

Radio Guide

Radio Technology for Engineers and Managers

February 2006

Audio Transmission via Internet ACCESS



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Internet Audio
Ready for Prime Time
Page 4

Technology is rapidly changing the way broadcasters and syndicators will handle getting the audio from one location to another. Most of the older methods used for program transmission and remote broadcasts may still work but they are often no longer practical or cost effective.

While few of us really want to be the very first to use a new product, sometimes circumstances just happen that way. At other times, we simply get the right “vibes” from the manufacturer and plunk those dollars down on gut instincts. This article is largely inspired by such a “vibe.”

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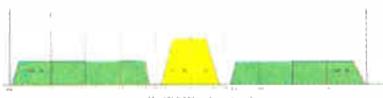
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Cover Photo: Dave Graveline of Advanced Radio Network uses the Comrex ACCESS for his broadcast from the CES 2006 Show in Las Vegas.

Radio Guide

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Will 2006 be the Year for IBOC?

OK, I will say it directly: the exhibits at CES 2006 (the Consumer Electronics Show) in Las Vegas simply dazzled attendees with technology. However, the products of greatest interest to us – HD radios – were hard to find.

Yes, iBiquity had a booth; many of the radios you saw at last year's NAB shows were displayed, as well as the new Boston Acoustics' Recepter (*Radio Guide*, January 2006). Many of the broadcasters attending the show stopped by the booth to look. However, little information was available besides "more radios are coming," something we have heard now for several years. Some of the booth personnel even joked they did not have radios themselves, but were hoping for a shipment this spring.

The CES showcase for new technology was like candy to a techie (Page 36). On display were a tantalizing variety of HDTV products (TVs and DVRs, etc) to iPods (and iPod clones) to cell phones that will play your favorite songs. But ask at most booths for "HD receivers" and you were directed to the TV section.

Receiver makers are doing their part – even beyond what one might expect, given the size of sales represented by a receiver technology that has not yet reached "critical mass." The broadcast equipment manufacturers also have spent all sorts of capital to design and build the transmission gear.

Broadcasters themselves are doing their part to drive interest, promising some \$200 million of on-air spots and promotions, even arranging a variety of formats on the multicast channels – all this after spending millions of dollars on upgraded transmission systems.

And *Radio Guide* will continue to bring you the help you need to implement the technology (Pages 8 and 24).

What could possibly be lacking in the quest to make IBOC a success? – *Radio Guide* –

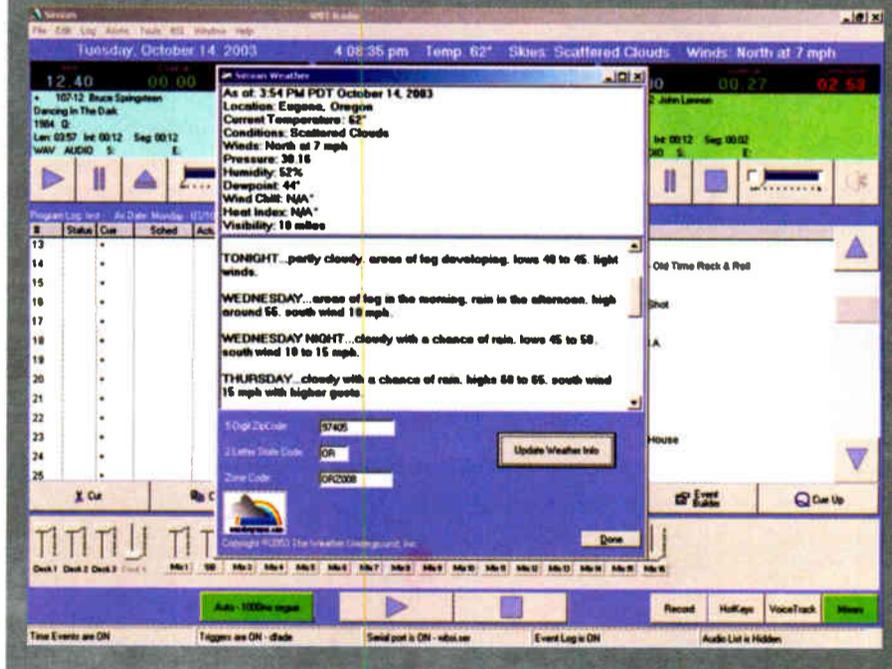
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Simian 1.6 is the result of input from numerous BSI users. Thanks to their input, Simian now includes an on-screen weather display that updates from the internet.

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Internet Audio Ready for Prime Time

The Comrex ACCESS

by Bob Burnham

This is actually the final part of Bob's five-part series: "How to Syndicate Your Own Radio Show." Previous installments have appeared in the August, September, December 2005, and January 2006 issues of Radio Guide.

Technology is rapidly changing the way broadcasters and syndicators handle getting the audio from one location to another. Most of the older methods used for program transmission and remote broadcasts may still work but are often no longer practical or cost effective.

While few of us really want to be the very first to use a new product, sometimes circumstances just happen that way. At other times, we simply get the right "vibes" from the manufacturer and plunk those dollars down on gut instincts. This article is largely inspired by such a "vibe."

ISDN GIVING WAY

One major issue currently driving change is the move by many telephone companies to no longer provide ISDN lines nor support for them. At this point, I would not recommend purchase of an ISDN-based codec unless the needed circuits were already in place and known to be functioning correctly.

On the other hand, various companies have been developing codec products that utilize the Internet to carry the audio. Some of them have been available for years and attempt to do everything in one "remote friendly" box. Of course, until now, the public Internet has not previously been given serious consideration for professional (i.e. "mission critical") needs.

However, some cutting-edge products currently are coming out of the factory-test mode. You can expect to see several of them at the NAB 2006 show in the spring. One product, the Comrex ACCESS, has already arrived.

EVALUATING A CODEC

For remote broadcasts or a syndicator, the reliability and ease of use of the codec is just as important as a transmitter is to a traditional radio station. Thousands of dollars can easily ride on whether such gear purrs along invisibly or chokes unexpectedly, giving some of us more gray hairs than we already have.

We do not always have the luxury of "try before you buy" and a typical broadcast codec is often one such device, especially those employing such new technology. The biggest companies do not always make the best products, although the good companies will always stand behind what they make and are able to tell you how to use it.

The absolute best way to evaluate any piece of equipment is to get your hands on it and subject it to torture tests, preferably in a real-world environment. Some products need to be put in service for a year or two (or three) before those of us in engineering can give them a real informed thumbs-up – or not. Many major purchasing decisions for this type of equipment are based on past experiences with the manufacturers and/or comments from other broadcasters.

MANUAL EDUCATION

Many manufacturers offer a complete owner's manual downloadable from the web and I have taken advantage of this option on a regular basis before making a final purchase decision.

Who reads manuals? I do! I do not say you have to commission Stephen King to write them, but get someone who knows his or her stuff and is as excited about it as the sales department.

I have found some of the best gear comes from companies that employ technical writers with a sense of humor. A manual that also can explain the products in a concise, non-confusing manner and actually get us enthused about our new (or future) purchase is a definite good sign about that product. A section covering "Hints and Troubleshooting" is also encouraging.

USER FRIENDLY

I downloaded a manual from one particular manufacturer (who shall forever remain nameless) for a codec being seriously considered for purchase. They were significantly less expensive than a more popular model.

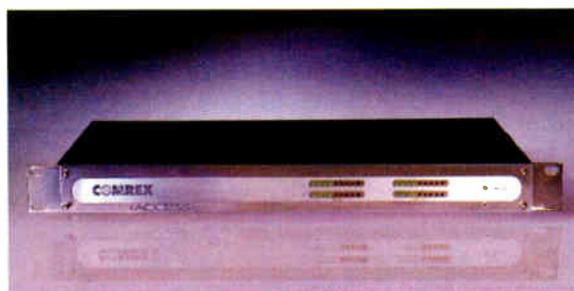
I have been doing radio engineering a long time, but this manual was written in a jargon that was completely confusing to me. If I cannot understand it, certainly someone with *no* technical experience has the remotest chance of figuring it out. The result was the company lost that sale. That I made the right choice was confirmed later, while troubleshooting a new client's studio set-up; I found distortion and other problems rooted in this particular device.

Comrex Corporation is one of several companies who does know what they are doing in terms of providing written equipment documentation. They are concise, clear – and, yes, they have a sense of humor. Nevertheless, a good manual is only one indicator of whether they make good "stuff" or not.

FIRST IMPRESSIONS

Comrex' new product demands a close look. Targeted for use in conveying audio over the Internet from point A to point B – or from point A to B, C, and D – ACCESS uses completely new technology. Comrex calls it BRIC (Broadcast Reliable Internet Codec) which taps into the resources of IP (Internet Protocol) networks.

Rather than the cost, and sometimes tricky configuration, of using a dedicated physical ISDN line to a single device, Comrex has designed ACCESS to connect to the high-speed Internet connection you already have. Attach another ACCESS device at the opposite end and you are on the air.



Comrex ACCESS

On-line services like Live365.com are primarily for dedicated streaming needs, and generally supply their own proprietary software. A product like ACCESS, however, is intended for professional use – i.e. a private and dedicated connection over a public network.

EVALUATING THE ACCESS

With technology as new as this, one has to wonder about the reliability and quality of ACCESS. It is not unusual to have a "back-up" for unproven technology. With ISDN, taking a remote or show on the road to an unfamiliar location can always be an adventure.

However, at least one broadcaster, Dave Graveline, President of the Advanced Radio Network, has already given ACCESS a positive review.

In January of this year, Graveline became the first to use the product to originate a live national show. The International Consumer Electronics Show (CES) in Las Vegas was the shows' origination point. In a press release, Graveline stated: "The operation was the easiest and smoothest ever and while we used a Comrex BlueBox as a stand-by dial-up unit, we never had to switch to that – even once – during our live three-hour broadcast!"



Dave Graveline using the ACCESS during the CES Show in January.

When doing ISDN remotes, I always took along a multi-line analog Comrex extender, figuring if I had at least two dial tones at the site, I could still get somewhat decent audio back to the studio if the ISDN circuit did not perform as expected. The fact that the Advanced Radio Network's ACCESS broadcast never needed their back-up is notable.

MEETING A NEED

A white paper (www.comrex.com/support/technotes/ComrexInternetPrimer2005.pdf), by Tom Harnett, Comrex Technical Director, also puts some of those reliability concerns to rest. The focus of Harnett's discussion is on IP Audio Coding and how Comrex approached the complex issues that cause instability, a problem that plagued the first generation digital products such as the Comrex HotLine.

Harnett writes in his report: "Remote broadcasters have been wishing for a system like this for a long time. As a former broadcaster-turned designer, it is my hope that this kind of enabling technology will tickle the imagination of the user, enabling more creative and entertaining programming to be broadcast from more diverse and interesting locations." I have found this to be very true.

One of the cool things I always tell my clients is that with today's technology a syndicated show – or any kind of remote broadcast – can originate (or already has originated) from almost anywhere. Harnett's remarks seem to underscore that observation and Dave's successful Las Vegas broadcast tells me the technology is here now.

LISTENING TEST

If you listen to the sample audio from one of the beta testers for ACCESS, it is also clear the audio quality problems of those early products are also in the past.

It does not sound like a HotLine. It does not sound like a Comrex Nexus (a popular ISDN codec running the older ISDN protocol). It also does not even sound like the legendary Telos Zephyr (a now-discontinued ISDN codec) running a more recent ISDN protocol. (Telos' current model is X-Stream).

It is the closest I have heard to a piece of Belden cable running from one studio to another.

MECHANICAL DESIGN MEETS SOFTWARE DESIGN

If it sounds good, how does it look? Most of the "look" is actually on your desktop or laptop computer screen.

The browser end of ACCESS is very self-explanatory. Very user-friendly, when used on the Internet, all you need is the IP location of the opposite unit and you are good to go. Forget about entering four sets of digits plus a dial-up number as is the case with ISDN codecs.

The on-screen metering (which has several different options) looks more like a high-end piece of hardware. An on-the-fly waveform display is reminiscent of popular digital editors. It is striking, to say the least.

(Continued on Page 6)

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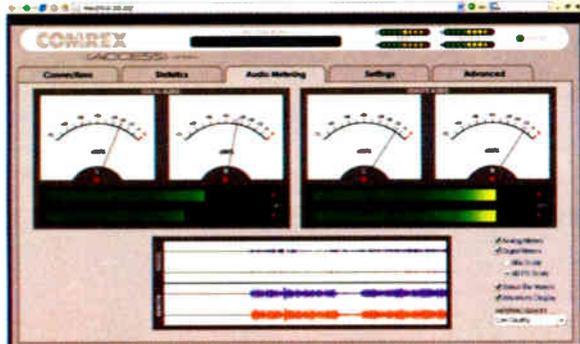
Internet Audio Ready for Prime Time

The Comrex ACCESS

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USEFUL IN MANY ENVIRONMENTS

ACCESS works over the Internet via DSL, Cable and Wi-Fi wireless networks as well as high-speed cellular data networks. Not surprisingly, it is also happy with a dial-up POTS phone line and can optionally work with some existing Comrex POTS codecs (i.e. Matrix and Vector).



The ACCESS Metering Screen

Kris Bobo, Comrex' Vice President of Development is very excited about their new product as well. She notes that the typical IP audio codec is only 85% reliable, while ACCESS is proving to far exceed that level. She also adds that their current tests over wireless (Wi-Fi) networks are going "amazingly ... really well." What I gather is that even Comrex is surprised at how well the first prototypes have apparently been designed.

As to robustness and ability to work well when the going gets rough, Bobo states "Even on pretty grungy circuits it can still deliver pretty decent stereo."

MULTIPLE FEEDS

An additional capability which will open the door to broadcast syndicators and eventually could eliminate the cost of satellite distribution is that a single ACCESS unit can actually feed several codecs simultaneously.

ACCESS is planned to eventually come in several different packages, similar to earlier Comrex products – a studio/rack mount version or the on-site version with the built-in mixer and other features. The mixer section will actually be detachable.

By the time you read this, the rack mount version of ACCESS will already be shipping. By Summer 2006, Comrex hopes to be shipping the portable unit (which can also be attached to a laptop using a variety of methods).

RATED "A BUY"

Cecile Gibson of Broadcaster's General Store quotes ACCESS at a cost of \$3,000, which is in the same price range as an ISDN codec. It should also be noted this is the list price. I am sure BGS or any of your favorite *Radio Guide* advertisers will quote you the "deal of a lifetime."

It looks like the price is right; about ten years ago, I remember paying more for a multi-line analog Comrex Extender. Mr. Harnett and his crew have apparently done their homework. Surely there must be a glitch somewhere in the design, but I have not found any thus far.

From an initial evaluation, all I can say is folks, this is a genuinely exciting piece of equipment for all broadcasters.

The passion for their products exhibited by everyone at Comrex, the established reputation of the company, plus my experience with their earlier products, all combine to be a good barometer of what we can expect of this new innovation.

Yes, I like it. This product looks good – really good.

– Techie Stats –

Comrex ACCESS BRIC features at a glance:

1. The first broadcast codec to work reliably over most Internet connections.
2. 7 kHz bi-directional low-delay audio over challenging IP networks like cable, DSL, Wi-Fi and cellular data networks using BRIC-ULB algorithm.
3. Less than 100 ms coding delay using BRIC-ULB.
4. 15 kHz bi-directional stereo or mono audio over unconstrained networks (or a single dial-up phone line) using BRIC-HQ1 algorithm.
5. Usable on networks with high packet loss and packet jitter such as the public Internet.
6. Utilizes BRIC Transversal Server (maintained by Comrex) to allow easy connections from behind firewalls and routers. Use is optional.

Additional OPTIONS:

HE-AAC and AAC Low Delay – Standard algorithms for extra high quality when more robust networks are available or Internet stability allows.

THE NEED TO STAY CURRENT

A major cost of producing a coast-to-coast show is the long distance expense for digital services such as ISDN. Because we are in the broadcast technology business, we make it our business to stay on top of the break-through product developments that will save our clients or employers money at this and other levels.

Many of us have also honed long-term friendships with vendors and other manufacturers' representatives who help in the process. These alliances are also what adds to our value to the broadcast industry and what should be a priceless commodity to those who are new to radio and trying to get a start syndicating their show.

A broadcast engineer never stops learning and neither do syndication consultants – and those of us who wear both hats. We have saved our good clients countless thousands of dollars and huge barrels of grief during the past decade of doing syndication the right way simply by applying what we have already learned through personal experience.

BETTER THAN ISDN

Some wonder why they should consider a move from ISDN (or other modes) to Internet transmission? There are two answers to this question.

The first answer is there is a lack of on-going support from area phone companies. Call your local phone company and find out how difficult it has become to order this service and how long it takes before a technician can actually install it. In some places, it may be next to impossible to get assistance if the line goes down.

