routed to different email recipients.

WVRC-4
Web & Voice Remote Control System

The WVRC-4 is a four-channel version of the WVRC-8 in a half-rack profile.

SRC-16
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The Broadcast Tools® SRC-16 is a computer interface to the real world. Connection through an RS-232, RS-422 or RS-485 serial port with baud rates up to 38400, the SRC-16 can notify your PC software program that any of 16 optically isolated inputs has been opened or closed and allows your software to control sixteen SPDT, 1-amp relays. Two units can be operated in a standalone mode (master/slave mode) to form a "Relay extension cord," with sixteen channels of control in each direction.

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ADC-1
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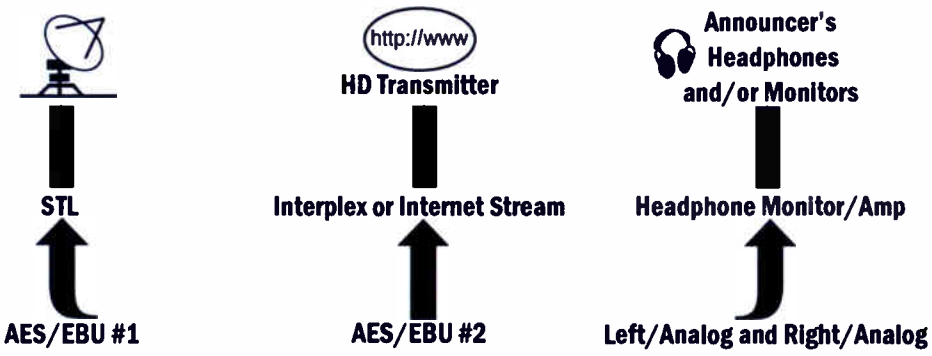

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The Orban 6300 is a high-quality, multipurpose stereo audio processor for digital radio, digital television, netcasts, STL protection, satellite uplink protection, and digital mastering. With 20 kHz audio bandwidth, the 6300 succeeds Orban's popular OPTIMOD-DAB 6200 audio processor but offers improved processing algorithms and more flexibility.