The second answer/reason is cost-related. A long-distance ISDN connection is billed per-minute. While this may not be an issue if your central distribution point is close by, but if you are in Boston and sending your audio to me in Detroit the cost of a four-hour daily show adds up to a lot of minutes of long-distance service.

In contrast, your Internet connection is virtually always "up" and it does not matter whether you feed 20 hours of broadcast audio per week or download 500 iTunes for your

iPod. In fact, if your connection has enough bandwidth, you can probably do both at the same time.

With ACCESS you can say "goodbye!" for good to your long distance bills for your remote or your daily show.

MAKING THE DECISION

With this series, we have opened up quite a few new areas and perhaps some proverbial "cans-o-worms" that all broadcasters face with constantly evolving technology. Additionally, allocating still more dollars to equipment is not always easy. It is exciting, and long-term; it truly is very cost effective to use the "latest stuff."

Many operators, however, cringe or have difficulty justifying the cost of upgrading existing equipment, as long as the old gear still works. Sadly, there are more than a few plate-modulated AM transmitters still on the air for this very reason.

The point is that, for those who are starting out fresh with a new radio show or a new station installation, it always makes sense to buy the best you can afford. Just make those specific decisions *informed* decisions.

KNOW THY LIMITS

Newcomers to the idea of syndicating their own radio show often wonder why they cannot "do it all" by themselves and why in the world would they want to spend the extra money for the services and guidance of people such as myself or Lowell Homburger (mentioned in Part I of this series in the August 2005 issues of *Radio Guide*).

The answer is sort of like a situation where someone had a toothache and started out to warm up a soldering iron so he could try to give himself a "hot filling" of lead and tin alloy. The hole in the tooth might be filled for the moment, but the long term viability is pretty poor. In any endeavor, not really understanding all the aspects of the project can quickly turn it into a major disaster!

I have turned away many syndication wanna-be's and tire-kickers who try to over-simplify what I do and especially what I *know*, having spent a lifetime dedicated to this passion. There are also many technical and programming people who have far more extensive knowledge and experience in their areas of specialty.

Yes, you probably can do it all yourself if you have the appropriate background and perhaps used your collection *Radio Guide* articles as a reference. On the other hand, if you overestimate your ability, you might just end up with a strangely soldered tooth bridge.

THE RIGHT KNOWLEDGE

But it is the comprehensive collection of knowledge necessary for syndicating a radio show that is completely unique. People like myself live and breathe broadcast equipment seven days a week.

That "collection" of knowledge might also include equipment acquisition: details such as where to get the best price on a certain piece of gear or whether it is advisable to consider previously owned gear for certain applications is what we love to discuss. But the resultant knowledge is also something of value.

With this series of articles, I have tried to imply good syndication is not a simple process and along with the technology it advances as fast as we can write these articles and get them to you. What might have been a great equipment purchase yesterday might not be the most cost-effective today.

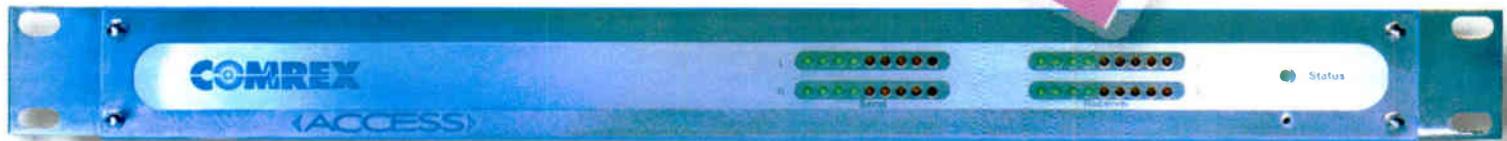
By relying on your friendly neighborhood broadcast engineer (some of us even help to create the content of *Radio Guide*), you can get an informed evaluation of new innovations such as the Comrex ACCESS.

Comrex has made an ACCESS available so *Radio Guide* readers can experience the ACCESS GUI at the following address: <http://70.22.155.131/>

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If you have questions on syndication, you can email Bob Burnham at the Specs Howard School of Broadcast Arts: bburnham@specshoward.edu

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Digital Radio Crash Course

Part 3 – Test Equipment

As with any new technology, implementation of HD Radio™ technology will require new test equipment to confirm proper operation. Jeff Welton continues his discussion of things you should know in order to keep your station functioning as smoothly as possible.

In the previous two articles on this topic, I focused mainly on hardware – what do you need to get HD Radio playing at your station, both for AM and FM.

In this article, we are going to start getting into some of the technical nuts and bolts with respect to what equipment you will need to be certain your digital transmitter is playing nicely with the neighborhood kids. I was going to segue into terminology from that point but that will be the focus of an upcoming article.

NEW TECH, NEW TOYS

There are many concerns raised about this new technology. Primarily, these are based on fear of interference – both between stations broadcasting an HD signal and between those stations and the ones that are still broadcasting a purely analog signal.

These concerns do need to be taken seriously, which means that you will require the proper measuring equipment to confirm that your equipment is conforming to the letter of the law. In addition, at some point down the road you will need to do some troubleshooting of a problem (this is radio, after all!).

There are a few pieces of equipment that can help with the troubleshooting aspect, some of which are absolutely essential while others fall into the “that would be nice if we could afford it” category. As much as possible I will try to cover all of them.

MORE THAN JUST THE BASICS

Keep in mind that we are not discussing the basic pieces of test equipment which are considered essential regardless of whether your station is analog, digital, or hybrid. Such items would include a multimeter, oscilloscope and dummy load.

If you do not already have this equipment in hand it should be at the top of your priority list, as these items are required for any transmitter-related troubleshooting. To illustrate: have you ever had a conversation with Tech Support that sounded like this?

Tech Support: “Grab your scope and connect it to point X.”

You: “I don’t have a scope.”

Tech Support: “Oh. [Long pause.] Well then, this is going to take a little longer.”

If that does sound familiar, make sure you arrange to acquire the basic stuff before blowing the budget on the items we are about to suggest.

ANALYZE THIS

The newest item on the list of “must haves” is a spectrum analyzer. As this is the unit with the greatest number of variables, I will spend most of this article discussing the various ramifications.

A spectrum analyzer is essential to confirm that your station is conforming to the occupied bandwidth requirements – the “mask.” As your HD signal fills up your allowable bandwidth much more completely than a traditional analog signal, it is necessary to be sure that you do not exceed the permissible limitations.

On AM you do have the ability to adjust the digital carriers in order to reduce intermodulation between analog and digital carriers; on FM you may see that a circulator (or isolator) is required to prevent spurious emission caused by feedback of the analog carrier into the digital transmitter output (for high level or space combined systems).

In either case, you cannot take the appropriate remedial action if you cannot not see the nature of the problem and the way to do this is with a *properly set up* spectrum analyzer.

UNDERSTAND THE TOOL

I emphasize “properly set up” because even the best analyzer in the world will not give good results if you do not have it configured for the signal you wish to measure.

I would hazard a guess that we get a couple of dozen calls a year from stations complaining of not meeting the NRSC mask (in analog AM broadcast) or having higher than allowable levels of second or third harmonic emissions (both AM and FM). Of those, over 95% are directly caused by stations sampling the off-air signal incorrectly and overdriving the front end of the analyzer.

In one extreme case, the station calling was complaining that the 2nd harmonic was 150% of the fundamental (carrier) frequency! While not going so far as to say this is totally impossible, with all of the tuned circuitry involved in an RF transmission system, it is highly unlikely such a phenomenon could be achieved without letting some smoke out of the system somewhere along the line.

ACCESSORIZE

Therefore, you need a spectrum analyzer but you also need some accessories to be sure you are not overdriving it.

I use two devices to accomplish this. First is a switched attenuator to allow me to control the level of the signal the analyzer sees. Most spectrum analyzers will set the input attenuation to a point that does not endanger the front end of the unit.



Kay Elemetrics Model 837 Attenuator

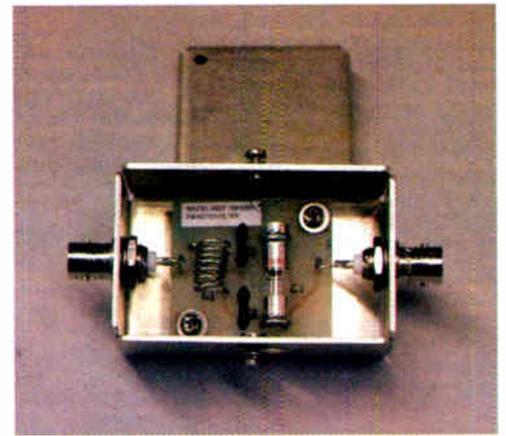
However, this does not necessarily mean that the signal is being sufficiently attenuated to prevent the front end from saturating and creating false spurious or harmonic indications. There are several switched attenuators available, including the one shown.

NOTCH FILTER

The second device is a tunable notch filter so I can further reduce the level of the fundamental, especially for NRSC and harmonic measurements. This will allow me to get higher levels of resolution on spurious and harmonic measurements.

With a noise floor in the range of 90 dB or so for mid-range analyzers, trying to read a harmonic level that

needs to be more than 80 dB below carrier will sometimes have you searching in the noise. The ability to reduce the carrier an additional 20 dB and adjust the analyzer’s reference attenuation accordingly effectively lowers the noise floor and brings the harmonic display up to where accurate readings can be achieved.



A typical Notch Filter from Nautel.

A tunable notch filter is easily created from inductors and variable capacitors (or capacitors and variable inductors) or can be purchased pre-built; ham radio suppliers are frequently a good source of these type of things. We build our own for AM and FM use as shown above.

BANDWIDTH RESOLUTION

Returning to the analyzer, there are a few parameters that you need to know before going out and buying one – resolution bandwidth (RBW) and trace detection mode being two of the major ones.

The resolution bandwidth requirement is different for an AM station broadcasting with HD Radio technology than it is for an FM station. The AM station will require an analyzer that can handle a 300 Hz resolution bandwidth, while the FM display only requires a 1 kHz RBW.

If you need to measure both, you will need a model that will provide the 300 Hz RBW. This is where it starts to get confusing, in that a specific model of analyzer may need an option to achieve the lower RBW.

POPULAR MODELS

For example, the industry standard for measuring an HD signal seems to have become the Agilent (formerly Hewlett Packard) model E4402B. This is (in my opinion) a pretty good analyzer. However, it does not measure below a 1 kHz RBW without the proper option package installed.

We also use the HP-4396A Network/Spectrum Analyzer in our test department. My personal preference is quickly becoming the Anritsu Spectrum Master, Model MS2721A – however it requires a significant level of input attenuation (40 dB or more) to give a proper display. The default setting (10-30 dB depending on signal strength) will usually indicate higher levels of spurious emissions than are actually present.



Agilent HP-4396A and Anritsu MS2721A

My comments are not designed to suggest a shoot-out or comparison of the different analyzers, as there are various factors which will determine what you choose for an analyzer – I only picked the Agilent and the Anritsu as I have worked with both.

Other factors that may come into play include your specific application. For example, portability might be an issue if you are a contract engineer, in which case an eight pound battery powered analyzer might be preferable to a 45 pound unit that requires an AC source.

(Continued on Page 10)



REMOTE CONTROL. PHONE BOOK. FLASH MEMORY. AUTO-ANSWER.

The remote interface provides remote control of the Call and Drop buttons, as well as providing LED confirmation of the keypad's



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Digital Guide

Continued From Page 8

Furthermore, the ability to capture a waveform to some sort of storage media is likely important to you. Both of the above models have this ability (floppy disk for the Agilent, Smart Media for the Anritsu).

I am certain there are other models available that can do the job (I know we have at least two other analyzers in the lab that are quite capable). The point is to look at the various aspects before committing to a specific unit.

CORRECT ATTENUATION

This brings me back to the switched attenuator – again, a very useful tool.

With a switched attenuator, you can connect the analyzer with the external attenuation set to zero, then add fixed levels of attenuation. If you add 10 dB of attenuation, you should see the fundamental (carrier) and all emissions/harmonics drop by the same level (i.e., 10 dB). If the non-fundamental frequencies go down by a greater amount, then you are overdriving the front end and need to add more attenuation.

Once the fundamental and non-fundamental frequencies appear to be decreasing by the same amount corresponding to the amount of attenuation that was switched into the circuit, then you can begin taking measurements. Just set the reference attenuation to match the level of external attenuation added and you are ready to go.

NOTCHING THE FUNDAMENTAL

If you need to decrease the indicated level of the fundamental to lift the spurious emissions out of the noise floor of the analyzer, this is where the notch filter comes into play.



A test setup, ready to use.

Here is how: install the notch filter and tune it to add a fixed amount (say -20 dB) of attenuation to the carrier signal and again adjust the reference attenuation to bring the peak of the fundamental to the top of the display. Look at the setup shown and note also the presence of the coaxial cable wrapped around a ferrite toroid at the input to the analyzer. This will help to block any stray RF signals being picked up on the cabling and give a cleaner, more accurate sample of the signal to be measured.

I also mentioned trace detection. For measuring an HD signal, it is recommended that the trace detection be set to sample mode. If this is not an option for your analyzer, peak detection is the alternative.

Please note that accurate results cannot be obtained if the trace detection is set to RMS mode – the default mode for most and the only option for low-end analyzers. If you cannot find a menu that allows you to change the mode of trace detection, the analyzer you are looking at probably only does RMS detection and which means it is most likely not suitable for the task.

Finally, your analyzer needs the ability to perform averaging. The recommendation we have is for a 30-second average so the specific number of samples being averaged will depend on the sweep time.

For most analyzers, this seems to work out to somewhere between 16 and 40 traces being averaged. Without averaging, it is much harder to get a fix on the exact level of the digital signals, due to the amount of instantaneous phase and amplitude modulation occurring in the various vectors. Averaging smooths things out significantly and makes for a much easier setup.

A note to remember on this is that, because it does take 30 seconds for averaging to occur, if you make an adjustment to any setting that will affect the output spectrum (primarily for AM installations) you will need to wait until the averaging is done before you know the effect that your adjustment has. Patience really pays off in this area.

So to recap, the primary features you need from the analyzer are: RBW (300 Hz for AM, 1 kHz for FM), trace detection mode (sample preferred, peak mode acceptable), averaging waveform storage and (possibly) portability. In addition, do not forget the switched attenuator and, if you plan to use the analyzer for NRSC measurements, a tunable notch filter.

THE MODULATION MONITOR

Next on the list of new items of test equipment required is a modulation monitor. To which you reply, "But Jeff, we already have a mod monitor." I am sure you do; I do not see many stations without one. But that monitor is obsolete now.

The problem arises from the fact that the way the HD carriers are modulated is such that it will make your analog modulation monitor read about 20% higher levels of analog modulation with the digital carriers on than it does with them off. This means that the only method you have of measuring your analog modulation is to switch the digital carriers off and you have no method of measuring modulation on the digital carriers at all.

This has been an issue since HD was introduced, as there were no digital modulation monitors available. For the most part until now, when we installed the HD generator at a station we have simply set the HD levels to be about the same as the analog when heard over a receiver.

However, some products are ready to hit the market. Day Sequerra is advertising a reference monitor

capable of measuring modulation of an HD signal (www.daysequerra.com). In addition, Belar and Inovonics also are in the process of bringing their digital modulation models on line (www.belar.com and www.inovon.com).

MORE THAN A CARRIER

With the test equipment we have mentioned and some careful observation you can assure yourself that the transmitter is running properly, your broadcast signal is within the allowable mask, and we can measure the level of audio modulation. But what happens when we tune to the station and hear a silent carrier?

This is when we learn to be able to trace the audio path. This becomes an issue – not so much because of HD – but because the audio path ultimately is AES/EBU, not traditional L/R analog audio. For this, there are several pieces of test equipment available and I will be the first to admit I do not have a lot of experience.

The one I hear about the most is the Bit Buddy and it seems to be rapidly gaining ground as a favorite among many engineers. In addition, we just laid hands on a Sencore DA795 AES/EBU audio analyzer – it is too recent for me to give an opinion, but serves to emphasize the fact that the gear is out there and if you do not have it, this would be the time to start researching what you want for testing AES audio.

Perhaps if enough of you email our kindly Editor, Barry, a future article by someone with more audio experience would focus on the best ways of troubleshooting a loss of AES audio (Barry can be reached at Editor@Radio-Guide.com).

IT DOES COMPUTE

There is one key piece of equipment that I have not yet mentioned – a computer or laptop. You are really at a disadvantage without one.

Most of the new digital equipment, as well as many other pieces that have hit the marketplace over the past few years, is software driven. As such, we and other manufacturers have an unprecedented ability to make upgrades to improve performance and reliability or simply to keep up to changing standards. This will frequently be done in the form of a software upgrade which often is installed to flash memory in the specific piece of equipment through a computer connected to the equipment's serial or Ethernet port.

In many cases to accomplish this will require that a computer be available at the user end, so more so than ever before it may be time to invest in either a transmitter site desktop or a laptop for engineering. In some cases, upgrades may be achievable through other means (for example, our NE-IBOC HD Generator contains a CD-ROM that can be used for this purpose), but this may not always be an option. Plan ahead!

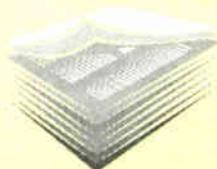
So now you should have a handle on all of the hardware required, both to implement the installation of HD Radio and to ensure that it is conforming to requirements. In upcoming articles, we will delve into the new language that goes with this new technology and then discuss the details of setting it all up.

As always, feel free to contact me if you have any questions on previous submissions or suggestions for information that should be included in future articles.

As the senior Customer Support Technician at Nautel, Jeff Welton has assisted in a variety of digital transmission installations. Comment or question? Contact Jeff at jwelton@nautel.com

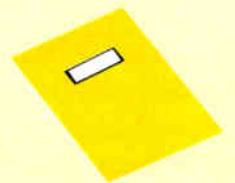


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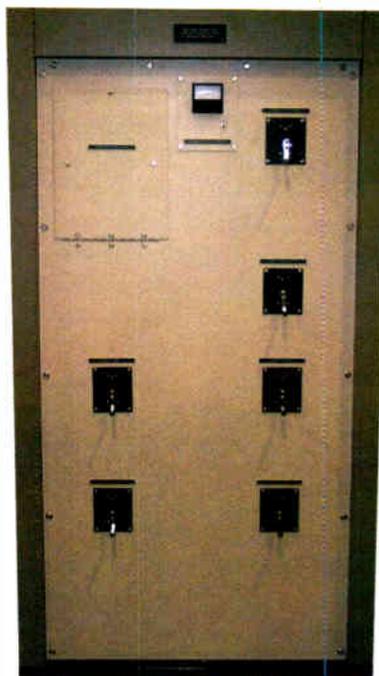
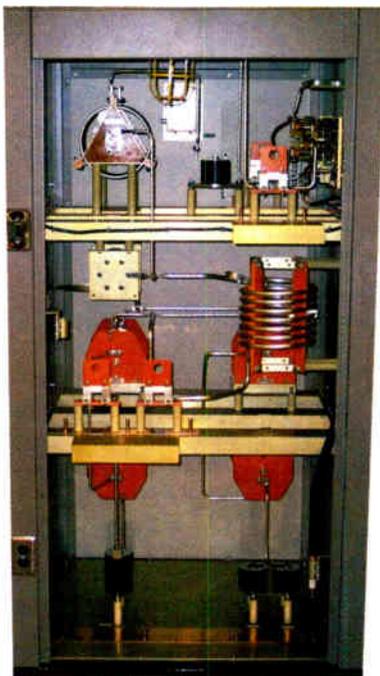
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Transmitter Shack

by Kevin Kidd

Thar's Copper in Them Thar Hills

And it would be a lot easier to mine if those darned tower things were not in the way.

The capital costs of a transmitter site include something that is rarely seen – or even thought about – except possibly by the engineer. That is the AM ground system. As Kevin Kidd shows, protecting that investment is not always easy.

Copper prices are at an all time high. COMEX futures are hovering around \$2.20 per pound with scrap copper bringing \$1.00 to \$1.35 per pound. In fact, scrap is bringing more than we paid for shiny new copper products a few years ago.

TROUBLE BREWING

Unfortunately, vandals with a keen eye on the non-ferrous metals market are also eyeing the copper products used in radio and power transmission facilities. There have been numerous reports of vandalism to both AM and FM radio stations and electrical substations in recent months.

Our local power utility had the ground buss bars cut out of a substation and recently had a warehouse building burglarized. The thieves left with a one thousand pound roll of copper wire, driving a bucket truck through a huge roll up door and a chain link fence to make an exit path. Of course, damages to the truck, fence and door were many times the cost of the stolen materials.

One of my contract stations has had a length of 5-1/4 inch coax stolen from a transmitter site. And I was the target of copper thieves in May 2005. The thieves stole a 300 pound roll of #10 bare ground system wire and a 100 pound roll of 0.032 x 4 inch copper strap off one of our trailers.

In the past year we have repaired or rebuilt 2 DA's where vandals had stolen copper. As is usually the case in ground system vandalism, the culprits removed only a few hundred dollars of copper but destroyed many thousands of dollars of other materials and labor in the process.

DISASTER IN SOUTH ALABAMA

The station engineer arrived at the transmitter to investigate signal problems and found a disaster. Vandals had been "working overtime" the previous night on his ground system.

The four-tower DA-N was now lacking any semblance of a ground system. Inside the ND tower fence, someone had dug around the tower and removed the copper strapping from the ATU and the radial termination strap surrounding the tower base.



All the straps were cut right at the tower base, severing the tower from the ground system.

Closer inspection of the other three DA towers revealed similar damage at each. The damage at the ND tower was much more extensive but as a whole the ground system for each tower was destroyed. Even though the local police department was notified and extra security precautions taken, the vandals returned at least two more nights between Wednesday and Monday.

A COPPER MOTHERLODE

The site had originally been built as a ND on a low frequency. Several years and owners later, the frequency was changed and three additional towers built to give a better night time signal into the COL. The existing ND tower was graced with a ground system that would never be found in a modern design.

In addition to the normal 120 radials, this tower also had 3 foot wide solid copper sheeting around the tower base. The three additional towers were built with standard expanded copper mesh for near tower base ground enhancement.

The vandal(s) cut and removed all of the arc gap, ATU and radial termination strapping. After digging a bit around the base of the old ND tower a virtual copper mine was exposed.

The control and sample lines were exposed but were left undamaged.

The vandals dug through almost the entire 25 x 25 foot fenced-in area around the ND tower. Their excavation exposed feed, sample and control lines but they seemed to be very careful about not damaging any of them.

One sample line did sustain some slight damage to its outer jacket but no electrical damage to the line itself. At this tower, the vandals removed all of the copper sheeting and all of the ATU grounding. Removing the infrastructure left most of the radials exposed and disconnected.

The other three towers had expanded copper mesh that proved too fragile to physically pull up as had been done to "harvest" the other copper materials. The copper mesh of the three newer DA towers was destroyed as the vandals ripped the heavy strap from beneath it.

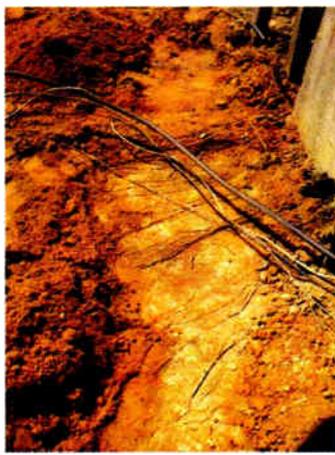
The vandals even dug along the 4 x 0.032 inch intertower strapping and removed it. Connections to all of the arrays ground radials had been severed by this time. The ND and DA operating perimeters officially departed from licensed values.

REPAIR WORK

AM Ground Systems Company (AGSC) did a complete appraisal of the damage and determined that the situation was dire but not entirely hopeless.

All four ground systems were damaged but the standby ND tower was "patchable" and would suffice for emergency use. We patched as much of the tower base ground infrastructure as practical and assisted in changing to the repaired tower. The ND signal improved dramatically on the patched standby tower.

A can of cold galvanization spray was used to camouflage the shiny new strap. With a little flat black thrown in for contrast, the strap almost perfectly matched the color of the concrete pier.



Vandals excavated around this tower base to remove copper sheeting.

USELESS RECOVERY

While we were working at the site, the local PD called to tell us that they had located some copper at a nearby scrap yard.

Covered from head to toe with south Alabama red clay, I went with the CE to check it out and was able to immediately identify the scrap as portions of his (former) ground system – the scrap and I were coated with the same sandy red mud. The police investigators thought it quite humorous; we were not amused. The suspects were locally known to be heavy drug users.

The scrap recovered was only a portion of the amount stolen; the total scrap proceeds probably were less than \$200. Figuring the time that the vandals probably spent digging at this site, we determined they had averaged less than \$5/hour.

Unfortunately, this ground system was so badly damaged – and due to its age – it was deemed as uneconomically repairable. AGSC rebuilt this ground system in January of 2005.

BURGLARS HIT SOUTH CAROLINA

AGSC also had a recent call from a religious college station in South Carolina. This station was off the air and the remote control would not answer.

Upon arrival at the DA-N transmitter site, the PD found that the transmitter building had been burglarized. It became very obvious very quickly that there were multiple problems, so management contacted us for engineering and ground system assistance.

Upon our arrival at the site, we discovered a staggering amount of damage to almost all aspects of the station property. It was apparent the vandalism of this site had been ongoing for weeks, if not months.

The vandals had cut and removed the exposed copper mesh from all three towers, cut and removed five runs of #8 THHN control/power wiring to each tower (200+ feet each), various amounts of sample lines to all towers, all the air conditioning plumbing, all the air conditioning condensers, building telephone wiring, audio and control wiring.



The station's coax, audio and control wiring were randomly cut.

Thankfully, the vandals did not cut the transmission lines. We were able to rewire enough of the transmitter building telephone and audio wiring to get the transmitter back on. The ground system for the ND tower was patched and semi-normal operation resumed under an STA a few days later.



The schedule 40 conduit was torn apart and the entire DA control system was ravaged.

AN EXPENSIVE INCIDENT

Total damage to this site was probably in the ballpark of \$75,000 - \$100,000. The ground system at this site was relatively new and not totally destroyed. Cost to repair the ground system will be relatively low but the other associated damage and engineering costs will be daunting.

The culprit was a local moped-riding crack head. He was apprehended after his father heard about the vandalism. The perpetrator had lost his drivers' license several years earlier and now buzzes around on a moped.

(Continued on Page 14)



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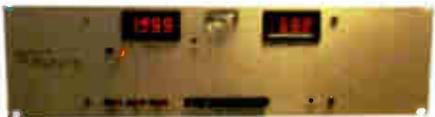
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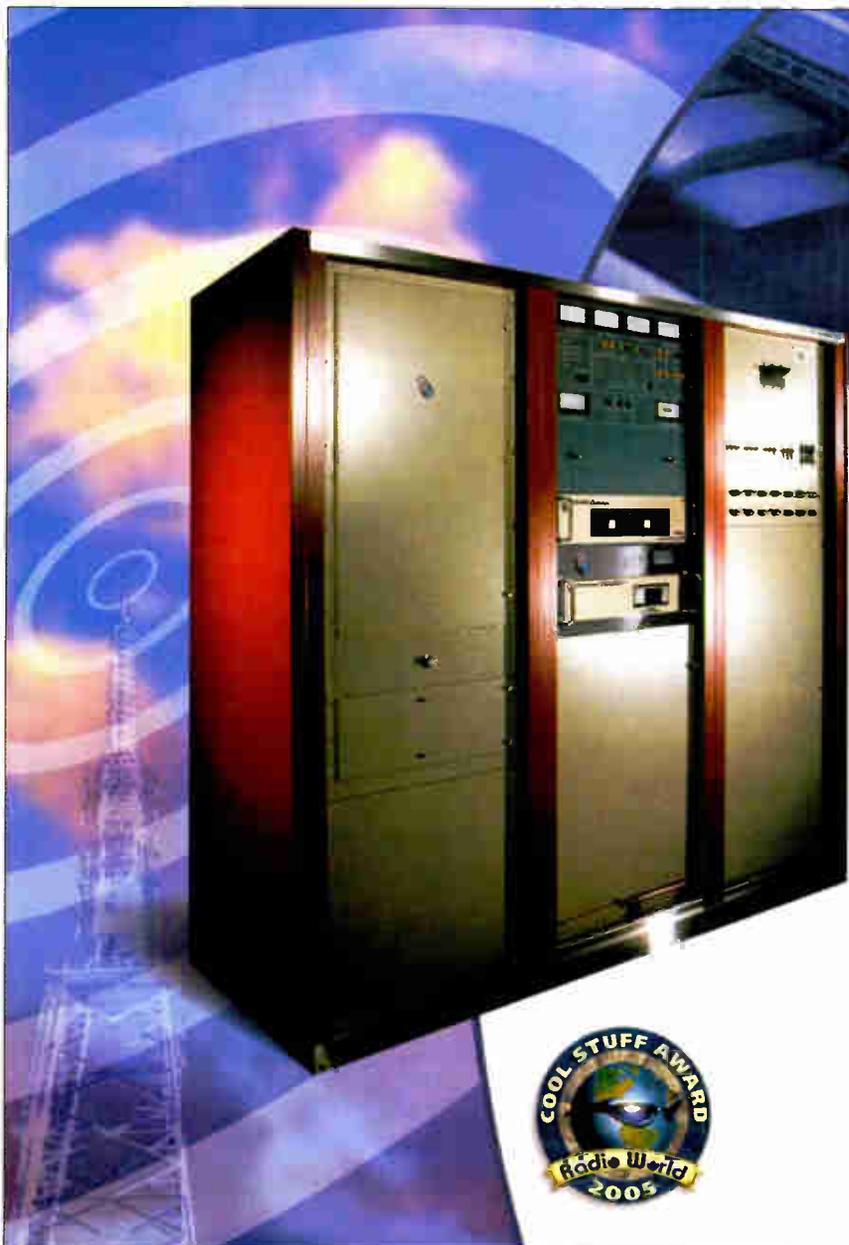
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Transmitter Shack

Continued From Page 12

Thar's Copper in Them Thar Hills

There were moped tracks everywhere on the site, even inside the tower fences. The father told investigators that he had been wondering where his son was getting all those moped loads of copper. I have asked many people but no one seems to know exactly how much a "moped load" of copper really is.



What was left of the HVAC units at the site.

The site had been a combined studio and transmitter site; four air conditioning units of about 5-10 tons each were also destroyed.



Even the copper tubing on the air conditioner was cut and stolen.

Obviously, given the magnitude of damage caused by one drug addict, it is well worth the time and effort for all stations to do a survey of the state of their site security.

IMPROVING SITE SECURITY

The old adage that good fences make good neighbors applies to tower sites, but that alone is not the cure-all for site security.

Both of the sites mentioned here had the FCC required tower base fencing but had no site perimeter fence. Both had some manner of site lighting but it either was not working or was disabled by the vandals. Neither site had any type of security or surveillance system.

Unfortunately, there is no one single good method to achieve AM site security. However a reasonably cheap and effective site security system can be assembled using several approaches.

A USEFUL SECURITY CHECKLIST

Here is a checklist of suggestions that can be employed at a modest expense at most sites:

- **Monitored site lighting.** A vandal's first action upon entering a well-lit site would probably be to disable the lighting. This might even take place a few nights before the actual burglary. Monitoring the lighting system current draw through a remote control would give an alarm if lights go out unexpectedly.

- **Motion detection around high value targets.** Motion detectors to completely cover a large DA site would be unmanageable. The areas of the tower base/ATU and transmitter building are the most likely to be vandalized. Motion detectors are prone to false alarms and must be carefully adjusted to ignore small animals and temperature changes.

- **Surveillance cameras (interior & exterior).** Decent IP security cameras are getting cheap. I use the Sony brand pan and tilt that sells for \$159. They do not perform particularly well in the dark but give good service under good security lighting.

I also use a software package from IRCAS (www.ircas.com) that will monitor numerous cameras for motion and various closures via serial ports. IRCAS will send email alerts and sound an alarm on any triggered condition. IRCAS can also simply record on motion without alarm if desired.

- **Random nightly security patrols.** Most urban areas have a security service that makes nightly patrol visits for a very reasonable fee. These visits should occur randomly every hour or two after dark. Local law enforcement officers can often be coerced into also making random patrols. The cost of the tee shirts and coffee mugs to make this happen will be more than offset by the added security value.

- **Regular site inspections by engineering or other station personnel.** A part of the regular engineering inspections should also include site security. Lights, fences, alarms, etc., should be regularly checked for operation and tampering, and when damaged fences or graffiti are found, repairs should be done as quickly as possible. One of the vandalized sites mentioned above had not had a regular engineer for almost a year and had not been visited by station personnel in about a month.

- **Simple intrusion detection on the transmitter building.** Simple alarm systems can be installed for about \$500. An even simpler/cheaper system can be built using latching relays and motion sensors for even less. The station remote control can be used to monitor activity.

- **Make sure that all copper products are hidden from view and not easily removed.** Some ground system contractors build the base screen and leave it exposed. This is inviting vandalism. Copper screen at AM towers must be covered. We normally do this with a layer of good quality landscape fabric and a layer of gravel.

This not only protects the fragile screen from vandalism but it also protects it from falling ice, animal (including human) damage, vegetation growth, etc. Coaxes and control cabling should be run underground and protected from damage by some type of conduit or sturdy duct when above ground. Even above ground conduit is subject to damage and theft (as noted in the attached images).

- **Perimeter and tower fencing.** The security offered by fencing is only as good as the fence itself. A poorly maintained light gauge four-foot chain-link fence will offer little protection from a determined attack. Any such fence can be cut in minutes.

Tower and perimeter fencing should be heavy commercial grade fabric, at least six feet tall and topped with barbed wire. Metal fencing in close proximity to AM towers opens another discussion on grounding and re-radiation, but we are going to stick to security here. Tower and building fencing should enclose all possible avenues of entrance and high value materials/equipment.

A major drawback to a full perimeter fence and locked site gate is that security and police patrols cannot easily access the site. A remote control motorized gate is advised if using site perimeter fencing and security patrols. If possible, a driveway should follow the site perimeter fence for patrol and maintenance purposes.

LAST LINES OF DEFENSE

It should also be noted that taking good security precautions does not guarantee that a determined burglar will not gain access to our sites. The only thing that we can hope to do is make it very inconvenient for them to enter and increase the chances that they would be caught if they do make entry.

A good insurance policy is your last line of defense. Many stations (and people in general) wrongly tend to think that their insurance is the first line of defense. Sure it may pay for the damage, but what of all the lost man-hours, air time and general hassle dealing with the insurance companies and law enforcement?

An old adage applies here as well: An ounce of prevention is worth a pound of cure – or copper as the case may be.

Kevin Kidd is an SBE Certified Senior Radio Engineer (CSRE) with 23 years contract engineering experience. He is the owner of KK Broadcast Engineering (kkbc.com) and AM Ground Systems Co. (amgroundsystems.com) in Lawrenceburg, Tennessee. Contact 877-766-2999 or kkidd@kkbc.com

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Streaming Audio

Part 1 – From Dialup to aacPlus

Internet streaming seems like a good way for a station to increase its potential audience, as well as staying in touch with listeners who are away from their hometown. With today's latest innovations, streaming looks to have a future brighter than ever before.

MORE LISTENERS, MORE BANDWIDTH

Not only has the number of Internet users increased, but new technologies like (A)DSL also have brought much faster connection speeds. According to an Arbitron survey from July 2003, residential broadband had tripled since January 2001. Coupled with the ability to be on-line at all times, this leads to a significant change of users' habits.

Listening to radio stations on-line has increased five-fold in five years, again according to Arbitron survey from 2003. Four in ten Americans listened to Internet radio with a weekly Internet broadcast audience measured at approximately 30 million.

Meanwhile, there were significant improvements in audio coding technology in recent years as well. Codecs available today use increased bandwidth more efficiently than ever, resulting in a noticeable increase in audio quality while reducing costs to both broadcaster and listeners. However, it was not so long ago that things did not look so promising.

BEGINNINGS

Real Networks was the first to introduce streaming to the world in 1995, with their Real Audio Player. Before Real Audio Player came out it was necessary to download the whole audio file before you could listen to it.

Streaming changed all that. It was now possible to send audio in packets and decode them on the fly, as they came in, enabling the user to listen immediately without having to wait for big files to download – a real problem with the slower modem speeds of that time. It was also possible for the first time, to listen to a continuous broadcast – just like conventional radio.

Users all around the world were thrilled with this innovation. The success built Real Networks into the big company it is today, although they made a couple of unfortunate mistakes on their way and alienated much of their user base.

Many predicted a huge boom of Internet streaming that would be the end of terrestrial broadcasting in a few years. Recognizing the market potential, a couple of years later Microsoft also entered the field with their Windows Media package. Both Real Networks and Microsoft began offering video streaming as well.

PROBLEMS

But things did not prove to be as spectacular and fast growing as predicted. There were problems and the technology was not mature enough. Internet connection speeds and backbone speeds were slow.

On top of that, bit-reduced coding was making its first steps and it often sounded like being underwater. Codecs suffered phasing and flanging artifacts that were particularly annoying when listened over longer periods of time.

With subsequent version releases and improvements, streaming codecs got a little better, with Real always being a step ahead of Microsoft in terms of codec quality and efficiency. Of course, being completely free and bundled with the Windows operating system, Windows Media runs a tight race with Real.

LOST DATA

In order to achieve the extremely low bitrates necessary for streaming, an audio codec has to throw away as much as 97% of the original data! That fact alone explains a lot of why it is so hard to make streaming audio sound good.

One of the ways to reduce the amount of data is to reduce the frequency range. All of the codecs employ this technique to a smaller or larger extent. Streaming codecs like Real or Windows Media try to keep as much of the high-end as possible, at the expense of increased artifacts, while non-streaming codecs like MP3 just filter audio. In both cases however, quality – though considered acceptable – is not very impressive.

Improvements in data communications technology – first ISDN and then (A)DSL – helped the problem of poor audio quality somewhat as there was a prospect of higher bitrates that could be used. But if a broadcaster wanted to reach as large audience as possible, it was necessary to keep the bitrate low since many users were (and still are) on dial-up.

Lower bitrate also reduces the problems of Internet congestion and re-buffering in case the packets get delayed or lost. So the main focus was still on improvements in codec audio quality. And that left a lot to be desired.

FINANCIAL ISSUES

On top of the technological challenges broadcasters and webcasters were facing, in 2000 RIAA launched a mechanism for collecting royalties on music streamed over the Internet. These additional costs caused many stations to stop web streaming and even more webcasters went bankrupt and shut down their on-line stations.

Later negotiations brought costs to acceptable levels. There were comments that the initial high rates SoundExchange was asking was a "payback" for the fact that US broadcasters were always exempt from performance royalties, unlike those common in almost all other countries.

After the royalties issue settled down and streaming was again profitable, there was finally a breakthrough in improving low-bitrate audio coding. In 2003, a new codec called aacPlus was introduced and it was soon clear that it marked a stepping-stone in bringing higher audio quality to on-line listeners.

A REAL IMPROVEMENT

aacPlus is based on the Advanced Audio Coding (AAC) codec developed by Fraunhofer Institute. AAC is a successor of the famous (or infamous, depending upon your viewpoint) MP3 and introduced a number of improvements over MP3. There was now more resolution in filter banks, adaptive linear prediction, higher coding efficiency, and enhanced joint stereo techniques.

The result was a roughly 30% increase in quality, making AAC the first codec to pass the European Broadcasting Union (EBU) test for transparency at 128 kbps.

But as good as AAC is, it was not very suitable for streaming applications that require extremely low bitrates. At low bitrates (just as MP3) it relies on cutting down audio bandwidth to reduce the data needing to be processed, leading to low audio quality. Something else had to be done.

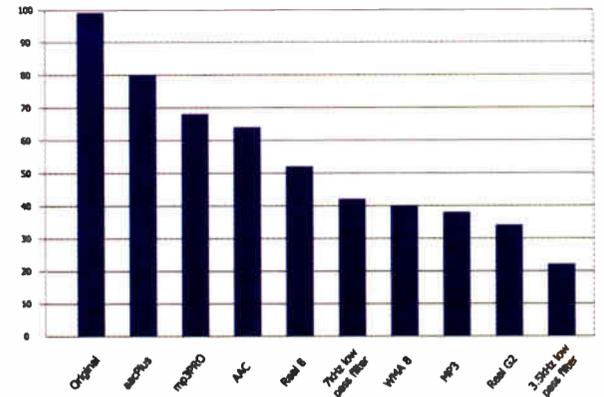
ENTER THE NEW WORLD

A bunch of clever people at Coding Technologies came up with the solution; they called it Spectral Band Replication (SBR).

In essence, SBR makes it possible to use a core codec (for example, AAC) to compress the lower part of the spectrum and use a separate process to code higher frequencies with only a minimal bitrate. Since the core codec operates on lower bandwidth, it is more efficient and the audio is of higher quality.

Additionally, the SBR extension enables the decoder to re-create the "missing" higher frequencies, resulting in audio delivered with a much wider frequency range than prior codec technology.

SBR technology can be used with either MP3 (also called MP3Pro) or with AAC (called High Efficiency AAC or HE AAC – better known as aacPlus). And thus a new codec was born, specifically designed for extremely low bitrates such as those used in streaming.



aacPlus scored highest on the EBU Internet codecs test using MUSHRA method (comparison at 48kbps stereo shown here)

Though aacPlus also exhibits some artifacts (a certain "harshness" of the high end), they appear to be of a much more tolerable nature and often not even noticeable. It is certainly a far cry from audio that sounded like going through multiple flanging effects.

A big plus is the increased frequency range which makes aacPlus sound much like original material at bitrates as low as 32 kbps – in stereo!

STEREO CODING

If we can parameterize high frequencies, why not parameterize stereo information as well? This is what experts at Coding Technologies asked themselves and came up with another scheme – PS, which stands for Parametric Stereo – which was incorporated in an improved version of aacPlus (variously called HE AAC v2, aacPlus v2, or Enhanced aacPlus).



First we mix, and then we separate.

The core codec deals with mono information only (further improving audio quality); a small amount of data is used to describe spatial information. It may be worth mentioning that this technique is much a better version of the intensity derived stereo used in earlier codecs such as MP3, as it takes phase differences into account.

PS also can be used to efficiently code surround (5.1) audio and steps are underway to license this codec as well. Both aacPlus and aacPlus v2 have been included in the MPEG-4 standard, which means they will be used everywhere – from web streaming to handheld devices.

Another good thing about PS is that aacPlus v2 is backwards compatible with both aacPlus and AAC and that aacPlus is backwards compatible with AAC.

CURRENT STATE-OF-THE-ART

aacPlus is today's most powerful bit-reduced codec offering the highest audio quality even at very low bit rates.

Experienced webcaster Gary Blau of Boomer Radio agrees: "aacPlus v2 stereo allows us to deliver a quality experience that is directly competitive with FM radio at bit rates as low as 32 kbps. Even at 24 kbps it does an amazing job; at 48 kbps and above even critical listeners will be satisfied."

Blau continues: "All codecs have their own sound and character, but aacPlus v2 does not share the painfully annoying 'flanging effect' flaws common with other codecs (such as Windows Media). Its artifacts are much less obvious and take the much more tolerable form of increased 'edginess' at lower bit rates."

Indeed, although aacPlus v2 at 32 kbps stereo sounds much better than any prior codec, the step to 48 kbps makes a significant improvement and seems to be the optimum choice between bandwidth and audio quality.

Next we will talk about the Orban OpticoDec, the first commercial aacPlus encoder that makes high quality streaming with aacPlus a breeze.

Goran Tomas is a radio engineer and audio consultant based in Zagreb, Croatia. You can contact Goran at goran.tomas@post.hinet.hr

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A Non-Comm View

Making the Connection to Your Station's Stream Easier

by John Devecka

Streaming a program is slightly more complicated than just putting an audio file up on the Internet. John Devecka offers some suggestions to help guide your listeners through the choices.

Since WLOY began streaming our programming, feedback from listeners has taught us a lot, especially in terms of making it easier for them to connect to us. One-size streaming definitely does not fit all.

VARIABLE NEEDS

We all have Internet access now, especially if we are on a campus somewhere. Chances are the campus even has pretty high speed connectivity in the dorms, but not everyone does. Many students living off campus and other community members may not have high speed connections.

This discussion is aimed at stations already running a stream (or perhaps a couple, so you can offer high/low bitrate options) offered to students and the public. There are a number of options for each streaming origination program (from Shoutcast to Quicktime) and we will try to dig into those in another column.

For the moment, we are going to look at how to help the listeners help themselves. Listeners have a lot of on-line listening options from which to choose and they can be a picky bunch. If your stream is not easy for them to capture, you can easily lose them for good on their first visit.



The Internet listener's portal to your station.

The challenge is to make it easy for them to connect, set up their players to help ensure they stay connected, and arrange to have the maximum amount of information and support up on your website.

THEY DO NEED HELP

After three years of emails from listeners with connection issues that often turn out to be a problem at their end, I have come to the conclusion that your average on-line listener really needs some guidance.

This assumption is backed by a user error to streaming error ratio (U/SER) in the 100:1 range. Certainly it is easy to get a computer and even get on-line these days, but also more likely that inexperienced users will be trying to listen to your stream. Helping them helps the station.

Our discussion assumes your streaming computers and the necessary connections to the world are all set up. What we are after here are ways to allow your listeners to connect more easily and effectively.

There are some basic things you can do to make connections easier, such as making a "LISTEN NOW" button, so listeners do not have to search around your website for connections.

Once the button is placed, it needs to point to something. What should the button trigger? If you only have one stream, this is easy. There is no need to be complicated, you need to direct the "LISTEN NOW" function to that stream with your tag; for example: 144.126.163.67:8002/listen.pls.



Make it real clear where the audio is found.

Typically, the best course is to make it point to a playlist file (.pls) which, in turn, will trigger many media players to automatically load and run the stream. Of course, if you only have one playlist file, you also have to decide whether to have your high or low bitrate stream as the connection option (assuming you have options).

MULTIPLE STREAMING

If you have more than one stream running, you can either set up multiple "LISTEN NOW" buttons on the main page or have that button direct them to a secondary page containing all the connection information listeners may need (including optimizing information).

This often works better than the use of a playlist trigger. That is because many people have turned off their media player auto-play functions, trying to avoid both annoying ads and potential malware insertions.

As a result, when they click on your "LISTEN NOW" button, they may not get a connection. It may auto-load their media player but not actually load the stream or their player may not like the way your playlist file is connecting. After all, although it is a computer and not a person, they can be just as moody and picky about whom they want to talk to at any given moment.

(Continued on Page 20)

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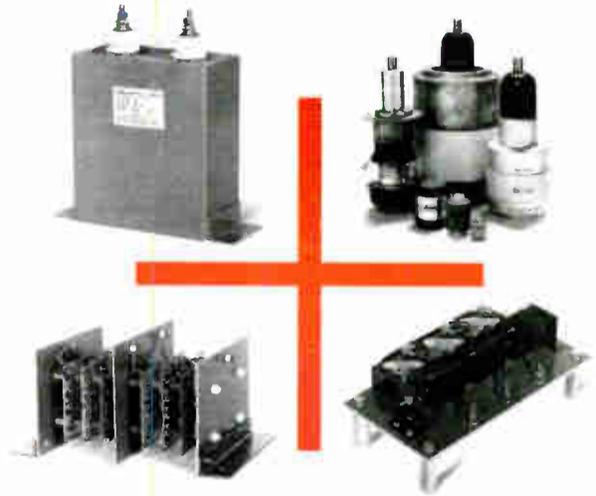


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Continued From Page 18

PROVIDING CHOICES

Most stations end up using a "LISTEN NOW" button on their front page that takes listeners to a secondary page listing the options to make sure their connection is working.

At WLOY, we have a list of all the main media players a listener might use on that page: iTunes, Quicktime, Real Player, Windows Media Player, Winamp, and XMMS. Yes, there are others but these are the main ones and most users with others eventually figure out how to make them connect with similar commands. These cover Mac, Microsoft and Linux operating systems, thus covering most listener options.

When someone reaches this page you have a variety of ways you can configure the information and connections. Do you want to have them connect straight through, select a bitrate, read tech tips, or what? It is up to you, but you should make certain the tech tips and a way to report connection problems are right there, easy to access.

My suggestion is that you have the names and logos for each of the players up on the page so users can just click and connect. We are still experimenting with our ideal configuration; we started with the logos, then took them down and went all text, then added screen shots and a tech page that now is being redone. Everything about the web is dynamic, right?

So keep fiddling until you get the result you want: lots of on-line connections and few email complaints. Everyone's ideal listener demographic will be different, so keep tweaking to satisfy yours.

BITRATES & BUFFERING OH MY!

Rebuffering is a common problem for Web listeners. Buffering is the process the software uses to pre-load some of the audio before it starts playing. When a connection loses data, the streaming player will use up the buffer to keep the listener experience seamless. If, however, the data loss or line problem lasts more than the time allotted in the buffer, the signal drops and the listener will get a message that the media player is "rebuffering."

Generally the software is pre-configured with a small buffer, in order to reduce the starting time delay when you click on a webstream or playlist. Since the program will have to fill the buffer before it starts to play, you may have to wait a bit. It can be frustrating at first, but a larger buffer will generally also mean no dropouts and delays in midstream.

One of the other critical issues that you can control is the selection of bitrates the listener can grab onto in order to listen. If all of your target audience is on campus, inside the firewalls, and using intranet connections, then you can run a fairly high bitrate (128 kbps stereo) stream without dropout issues (or at least few of them).

You might also want to consider your off-campus listeners and run some lower bitrate streams for them. We run a 128 and a 64 kbps stream currently and will be adding some others shortly. We are also considering installing an Orban PC1100 card and running their Opticodec at 32 kbps, as many users I know are very happy with the resulting sound despite the low bitrate.

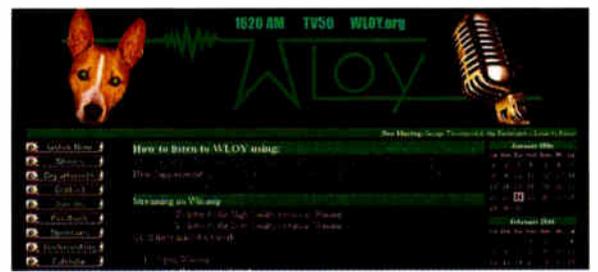
REMEMBER THE DMCA

Without debating the politics and issues of the Digital Millennium Copyright Act (DMCA), you do need to remember that you have to pay the piper if you are streaming.

Thanks to the efforts of several folks (and I will not start a battle by naming specific names) the Small Webcasters Settlement Agreement with the RIAA has kept a lot of DIY stations and schools on the net. Expect to pay somewhere in the \$800-1,000 neighborhood per year, which includes ASCAP, BMI and SESAC.

Please note that you need to go to Soundexchange.com to register your station (or stream) and pay them. They will not chase you for the money or send an invoice, but there may come a day when a Homeland Security agent comes to your door on their behalf.

By following these suggestions you will be on the right track. One last bit of advice I could share with you is to see if your school requires insurance to cover your Internet broadcasts. Apparently some schools like SUNY



On WLOY's listen page
www.wloy.org/index.php?page=stream
instructions are given for the various players.

Potsdam have insurance to protect the school from lawsuits that may come from material in their campus media. How about that for one more thing to worry about?

John Devecka, Ops Manager of WLOY hopes this material will help alleviate some of the headaches you have had. They have helped his listeners. Now, if only he could get the stupid computers out of the station. Contact him at john@radioedu.com



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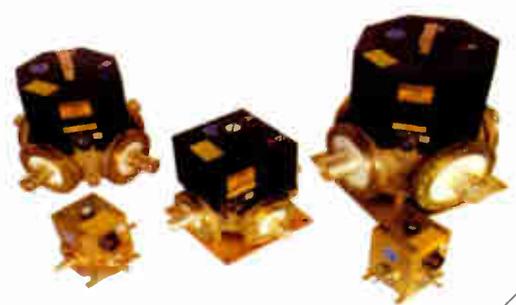
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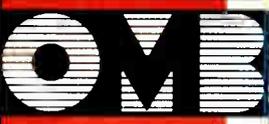


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Back on the Road with the Alternative Inspection Program

The Alternative FCC Broadcast Inspection Program (ABIP) has helped many stations identify and correct problems before they could turn into expensive FCC issues. Ken Benner reports on some of the highs (and lows) he has experienced.

It seems like it never fails: for those of us doing these inspections, it is not unusual to claim "We've seen it all!" ... then just a few days later we find another wacky, incomprehensible "How can this happen?" situation.

Here are a few recent examples we think you would like to know about. Perhaps some of these actual cases might trigger your mind about something you have noticed and provide the solution for you.

WE DON'T NEED NO STINKIN' LICENSE!

Let me start out with one of the most unusual experiences I have had. It was at a station that could not locate its license.

"It was here yesterday," the manager explained repeatedly. Finally, I punched up the FCC web site on the computer, entered the station's call and, lo and behold, there in big bold red type was the word "Deleted." It turned out the station had been operating on an expired license for over a year. Beats me why they even signed up for the inspection program.

The lesson: make sure you know the status of your licenses – all of them, even the auxiliary licenses – and remember it is your responsibility to file on time for their renewal.

LACK OF COMMUNICATION

Another station did file for its license renewal and it was granted. However, a few months later a nasty note from the FCC implied the station was operating illegally because a review of the renewal application determined the system was at substantial variance from what the Commission had on file.

At first, the licensee panicked, spending a lot of money with his communications attorney trying to figure out just how they were going to pacify the FCC. Months went by without any sort of resolution. But it was the ABIP visit that solved the problem – or rather discovered there was really no problem at all.

We found the licensee had hired one of the finest consultants in the country to prepare his license renewal. The consultant simply had noted the measurement method of the licensed radiation parameters had been modified and explained it fully in the renewal application. The processing clerk had overlooked the additional page or two in which the modification had been made clearly, establishing the current legality of the station's operation.

All of which is why it is important to be familiar with the documents you and your consultant file with the FCC. Knowledge prevents panic.

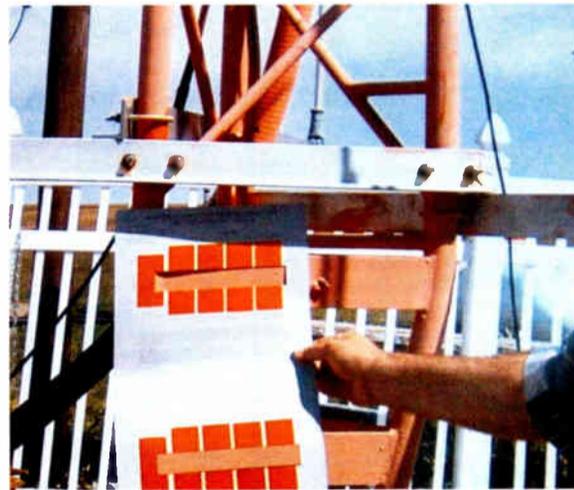
TOWER PAINT WOES

A key inspection point is checking that a station's tower is painted correctly. One tower crew tried to save money on the paint it supplied. It was not the station's fault in this matter.

During my inspection of the tower, I thought it odd that the aviation orange seemed to get lighter with each level down the tower. In fact the color at the bottom was something like boudoir-pink. I took pictures of the tower with my color chart and suggested the licensee sue whoever was responsible.

It did not take long to learn the tower painting company had gone bankrupt. A paint sample and a series of photos were sent to Sherwin-Williams for possible fade analysis. It was determined the crew had thinned their paint as they approached the bottom.

In the end, Sherwin-Williams generously supplied – at no cost – the paint to redo the job with a more reputable paint crew and the result was much better.



This paint faded rather fast – after only two years.



The properly repainted tower compared with the faded version.

PROPER CARE OF VIOLATIONS

If an inspection does turn up violations, it is not the end of the world. What is important is how you respond to the notice.

A while back there was a story about a poor little station fined a tidy bundle of money for several things found non-compliant by an official FCC inspector. Let there be no question – every violation cited was real – the dedication to compliance had really been neglected. (I later inspected the station and was able to review all that happened.)

However, the NOV's finally got the station's attention. With the help of a top-notch contract engineer, every citation was promptly corrected and the FCC was notified with a sworn affidavit signed by both the manager and engineer including an explanation to the effect that paying the fine quite likely would put the station out of business.

Long story short: FCC rescinded the fine! Trust me, the FCC is not always about issuing large fines. If a station acts and communicates in an honest way, the Commission is often willing to cut it some slack.

About five percent of the stations I inspect cannot be certified while I am on site. If it is a simple thing like a missing public file folder, I will simply request a signed statement to the effect the item will be corrected within 30 days and provide them with a certificate of compliance.

Am I certifying a non-compliant station? Of course I am! Common sense will tell you there is no station in the country 100% compliant with every nit-picking thing in the Rule book. And most of the FCC people fully understand this.

THE INSPECTOR LEARNS HIS LESSON

On the other hand, there was an incident that will never happen with me again. It involved a station with several items of non-compliance – read that *serious* items of non-compliance. However, it was in an isolated area making it extremely costly to re-inspect the station considering time, lodging, air-travel and other costs.

The staff appeared to be honest and professionally dedicated. So, before I left, I wrote them a letter explaining in detail exactly what was wrong, what needed to be corrected and how, additional sources of information, and suggested some reputable contract engineers available nearby. Furthermore, I had them sign an attached memorandum promising all items would be corrected within seven days.

Based upon their signature acknowledging the memo, I provided them a certificate of compliance.

A MAJOR OOPS

One item of non-compliance was the station's directional antenna system. About a year and a half after my visit another station receiving serious interference from this DA filed a complaint with the FCC. This brought an official FCC inspector, who discovered every non-compliant item I had discovered *had not been addressed*.

The approximate fine was \$30,000. Never again will I certify a seriously non-compliant station without a sworn affidavit attesting fully-achieved compliance of each item in the inspection report.

Why did I not get fined or sued for incompetence? Because the FCC recognizes good faith and professional dedication on the part of those of us who try to do the right thing, use common sense, and not try to bluff anyone. For this reason I now keep full documentation at our office supporting the issuance of every certification we give out.

MORE DA ISSUES

As it turns out, AM directional antenna systems are among the most frequent items that plague these alternative inspections. Over half the DAs I inspect have no record that the monitor points have been read in years or that the phase monitor is calibrated and operating properly. Many lack a calibrated Field Intensity Meter. Sometimes during the inspection we even "find" a cell-tower has sprung up near the antenna site.

Obviously in those cases we cannot certify such stations as compliant until we receive an affidavit from their consultant detailing proper corrections.

Nevertheless, preventing fines is easy: if any monitor point reads high, simply reduce your power such that each of your monitor points measure less than the maximum permissible field stated on your license.

For example, one of your points reads 100 mV/m and the maximum permissible field is only 95 mV/m. Since your monitor point levels relate proportionally to your common point current, reducing your common point input current by 6% should result in a monitor point reading very close to 94 mV/m. Remember, if your DA is out of tolerance you must correct it promptly or shut down (Section 73.1350(d)).

PREVENTING PROBLEMS

In this respect, one question I am frequently asked is: "What do we do if something serious happens to our transmission system? Perhaps a lightning strike, a fried transmitter or antenna, or the DA develops a serious out-of-tolerance situation.

My answer: just use common sense. Get on the air by whatever means possible that will not cause undue interference to others. Then call the 24/7/365 FCC emergency Duty Officer and obtain an STA (Special Temporary Authority). His phone number is 202-418-1122.

In almost 50 years of dealing with the FCC I never have had the slightest problem with staff. Whenever I am asked to conduct a seminar for one of the State Broadcast Associations I always receive a positive response from an FCC regional representative to join me to assist in the Q & A.

I trust them and they trust me, as we mutually assist the broadcast industry. Never hesitate to call your FCC regional office; they will always do everything in their power to help you.

Ken Benner has been actively inspecting stations under the Auxiliary Broadcast Inspection Program for over a decade. If you have questions about the issues above or ABIP inspections, contact Ken at bennerassoc@comcast.net

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Field Guide

by Mike Irby, Director of Engineering and IT
Clear Channel Radio, Tucson

Continental Electronics' New 816HD Debuts at Tucson's KRQQ

With 2005 coming to an end – and along with it the aggressive timeline Clear Channel placed on the IBOC rollout initiative at KRQQ in Tucson, Arizona – we solicited the help of Continental Electronics to develop a quick all-inclusive HD solution.

FITTING THE SPACE

Our transmitter site, atop Tucson Mountain just west of downtown Tucson, would prove to be a challenge, not only for equipment delivery but because of the limited amount of floor space available to us as well.



Tucson Mountain

As with many stations using mountain top facilities, enlarging the room just was not an option. Inside the transmitter room was a 20 kilowatt Continental 816R-3 serving as the main transmitter. Next to that was a Collins 830F that was limping along as our backup transmitter; the new unit would need to fit on the same floor space.

Continental's answer was the new 816HD-series transmitter with low-level combining. This transmitter amplifies both the analog and digital signals using common amplification and does so while with the same footprint as our existing analog transmitter.

ENHANCING A PROVEN TRANSMITTER

The 816HD is the latest version of the FM transmitters first delivered by Collins Radio in the 1970s (as the 831 series) and which has developed an amazing reputation for reliability over the years.

Continental took over the line when they bought the Rockwell-Collins broadcast operation in 1980, renumbering the series and improving it. The 816R3 at our sister station is still going strong 24/7, over 21 years after it was installed in 1984; others have been going even longer.

The big challenge for the 816HD was for Continental to adapt the transmitter for digital operation by making the tube power amplifier section linear enough for the purpose and yet still maintain the Transmitter Power Output (TPO) necessary for analog operation. A discussion about this was in the July 2005 *Radio Guide*.

Briefly put, using a new IPA section and a 4CX20,000E tetrode PA tube allowed the necessary modifications to the transmitter so that it meets the NRSC recommendations on spectral emissions. Although not necessary for all power levels, the Continental 816HD uses pre-correction to comply with, and significantly exceed, the NRSC mask while generating analog power levels up to 21 kW.

GETTING READY FOR DELIVERY

In preparing for the new 816HD transmitter, we decided to start by completely moving everything from the room with the exception of what was absolutely

necessary to remain on the air. Consolidation and ownership changes over the years had left us with virtually no documentation on this facility or its interconnection to one of Clear Channel's other stations in a separate room at the same site.



Continental Electronics 816HD Transmitter

We removed all intra- and interconnecting cabling, RPU and monitoring equipment, backup transmitter, dummy load – we even replaced the old tile floor that was creating a dust nightmare.

Next we installed an entirely new audio processing chain along with new cabling complete with proper labeling and documentation. As the work in the transmitter room was nearing completion, we coordinated with Mike Troje at Continental Electronics. He was able to have the new 816HD transmitter on site in less than 48 hours.

A CAREFUL TRIP UP THE HILL

The trek up Tucson Mountain is not an easy one – as with many mountain sites, the grade gets pretty steep. That trip, along with the complications of actually getting the transmitter through all the doors and hallways into the room, took the better part of a day. Fortunately, the company that moved the transmitter had experience with this site and was well prepared for the challenges.

Once the transmitter was in the room and in place, all the panels were removed and a thorough inspection for loose hardware or connections revealed that everything was in order. Because the 816HD requires no special plumbing or combiners, we simply connected the transmission line to the directional coupler and made all the electrical and control connections.

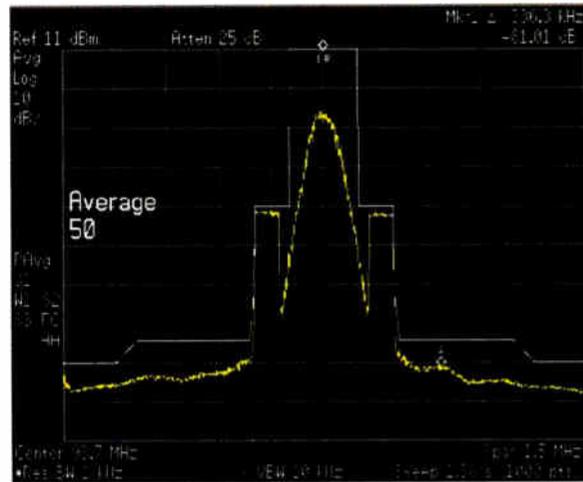
I was pleasantly surprised at the ease of installation; with the exception of the IBOC generator, it was no different than any other 816-series installation and by the end of the day we felt like we were ready to go.

THE ACID TEST

Continental dispatched a team of experts – Dan Dickey, Richard Garret, Alan White, and Mike Troje – for the initial turn-on of the transmitter, their very first 816HD in the field. Clear Channel's regional vice president of engineering, Gil Garcia, also joined us.

As midnight approached, the main transmitter was powered down and the 816HD was brought up into the antenna at low power and walked up to its full analog TPO of 20 kW. All readings matched the factory test data.

One of Clear Channel's key stipulations for equipment acceptance was that the 816HD meets the NRSC spectral mask with full modulation applied. The spectral images we measured showed that the 816HD was well within the mask, regardless of power or modulation level.



816HD Spectral Plot with 100% Modulation

Even though we had prepared to work through the night, by 2:00 AM it was clear the transmitter was operating without a hitch and we had accumulated all the data and readings we needed for acceptance. As we left the site we felt confident selecting the 816HD was a good choice for KRQQ.

RUNNING WELL

Since that night in late November, the transmitter has been operating flawlessly at full TPO, even through several of the electrical anomalies that frequent southern Arizona.

We have intentionally run the transmitter up and down while observing the signal to make sure there would be no problems, even if we had to operate at a "non-standard" power level during work on any of the co-located towers on Tucson Mountain.

Thus far the spectral and operating parameters have continued to look just as they did on Day One.



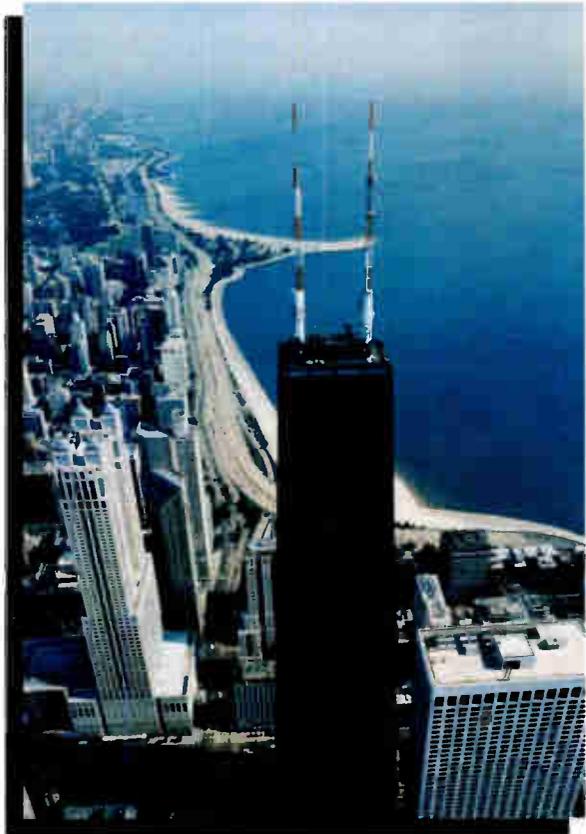
KRQQ's 816HD transmitter
alongside the 816R-3 (now the Backup).

Having had an excellent relationship with Continental Electronics over the past 21 years, it was really great to see Continental back in a leadership position with a product the industry most definitely needs.

We passed a small window of opportunity for this project on to the Continental folks and they were willing to meet our timelines and work within the constraints of the project. We stayed in close contact with each other and, simply put, Continental delivered and I could not have asked for more.

Mike Irby is the Director of Engineering and IT at the Clear Channel cluster in Tucson. He can be reached at mikeirby@clearchannel.com

When You Want More Than Just An Antenna



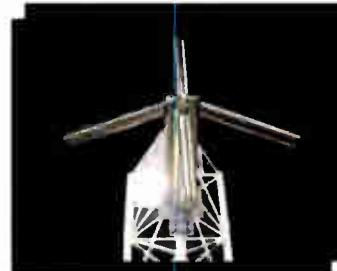
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Adventures in the AM Field

(Confessions of an AMD in the Trenches)

Part 2 – Gathering Data

Phil would like to remind everyone that this is not one real station, but a fictionalized synthesis of several.

It was almost too real to be true. During an inspection of a directional array that seemed to “wander” and require expensive adjustments every few months, the CE and I discovered the previous solutions had been mostly turning cranks and hoping.

THE REAL ISSUE

As we prepared to solve the problem the right way, so it would be stable for a long time, we reported to the manager that we were narrowing in on the problem, but had temporarily made the station legal by reducing power about 15%.

His key question was, “How quickly can we go back to our thousand watts at night?”

My answer was I honestly did not know because we needed more data to completely understand the problem. That drew a scowl and a comment that “Joe Blowhard nearly always fixed it the same day or the next day by cranking the phasor.” In return, I inquired as to how many times that had happened in the past five years.

He now understood the point and asked, “So what do we have to do to keep it fixed?”

A BETTER APPROACH

The nighttime array was a tight one, thus I explained keeping it within limits was a manageable issue, but needed continuous regular maintenance.

Next I offered a choice, either “crank” the phasor while watching the points, which in my opinion was another band-aid, or survey the pattern and understand the problem for a more intelligent correction.

I also mentioned the night pattern had to be brought up to full power quickly to avoid asking for Special Temporary Authority to continue reduced power nighttime operation pending pattern alignment.

SURVEY? WHAT DO YOU MEAN, SURVEY?

The GM asked if a survey meant running a partial proof of performance of the patterns. Maybe later, I told him, but only if it appeared changes were needed in several monitor points or we found parameters outside normal tolerances were necessary to keep the pattern within its design limits. At this point, we needed information about the performance of the array from the field.

The CE questioned why “all the meters” at the transmitter could not give us that information and I explained that, first and foremost, a directional array is designed to produce different power levels in different directions at a distance *away from the transmitter*. Incorrect meters or the effects of man-made structures could change the results in the field, so first we needed to know the actual changes in the field *before* we could formulate a plan.

At this point, we had identified several problems for our inspection report, but we could not accurately define the *scope* of all the problems, nor did I know that we had uncovered everything that might affect the performance of the day and night directional arrays.

“Well, what do you do next?” was the GM’s easy question.

“We do it the same way as we would with a new pattern. We align it according to its design, which is to say we adjust for the correct phase monitor readings, then we survey in the field to find exactly where that puts the lobes and nulls. If those agree with the design and all points are in their limits, we are done. If not, we find out why.”

GETTING RIGHT TO IT

His next questions were not so easy. “When can you start?” He also wanted to know exactly how long the survey would take. That, I said, was a matter of how the available roads fit the pattern, but it would take a day or two, possibly three, of field work. He seemed to think for a moment and asked if there was any way we could get started tomorrow if he could get us rooms for the night.

To myself, I thought there was at least a chance we could make good progress in that time. We had a field intensity meter. We had all the maps and GPS on the computer. The maps and notes from the last full proof were there. I would have preferred time for more planning, but the weather was good and, all things considered, we had everything we needed to do a survey.

I conceded we could rearrange the schedule for the rest of the week so we could start the next day and possibly work two days. Rooms would not be a problem. One of the group owners owned a nearby motel and they would pick up all lodging and meals costs on a direct billing to the station. The CE said he would meet us for breakfast at 7:00 AM the next morning and we called it a day.

MEASURE THREE TIMES, THEN ADJUST

That evening, after dinner, I plotted routes that would cross the radials of the last full proof skipping the major lobe radials well away from nulls. The next morning, we carefully recorded the phasor data and checked the phase monitor calibrations using what I call a “gang tee” for connecting all working phase monitor inputs to a single RF source.

Except for the number three tower, all indications were equal and showed slightly above 25% of the normal reference reading. The CE was watching and asked why I was feeding all channels from one sample, and why we did not get equal results.

Pushing the button for the number three meter, I pointed to the indicated 0.285 ratio and said, “I always do that, and once in a while I find something like this.”

He wanted to know if I thought there was a problem in the phase monitor. My assistant laughed saying I did not think it, I *knew* it. I explained either a terminating resistor had increased in value or there was a bad relay in that channel. Either way it was time for the monitor to go back to the manufacturer for repair and calibration. The CE asked if a small error like that could cause a problem.

A SLIGHT PROBLEM

“Small error?” I asked. “Think about it. If the input is 0.250 and the reading is 0.285, what is the error?” Pink crept into his face as he saw the meter actually read 14% more than the input sample.

I told them, “It is not completely accurate, but what we will do is increase the power to number three so it appears to be 14% above the licensed value. This puts true tower current very near the correct value. We could check base current meters as a backup, but I saw those yesterday and two of them were last calibrated over forty years ago. At this point it better to go with what we have and make the best of our remaining time.”

My assistant opened the back of the phasor as I watched the phase monitor for any changes in phase or ratio. Finding nothing remarkable, I moved each crank slightly in each direction to confirm that all were firmly connected to their respective coils and vacuum variable

capacitors. Finding nothing loose, I adjusted the phasor as my assistant observed the coils and capacitors, while watching for signs of arcing or slipping controls.

After both patterns stabilized within one-quarter of a degree and less than one-half percent of power, we checked to see if, or how quickly, the same readings returned after a pattern switch. The daytime pattern took nearly ten minutes to return to the same phase monitor readings, so we could not plan on switching patterns frequently. That meant two trips around the routes – one for the day pattern and one for nighttime.

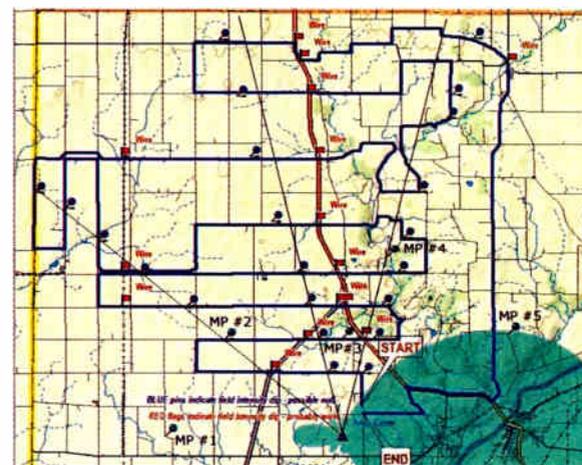
Our next step was checking the nighttime monitor points before surveying the night pattern. While there was some decrease in the over-limit points, they were not yet in full compliance. Thus, began our hastily planned survey.

A SLOW BOAT ACROSS THE CORNFIELDS

As the GPS bug crawled across the topo map we watched the field intensity. The excursions were substantial because we were driving through nulls and minor lobes about two miles from the array so I put the meter in the logarithmic scale mode on a lower scale.

Most of our route was over subdivision streets and country roads so we were not setting speed records. This gave me time to mark the map as the FIM dipped. Our route crossed each null azimuth several times as we moved away from the array.

Several times we found apparent nulls that did not seem correct. I had marked these with red virtual flags on the computer map, rather than the blue pins I used for what appeared to be pattern nulls.



Slowly but surely we find the real pattern minima.

The CE questioned these, and I explained that it helped to look overhead with one eye while watching the meter with the other one because overhead wires caused some of the reading dips. If I saw a wire across our route as the meter dipped, I flagged the reading as probably not a pattern null.

By lunchtime, we had a very nice map of pins and flags for the nighttime pattern. Most of the pins lined up, so drawing a straight line through the majority missed very few, but two of those lines missed their monitor points. The red flags scattered randomly, although some appeared to line up with roads where we had seen utility lines across our path.

DAYTIME IS SIMPLER

The day pattern was simpler, more or less pear-shaped with four rather broad nulls and a medium sort of lobe aligned with the towers opposite the major lobe. By about 4:00 PM that afternoon we had enough information to flesh out the shape of both patterns as they existed in the field.

We could see there was a resemblance to the authorized pattern, but both were somewhat distorted. The daytime monitor points benefited from loose limits and wide, well-filled minima, but it appeared that they were trending toward the maximum unless the array was properly re-aligned.

Now it was time to use the gathered data to make the patterns agree with their designs. We will learn how next time.

Phil Alexander is also rumored to be fictional, but we mustn't tell him, otherwise he might just disappear before telling us the whole story. Compliments and complaints to dynotherm@earthlink.net

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Silent Bytes, Quiet Rooms

Noiseless Computers for the Broadcast Studio

The computer has been invading broadcast studios at an ever-increasing pace. Studios now demand not only a computer for automation, music cuts, and spot play out, but Internet access for weather and news, plus dedicated machines for news wires and possibly remote control.

However, a studio requires a quiet environment. Numerous computers around a studio with their noisy fans are simply unwelcome. Broadcasters have found a range of solutions to the problem.

LIVING WITH FANS

When stations place CPUs into the studio, it is obvious that the primary source of computer noise is the fan.

Often the computer used in a studio for automation and live assist is a larger desktop or tower machine (if not rack mounted) with professional sound cards.

Quieting such a box for studio use is a challenge. Removing the machine to a remote location requires rerouting or extending audio cables. Keeping it in the studio means the fan's noise needs to be muffled, lowered, or the fan eliminated. Understanding what is going on will help in devising quieting solutions.

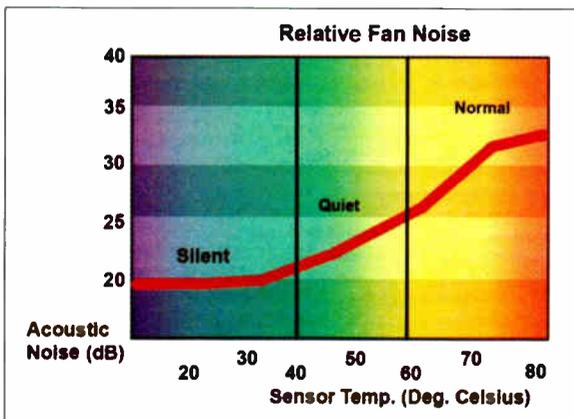
In an article in *Electronics Cooling* magazine (May, 1996), Mike Turner of Comair Rotron states that fans are utilized when a high flow rate is desired but at a low pressure differential. Blowers work against a higher pressure differential but at a lower flow rate.

MOVING AIR

Blowers and fans are two differing technologies. A fan delivers air parallel to the fan blade axis and a blower delivers air perpendicular to its axis. The blades in both types are airfoils.

Common examples are a household box fan and a squirrel cage blower in a furnace. The box fan delivers a great deal of air, but against essentially no backpressure resistance. The furnace blower must overcome the resistance of the furnace ducting.

If the box fan has a ring (or venturi) surrounding the blades, it is a tube-axial fan – the type commonly seen in computer usage. The venturi reduces vortices coming off the fan blade tips. A vane-axial fan has vanes on the propeller tips to straighten the swirling air flow. These technologies have the effect of increasing efficiency and quieting the fan.



The fan's noise depends upon the fan's speed.

AIR FLOW VS NOISE

The greatest air flow delivery occurs when the pressure differential across the fan is zero. As the differential increases due to restriction and fan speed is

increased to compensate, airfoil stall eventually occurs. This is called the "shut-off" point. It is noisy and obviously inefficient.

It can be seen from the graph that a tube-axial fan in a computer will operate quietly and most effectively with minimum restriction and at slowest RPM.

Of course you may be faced with the necessity of installing a noisy computer in the studio, such as a rack-mounted unit that cannot be placed elsewhere. Even for this eventuality, there are solutions. Noren AcoustiLock builds isolation cabinets incorporating acoustically padded internal matrixes to silence fan and computer noise.

Another brand of similar enclosures is Isobox. These are rated for 20 to 30 dB of noise reduction depending on frequency and whether measurement is made of sound leaking in or out of the case.

Web Sites Helpful in Quieting Computer Fan Noise

www.zalmanusa.com

(heat pipe cooling)

www.hushtechologies.com

(assembled, quiet, small form factor)

<http://us.shuttle.com/>

(assembled, quiet, small form factor)

www.kvms.com

(KVM extension and switching technology)

www.acoustilock.com

(noise reduction cabinets)

www.customconsoles.com/isobox.php

(Isobox sound proof boxes)

www.electronics-cooling.com

(technical magazine)

www.silentpcreview.com

(information and reviews)

www.activethermal.com

(fan based cooling)

www.endpcnoise.com

(quiet computer hardware)

www.silentpc.nl

(quiet computer hardware)

www.quietpcusa.com

(quiet computer hardware)

www.antec.com/us/

productDetails.php?ProdID=81800#

(P180 case)

www.aopen.com

(low noise cube computers)

www.logicsupply.com/default.php/cPath/49

(fanless systems)

www.acoustiproducts.com/en/acoustifan.asp

(quiet PC fans)

www.quietpcusa.com/articles/how_to_silence_a_computer.html

(various methods of silencing a computer)

PUSH OR PULL

Many computers in studios and offices are installed inside existing furniture. Often the furniture has not been designed to contain heat producing equipment or was poorly designed. Cooling air must flow through this space. Should it be pushed or pulled? Mike Turner's article addresses this question.

Turner points out that pushing air into the enclosure allows the air to be filtered. The fan handles denser, cooler air increasing its efficiency and extending its life. The heat of the fan motor is introduced into the enclosure, but in this application these considerations are of little relevance. Placing the fan or fans low and the exhaust openings high is, of course, best. Lining the interior with acoustic foam would be a good idea.

Fans may be placed in series when there is more resistance to airflow, although Turner explains that fans in a parallel configuration are best for higher volume, low resistance applications. It might be useful to install fans next to each other in parallel arrays, but wire each two in series so they will run slowly.

Alternately, install 220 volt muffin fans running on 110 volts. The quiet slow breeze may never be noticed. The greater the area of the fan or fans in parallel and the slower they turn the quieter they will be.

THE KVM SOLUTION

The most obvious thing to do is to remove the computer from the room, leaving the keyboard, video, and mouse (KVM) conveniently located.

Of course, any insertion of floppies or of CDs for ripping requires a trip down the hall. Worse, a computer room is often locked for security, rendering access impossible without the key.

If KVM extension is still chosen, two means of KVM extension are available: long cables and KVM extenders. High quality, low loss KVM cables are available to move the computer to another area. For example, Avocent lists up to a 75-foot premium PS/2 and VGA video cable set. The advantage of a plain cable is simplicity, lower cost, and lack of susceptibility to lightning damage.

LONGER LENGTH ISSUES

For longer distances, one of two types of KVM extensions may be used – CAT5 or fiber. The well-known Avocent (formerly Cybex) KVM extender utilizes two small boxes at either end of a CAT5 cable. They are available with not only VGA, PS/2 mouse and keyboard connectivity, but audio and RS-232 serial as well. These are rated for distances up to 500 or 1000 feet.

It has been the author's experience that these devices are highly sensitive to lightning strikes. Consider that each end is hundreds of feet apart and a strike may induce a substantial voltage differential end-to-end. Ethernet NIC's and switches are similarly damaged. At perhaps \$450.00 for a KVM extender pair, a strike can become expensive.

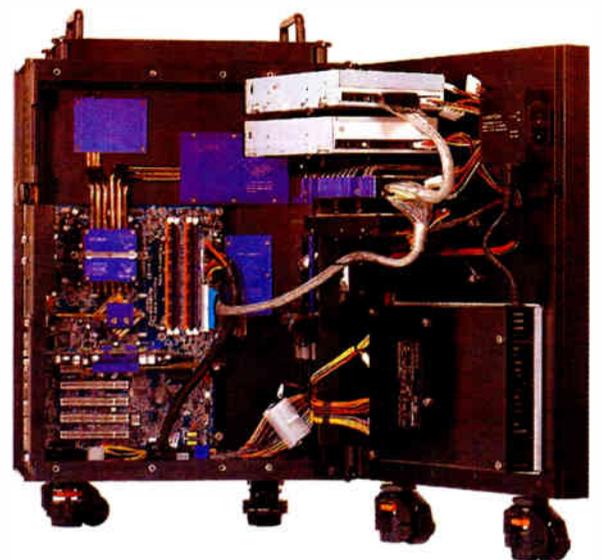


Figure 1: Zalman 500 Series fanless computer.

For more than 1,000 feet or for lightning protection, fiber linked devices are available. Fiber technology for this application costs well into the thousands of dollars, however. KVM over IP is in reality a remote desktop technology and requires a local computer and its attendant noise. Careful planning to allow plain KVM wiring to remotely located computers seems to be the prudent solution. One source of information covering many brands is www.kvms.com.

(Continued on Page 30)

“Some people don’t like change. Change doesn’t much care.”

“I guess being the very first station to use Ethernet for audio routing has made WEGL a little famous! Someone’s always on the phone:



‘Tell me about your Axia system. What’s the real story?’

“The real story is that two years ago, when our old analog consoles began to fall apart, we put in an Axia IP-Audio network and SmartSurface. And I’ve never had a single reason to regret that decision.



“Sure, I was skeptical at first. But audio-over-Ethernet technology is compelling!

Other companies just use CAT-5 to carry audio using proprietary protocols. Axia uses standard Ethernet to build a true network with uncompressed digital streams



plus machine logic and program-associated data. No one else does that! I was a little concerned about dropouts and QoS

problems, so we went to the Axia factory and assembled a network ourselves. It was easy to do, and it just *worked*. We were sold.

“The jocks took to the new board like fish to water. Show Profiles are their favorite part, since they can all have custom board setups. Some like their headphone levels blasting, some don’t. Some like the mic on the left side, others on the right. I’ve got one guy who brings in his vinyl records every week for an oldies show; he’s the only one who uses the turntables but when he loads his profile, they’re ready to go.



“There were a few little bugs, but we had the very first surface! Axia support gave us new software right away and our problems were solved. Two years later, I’m more impressed than ever. I recommend Axia one-hundred percent.



“Since the first studio was installed, we’ve added a new production and interview studio, and we plan on building three more studios. It’ll be all Axia — all the way to the transmitter.”



— Marc Johnson, Chief Engineer, WEGL-FM
Auburn University, Auburn, Alabama



www.AxiaAudio.com

Continued from Page 28

LOOK MA, NO FAN!

Many laptop computers do not incorporate fans; they are seen more and more regularly on TV anchor desks. Redesigning a radio studio to allow convenient operation and viewing of a laptop is a possibility.

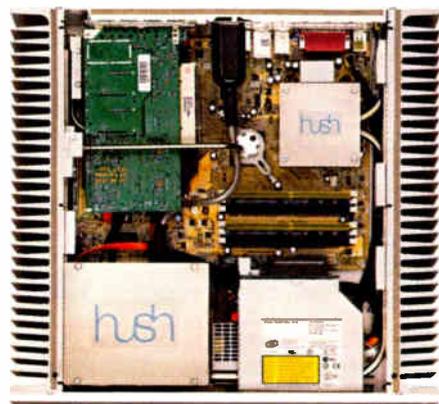
To eliminate fans entirely, heatpipe technology has been applied to computers. Heat is moved away from the CPU, other cards, and power supply using liquid in pipes; a convection flow or pump may be used. External fins then radiate the heat silently.

Zalman has a range of PC tower cases – the TNN series – ready for installation of a range of recommended motherboards and video cards plus broadcast specific components such as professional sound cards. (Figure 1)

Although these cases are considerably more expensive than conventional cases, they will pay for themselves considering the lack of need for an expensive and electrically fragile KVM extender system. One or two lightning strikes and you are ahead. Completely silent, they can be placed anywhere in a broadcast or recording studio.

MORE CHOICES AVAILABLE

Computer vendors of both built-up systems and components are becoming savvy to the noise problem apparently due to the home theater craze. Hush Technologies (www.hushtechnologies.com) offers a series of computers for this specialty market. They were originally configured for the home entertainment and office market, but are now reaching into the broadcast environment with a few systems already on-air.



Hush Technologies ATX Series

The Shuttle xPC is another similar product. Available from additional sources are assembled systems with a spare PCI slot or two. Logic Supply's site features a page with fanless systems from Hush, Serener, a house brand, and Sumicom.

QUIETING EXISTING CPUS

If a silent case or computer is undesirable due to cost restraints or configuration incompatibility, consider one of the Antec acoustically designed cases of more conventional design, but with quiet features. The P180 is an example.

For an existing computer, a simple retrofit of a quiet power supply and acoustic padding inside the case may be just the

ticket. The Antec Phantom series or Zalman ZM series, for example, have fanless power supplies or a temperature-controlled fan that speeds up only when needed.

If you do install a silent/quiet power supply, adhere sound deadening foam to the case walls where it will not block air flow and slow down the case fan. The foam will absorb a portion of the noise of the CPU fan. A potentiometer of a few hundred ohms in series with the fan will allow you to set a slow speed.

Many BIOS versions now report CPU temperatures. The CPU fan is likely to be automatically speed-controlled, so note the speed also. Record the CPU temperature before and after conversion to a slower case fan. Studios are generally air conditioned, so cool air will likely be entering the computer. If the CPU temperature is normal and the case fan is sufficiently quiet, replace the pot with a resistor.

Next time, we will explore an implementation used by the author for an inexpensive, custom built, external

solution for those computers that cannot be altered, such as an OEM machine under warranty.

In case you would prefer an easier way to access the URL's Jeff has listed, he has provided a page of these links online. Just point your browser to http://www.olderadio.com/jeff_johnson.htm

Jeff Johnson is a longtime fixture in the Cincinnati, OH, engineering community. He may be reached at: Jeff.Johnson@goodnews.net

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CSD-1

The CSD-1 converts a composite stereo signal into discrete left and right balanced outputs. Features include; twin BNC input connectors; multi-turn input level control; twin power connectors allowing up to four units to be driven off of one power transformer; front panel output trimmers; front panel stereo and power LEDs and plug-in Euroblock output connectors. The CSD-1 is powered by a surge protected internal bi-polar 12vdc power supply affording superior headroom and high definition audio. The CSD-1 may be set on a desktop, mounted on a wall or up to four units may be mounted on the optional RA-1, Rack-Able mounting shelf.

DMS-III

The Broadcast Tools AES/EBU Digital Monitor & Switcher III is designed to accept and automatically or manually switch two AES/EBU signal sources when an AES digital error and/or analog silence are detected. Features include: Automatic control function that switches to a back up source upon failure of the main source; Switch functions can be triggered by loss of clock, AES digital error flags, front panel transfer switch, external switch contact and/or the internal analog stereo silence sensor. Additional features: Front panel error status and sample rate LED indicators; front panel headphone jack and level control; balanced stereo monitor output; remote control; removable screw terminals; Plug & Play installation; dipswitch selection of precise time delay from 2 seconds to 85 minutes and restore timing delay from off to 10.2 minutes; defeatable sonalert aural alarm; SPDT status relays; SPDT one-second pulse relay. The DMS III may be set on a desktop, mounted on a wall or as part of the new RA-1, Rack-Able mounting shelf.

RDDA 4x4

The RDDA 4x4 quad-mode AES/EBU digital distribution system provides up to sixteen outputs from a single digital source. The sixteen outputs may be split into four groups, providing four transformer-balanced outputs each from a single source.

The RDDA 4x4 is ideal for distributing AES/EBU signals of sample rates up to 96kHz and/or word clock around your facility without any signal alteration.

The RDDA 4x4 is equipped with four transformer balanced loop-thru inputs with selectable termination and sixteen transformer-balanced outputs with selectable termination. The half rack profile, allows the unit to be set on a desktop, mounted on a wall or as part of the new RA-1, Rack-Able mounting shelf.



ADCS III AES/EBU Analog to Digital Converter & Switcher



CSD-1 Composite Stereo Decoder



DMS III AES/EBU Digital Monitor Switcher III



RDDA 4x4 AES/EBU Digital Distribution System



DAS 8.4 AES/EBU Digital Audio Switcher

DAS 8.4

The Broadcast Tools DAS 8.4 provides AES/EBU digital audio routing/switching of any one of eight AES/EBU inputs to four AES/EBU outputs. The DAS 8.4 may be used in Multicast applications, where an AES enabled EAS device assigned to input eight is routed to all four outputs via a contact closure or serial command. When the alert/test is completed, the DAS 8.4 will return to its previous I/O configuration. The DAS 8.4 may be controlled via front panel switches, contact closures, 5-volt TTL/CMOS logic and/or the multi-drop RS-232 serial port. The front panel is equipped with input and output selection push buttons, output assignment LED's, sample rate LED indicators and a headphone jack with level control. Additional



8x1 DAS AES/EBU Digital Audio Switcher

features: 96 KHz AES receiver, a 24-bit D/A converter with analog balanced stereo output, headphone amplifier and 16 x 16 GPIO port. Installation is simplified with plug-in euroblock screw terminals. 1-RU chassis.

8x1 DAS

The 8x1 AES/EBU Digital Audio Switcher routes any one of eight AES/EBU digital inputs to three AES/EBU outputs in a 1-RU space. Programmable or last selected source memory, safety lock out, output muting, remote control/status, multi-drop RS-232 and RS-485 serial ports. Two versions: balanced 110 ohm with XLR connectors, or 75 ohm unbalanced with BNC connectors.

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by John Mackley
Telos Tech Support

Protecting Your Gear from Lightning

Sooner or later, some part of your facilities will take a lightning strike. Preparation can help guard your expensive equipment against damage or even destruction. Here you will find some tips compiled by the Telos engineers to help keep your station running smoothly.

TELCO LINES

Several companies make surge suppressors intended for phone lines and ISDN lines. Some are in-line connectors with modular plugs; others are hardwired at the demark point. The two primary methods of protection are Series and Shunt.

Series devices typically plug directly into the line between the equipment and the demark, serving to block incoming surges before they reach your equipment. Shunt devices attach in parallel with the line and attempt to direct the surge away from the equipment by providing a better path to ground. Some devices combine both methods of protection.

Some Telco equipment manufacturers offer punch-block solutions, such as the Siemon Pico Protector Module. These units mount right to the punch block in place of bridging clips. Other modular devices are offered by several companies, such as Polyphasor, TrippLite, APC, and Panamax, and include ISDN and T1 solutions.

AC POWER LINES

Power conditioning and backup are fast becoming a requirement for many sensitive electronic devices including computers, audio processors, and any mission critical component that relies on clean power for a CPU-controlled device.

Many of the home backup power devices have some protection, but larger commercial types of power backup provide better protection. These units usually have a better reaction time and improved line filtering. Some of the very large installations tend to work in a "hot" mode where they are constantly on-line with the commercial power merely maintaining a charge on the batteries.

A good surge suppressor should have some kind of an alarm system, since once most surge suppressors have done their job they typically need to be replaced. During a major lightning strike the deadly force of the lightning is dissipated and may destroy the suppressor's components, but ideally not your equipment.

OLD FASHIONED TRICKS

For years, computer technicians have talked of tying knots (usually three) in the power cords of computers as lightning protection. They report that, during really bad lightning strikes, the power cords with the knots were totally destroyed – but the computer was perfectly fine.

Others have used ferrite beads and looped the cords through these. Some people report the same results doing the same trick with phone lines. It couldn't hurt to try.

GROUNDING

Proper grounding is essential to equipment safety. The idea is to provide a central grounding point for all audio and broadcasting equipment to maintain a common ground. RF lines entering buildings from antenna

structures would typically have copper strap bonded to the outer conductor and be shunted to the common ground to help divert a major surge away from the equipment.

Equipment racks in engineering rooms, studios, and transmitter sites are also tied to this common ground system to maintain the same potential. Dedication to proper AC and ground wiring techniques can ensure minimal risk to one's equipment due to a surge and also can reduce incidents of ground loops and hum in your facility.

There are a great number of technical papers, books, methods, and philosophies on grounding. Do some research and contact a vendor experienced in this field for any grounding recommendations to your facility.

With proper grounding of your studio equipment and a good AC power ground, you stand a much better chance of surviving a lightning strike. Instead of losing an entire studio, you may only lose one or two items. For more information on suppliers, facility grounding and techniques refer to the Internet links found at: www.radio-guide.com/grounding.html

QUICK TIPS

- Place the surge protection circuits close to the equipment. If possible, tie the ground of the telco line suppression unit to the common ground or the chassis of the protected equipment. Use a very short lead (4-6 inches) between the suppression module and the equipment.

- Establish a common ground in your facility and attempt to route all your grounds to that point.

- Choose power conditioning and UPS units suited for and rated for handling your equipment, and include the features and options you will need. Verify the surge protection of these devices, making sure it is adequate. Frequently check these units for faults, especially after storms. Buy the best your money can buy.

Remember all telephone and cable related equipment must deal with a "double whammy." Lightning can come from either the power line or the phone line/cable line – and sometimes both! Protect all lines into your equipment.

NOTE: The author and Telos Systems do not endorse or recommend any specific vendor or product listed in this article.

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	6 kW	1995	Henry 6000D
	7+kW	2005	Harris Z16 HD
	10 kW	1988	BE FM 10A
	10 kW	2001	Henry 10,000D-95
	12 kW	1996	CCA 12,000G
	20 kW	1978	Collins 831G2
	20 kW	1985	Harris FM20K
	20 kW	1991	Harris HT-20
	25 kW	1980	CSI T-25-FA (<i>amplifier only</i>)
	25 kW	1982	Harris FM25K
	30 kW	1986	BE FM30A
	35 kW	1990	Continental 816R-5B
50 kW	1982	Harris Combiner	

(w/auto exciter-transmitter switcher)

Miscellaneous Equipment

USED MISC. EQUIPMENT:

Bird RF Thruline Watt Meter, 50S
 Bird Dummy Load, 10kW
 Denon 720R Cassette Player
 Potomac Phase Monitor AM19, w/sampler.
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First Person

by Scott Cason

Share Your Love of Radio

I love radio. It is a love affair that dates back to my first gig at an AM daytimer in my hometown of Vienna, Georgia.

AN EARLY START

It all began when I was still in high school. It was cool to be a disc jockey in the 10th grade – at least all your friends thought it was cool. However my talents were in taking things apart and so, on the advice of the great Charlie Hill from nearby WCEH in Hawkinsville, I became a radio engineer.

It tickles me to read in an article about the “glamorous life” of a radio engineer. “But you get to see all the football games free” or “You get to go to all the concerts and get backstage passes” is what my friends would invariably say.

What they never saw was me – hot, sweaty, and dirty – crawling around under the stands at the stadium, running telephone lines or climbing around up on the catwalks high above the arena floor, in order to set up the microwave links on the roof, in a wind chill of 40 below.

They also had no idea that an engineer is expected to know how everything in a radio station works and how to fix it when it breaks, while being available anytime someone might call with the most minor problem. Personal life – what is that?

A CHANGE IN FOCUS

It does take a special type to be an engineer. To keep a station on the air, you need some background in electronics, a bit of mechanical aptitude to get out of any

situation, and the ability to think outside of the box – being able to fit a square peg into a round hole until you can find a round peg to take its place.

I love radio because each day brings something new. You could say engineers learn as we go.

In recent years, computers have taken over radio studios like kudzu on utility poles in South Georgia. It amazes me how dependent radio has become on computers and their associated networks, yet when we have a problem the only person there to fix it has been trained in RF for the past 20 years. It is a day-to-day struggle that sometimes does not end in the engineer’s favor.

TRAINING NEW TALENT

Another new task is teaching RF to the promotions’ kid during off-hours. However, even if I found someone with the aptitude to work on transmitters and consoles, I would not have the time needed to train them properly.

True, solid-state transmitters run lower power amplifier voltages. I consider them appliances for the most part, but the current in these transmitters is sometimes ten times the current in a tube transmitter. Furthermore, all of my backup transmitters have tube amplifiers. They need love, too.

I have been fortunate. At every job I have had, someone was there to show me how to do it right. One mentor told me that being a good witch doctor was not about being able to shake bones well, it was about knowing which bone to shake well. I often wonder how do you train someone which bone to shake in today’s reality? And how to shake it well?

Along the way, as I worked in TV for 12 years, I longed to be back in radio full-time. I recently returned to that first love, but boy has it changed.

I thought that after the Telecommunications Act of 1996 owners would fully understand the importance of having competent engineers employed when they owned multiple stations in a market. They have not and part of that blame should rest on us for not letting them know.

WHO IS NEXT?

Who is going to replace me when I am gone? Who is going to know and understand that “sick to your stomach” feeling you get just before you press the plate on button after an all-nighter, followed by the elation you feel when the beast comes up and starts to purr the sounds of George Strait for a fifty-mile radius.

Unfortunately, few kids are willing to accept 24/7 “on-call” time. Fewer are standing in line to learn how a grounded grid tetrode works or understand a transmitter enough to diagnose a problem just by the pitch of the blower when you walk into the room.

What can we do about this very well-known problem? Getting Nautel to manufacture a transmitter that will repair itself is one thought, although not very practical. It probably would not fit into next year’s CapEx budget anyway.

A SOLUTION

I think the answer starts with us – the current Brain Trust of the broadcast engineering profession. If we are to find the next generation of Richard Haskeys to train, we need to get the word out that broadcast engineering can be quite rewarding.

Granted, it is not for everyone – being a brain surgeon is not for everyone either. Current engineers need to take every opportunity to “talk up” broadcast engineering.

Tours of the radio station should include a stop by the engineering shop where the Chief Engineer could give a ten-minute glimpse into the engineer’s life. When a local school calls about participating in lectures on Career Day, the engineer should jump at the chance to tell young people about a career in radio technology. I also would like to see the SBE push the needed outreach to draw more competent people into the industry.

After all, we all do love radio, do we not?

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

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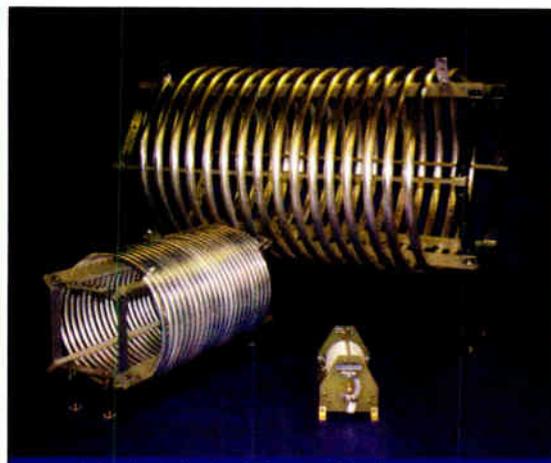


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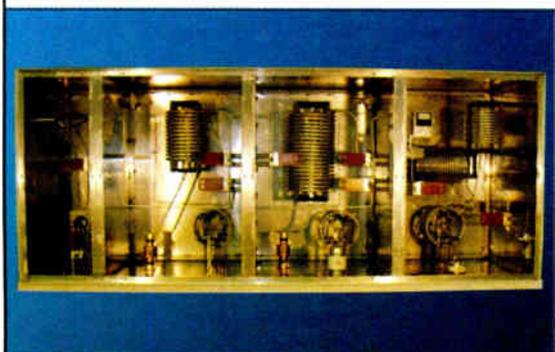
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Technology

Guide

by Barry Mishkind

CES - What's in it for Broadcasters?

This year's Consumer Electronics Show was big. Something like 2,500 exhibitors and 1.5 million square feet of exhibit space. Not only was the Las Vegas Convention Center full, as well as the Hilton exhibit areas, but the Sands Convention Center was full too. Toss in 150,000 attendees from around the world and Las Vegas' typical traffic patterns, and you have a real "zoo."

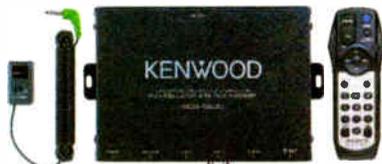
Although stopping even for a minute at each exhibitor in the allotted hours was physically impossible, we did see a lot of interest to the radio industry.

RECEIVERS

Probably question #1 is, "How many new HD receivers did you see?" And the answer is, unfortunately, not many. Most of the other receivers were those shown seen previously at the NAB shows in 2005.

On the plus side, the **Boston Acoustics Receiver** was on display, both at the Boston Acoustic booth and the iBiquity booth. It is a welcome addition to the available receivers, especially since it is a table-top unit not a car radio. The first shipment sold out quickly and more are "on the way" right now. Even better news is that BA has dropped the retail price of the Receiver to \$299!

Another new product that should be of interest was the **Kenwood KOS-A200**. This system solves the problem of integrating an HD receiver



Kenwood KOS-A200 External Media Controller

with existing OEM radios. The KOS-A200 allows everything from CD changers to MP3 players to HD and satellite tuners to be easily connected to the vehicle's existing system. (www.kenwoodusa.com)

Additional IBOC radios are said to be in the pipeline for delivery this year. It would be really good for everyone if they were on hand by NAB time.

COMPETITION

On the other hand, all over the floor were literally hundreds of competitors to terrestrial broadcasters. XM and Sirius were showing their latest models, including smaller, portable units. Yes, iPods and iPod-clones were everywhere, also all sorts of MP3 players, some with video, some with recorders.

Even the cell phone industry wants a piece of the action. Motorola's iRadio is but one of several plans where a monthly fee allows the user to download his own playlist to hear when and where desired.

Perhaps one of the more irritating things was the number of AM/FM/XM and AM/FM/Sirius radios, some with CD/MP3 players, on display. Many exhibitors openly scoffed at the idea of analog TV going away, much less analog radio.

MORE GOODIES

OK, let's get the annual television "who's bigger" war out of the way. Last year, the largest was a 102 inch rear projection screen. This year, LG matched that with a plasma screen, and Panasonic went one better, 103 inches of stunning HD video (no relation to HD radio). There was no official price, but numbers north of \$150,000 were mentioned. Order two for the control room, right?

Moving along, I found a couple of tools that I have already happily put in my toolbox: a **ThermoHawk Touchless Thermometer** (www.q3i.com) and an LED flashlight from **CREE** (www.cree.com). Having the ability to measure component temperatures easily and quickly is a great maintenance aid, and the LED flashlight really puts out a bright light.

Of course, it always seems no matter what flashlight you have, the batteries are always running down when you need it the most. For that reason, I was drawn to the **Freeplay** booth to look at their products - flashlights, radios, even a cellphone batter charger - all run by hand cranks. With one of these, you will never run out of light or audio at a tower base. By the way, avoid the "shake 'em" flashlights. I did not find any I would want to rely upon. (www.freeplayenergy.com)

ALL-IN-ONE

Flash drives are great. You can carry anywhere from 64 MB to several Gigabytes of data in a very small package. At CES you could find simple flash drives as well as units capable of multiple functions. After all, anytime you can combine several items in one package it always reduces the load. That is why many people love their Swiss Army Knife.



Swissbit's Swiss Army Penknife

The Swissbit people (www.swissbit.com) take this tool one step further and have integrated into the package a detachable 1 or 2 GB flash drive/MP3 player/FM radio and voice recorder.

Another combination that looks powerful is the **DualCor cPC** handtop PC (www.dualcor.com). This unit uses dual processors, one runs a full Windows XP (Tablet PC Edition) or Windows Mobile 5.0, depending upon whether you need a full computer or only a PDA (to save power).



The DualCor cPC can be used handheld or docked

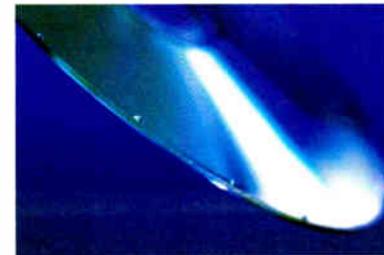
With a size of 6.5 X 3.3 X 1.2 inches, you can take this PDA anywhere and still have a fully powered computer at hand. The flip from one processor to the other is nearly instantaneous.

Recognizing that many people are using the iPod for all sorts of uses, **Griffin Technology** has developed accessories to make the iPod an all-in-one tool. There are microphones, FM modulators, desk docks and speakers, and the radio SHARK, among other goodies. The radio SHARK lets you record AM or FM broadcasts on your computer live or on a timer. (www.griffintechnology.com)

SOFTWARE

Speaking of computers and software, since the demise of COMDEX, the fall computer show, many software companies come to CES, including Microsoft, Apple, Lenovo (IBM), Intel, and many more. Some of the interesting products shown include the **Linspire** Desktop Linux OS (www.linspire.com), a full package that is designed to help almost anyone get started with Linux and be successful.

During a busy day in the Production Room or the Control Room, sometimes dozens of CDs at a time get scattered around. Even with careful handling, this often leads to scratches that quickly make the disks useless.



The Scratch-Less Disc

The **Scratch-Less Disc** (www.scratchlessdisc.com) attacks the problem from two directions.

With the use of what they call "Aero-Bumps™" around the perimeter of the CD and a special polymer coating, these CDs are resistant to the wear and tear that otherwise shorten the lives of the CDs.

CALL FOR ENGINEERING

Last year's "killer app" was VoIP and it is still hot; there were quite a few companies importing a variety of telephones to be used with the Internet.

With many people using VoIP, there are now solutions such as **TeleEvolution's PhoneGnome** (www.phonegnome.com) or the **uConnect V901M** (www.voipvoice.com) where you can hook one phone to both the public standard telephone network (PSTN) and your computer. Other models contain Skype firmware, allowing the phone to be plugged directly into any USB port, so you can take your VoIP anywhere there is an Internet connection, even if you do not have your computer with you.

Finally, where is that spare key you always need, but cannot find? Or your spare Compact Flash Card? The **Wireless Garden StashCard** is a secret drawer you put in your PCMCIA slot and hold anything from sticky notes to a spare \$20 bill. For less than \$10 retail, this could save your day.

There are only 2,480 or so exhibitors left to tell you about. Perhaps we can chat at lunch during NAB!

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ThermoHAWK™ Instant, Pen-Sized Non-Contact Thermometers

Taking the temperature readings of high voltage, high power broadcast equipment has typically been a time-consuming process. Instead of turning off the equipment and using a traditional thermometer to check for hot connections and surfaces, it would be much easier if you could take the surface temperature without this hassle.

red measurement technology to measure an object's surface temperature without actually touching it. The thermometer operates on two LR-44 1.5V batteries and displays digital temperature readings in either Fahrenheit or Celsius.



ThermoHAWK 200



ThermoHAWK 400

Now with Q3 Innovations' new ThermoHAWK™ series of touchless infrared thermometers, you will never have to go through this lengthy process again to check for hot spots and monitor surface temperatures. The ThermoHAWK is a non-contact, infrared thermometer designed to instantly test most surface temperatures at the touch of a button.

Ideal for use at the transmitter site, and anywhere else that temperatures need to be measured and maintained, the ThermoHAWK uses patent-pending infra-

Surface temperature measurement traditionally has been a slow process that required contact with a surface probe or sensor. This creates issues with surfaces that are too dangerous to touch, like AC mains connections, power transformers, or high current RF transmission gear. Because constant contact is required and it is common for readings to take 30 seconds or more, continuous, physical-contact surface temperature monitoring is difficult.

"The ThermoHAWK makes what has traditionally been a slow and unreliable process far easier and more accurate," said Q3 Innovations' Chief Executive Of-

ficer Brian Eddy. "In as little as half a second, the ThermoHAWK provides a reliable temperature measurement without compromising the user's safety."

The ThermoHAWK has many advantages over traditional surface temperature devices, including:

- *No Contact Necessary.* Simply point the ThermoHAWK within a short distance from the spot you want to measure and press the "test" button.
- *Short Response Time.* The ThermoHAWK will measure the temperature in as little as half a second.
- *Accuracy.* The margin of error using the ThermoHAWK is less than 2.5 percent.



ThermoHAWK 400L

Three models of the ThermoHAWK are available, the 200, 400 and 400L. The ThermoHAWK 200 has a measurement range of -27 degrees F to 230 degrees F, which is adequate for routine maintenance.

The 400 and 400L can measure temperatures from -27 degrees F to 428 degrees F, for hotter items. The 200 and 400 are about one half the size of ball-point pen and come with a keychain attachment, while the 400L is equipped with a flashlight in lieu of a keychain.

The ThermoHAWK 200 (MSRP, \$59.95), 400 (MSRP, \$79.95) and 400L (MSRP, \$99.95) are available on-line at www.FusionTank.com and will soon be released to retail stores.

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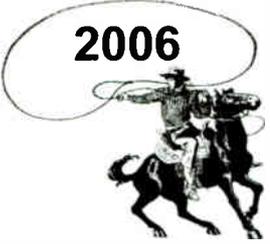
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2006



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The Radio Guide Industry Date and Event Register

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www.nrb.org

Great Lakes Broadcasting Conference

March 13-14, 2006
Lansing, Michigan
www.michmab.com

Oklahoma Assoc. of Broadcasters Convention

March 31- April 1, 2006
Oklahoma City, Oklahoma
www.oabok.org

AM/FM Renewal Application Filing Dates

April 1, 2006 – Renewal Filing Date
Delaware & Pennsylvania
[/www.fcc.gov/mb/audio/renewal/index.html](http://www.fcc.gov/mb/audio/renewal/index.html)

NAB 2006

April 22-27, 2006
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www.nabshow.com

Mid-Atlantic Broadcasters Conference

June 5-6, 2006
Atlantic City, New Jersey
www.njba.com

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AM/FM License Expiration Dates

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BOS-CON 2006 Boston SBE Regional Convention

October 25-26, 2006
Marlborough, MA
www.bos-con.com

SEA-CON 2006

Fall, 2006
Seattle, Washington
www.sea-con.org

SBE Certification Exam Dates

Exam Dates	Location	App. Deadline
April 25 NAB	Las Vegas	March 3, 2006
June 2-12	Local Chapters	April 21, 2006
August 11-21	Local Chapters	June 9, 2006
November 10-20	Local Chapters	Sep. 22, 2006

5. Weekly Public Notice of Termination

Pending Status

Each week, ULS will generate two Public Notices listing licenses, locations, and frequencies that were placed into Termination Pending status that week. One Public Notice will list site-based licenses and license components, and the other will list market based authorizations.

6. Licensee Letter Notification of Termination

Pending Status

ULS will also generate automated letters to the licensee to be sent to the address of record listed for the station license at about the same time the Public Notice is released. In that regard, it is important that the FCC has the correct address for the licensee. Many times this gets overlooked and the licensee never gets the letter. This letter will contain information on how to file the Petition for Reconsideration.

7. Deadline for Filing Petitions for Reconsideration – 30 Days After Release Date of Weekly Public Notice

If the licensee does not confirm that it met its deadline, the license termination becomes final. In the absence of a timely filed Petition for Reconsideration, the license termination becomes final and the Auto-Term process ends on the 30th day following release of the weekly "Termination Pending" Public Notice.

8. ULS Changes the Status from Termination Pending to Active, or Terminated as of the Construction or Coverage Deadline.

One of two actions will occur once the 30-day period for Petitions for Reconsideration has expired. If a licensee files a Petition before the end of the 30-day reconsideration period showing that it fully met its construction requirements in a timely manner and the WTB grants the petition, the TP status will be removed and returned to the "Active" status. If no Petition is filed by the end of the 30-day period, or if a timely filed Petition is denied by the WTB, ULS will change the status of the license or license component to "Terminated," effective the date of the construction deadline.

Radio Report

by Wayne Reese
Munn-Reese Broadcast Consultants

The FCC Auto-Term Process – Step-by-Step

Are Your Licensed Broadcast Auxiliary Services (BAS) Finalized?

Many broadcasters have been recently shocked to find their licenses in peril over one simple thing. They failed to tell the Commission they are actually using it.

As of February 1, 2006, if you haven't filed Form 601, Schedule K, alerting the FCC of your build-out, you will get a nasty surprise. For radio stations, this covers Studio-to-Transmitter Links (STL) and Inter-city Relays (ICR) authorizations. Authorizations for these services have 18 months to construct the facility from their grant date. According to the FCC Rules, §1.946(d), you must notify the Commission within 15 days of the expiration of the applicable construction permit that the system has been built.

In its attempt to keep the wireless database more up to date, the Wireless Telecommunications Bureau (WTB) has announced that it has enhanced the Universal Licensing System (ULS) to include an automated feature, "Auto-Term," for certain wireless services. Auto-Term identifies licenses, and license locations and frequencies (license components) subject to construction for which a notice of construction or a request for extension of time to meet the requirements has not been filed by the applicable deadline. Let us look at some of the highlights of this new practice.

The Auto-Term Process

The Auto-Term process has eight milestones in the timeline. Each milestone marks either the point at which a deadline occurs or a notice is issued.

1. Construction Reminder Letter – 90 Days Prior to the Construction or Coverage Deadline

The WTB started sending these reminder letters in May, 2002, by mail, approximately 90 days prior to the relevant deadline. However, the FCC has emphasized that this notification procedure is a courtesy service and not intended to replace the basic construction notification requirements set forth in its Rules. Lack of or failure to receive a reminder letter is not an excuse for noncompliance.

2. Construction and Coverage Requirement Deadlines

A licensee must file a request to extend a construction period before the expiration of the construction period by submitting an FCC Form 601, Main Form and Schedule L, through the ULS. The Commission's rule section explicitly states that filing the Request does not automatically extend the construction period, and further provides that the Request may be granted if the licensee shows that failure to meet the relevant deadline stems from the involuntary loss of a site or other causes beyond its control. Grant of the Request still requires the licensee to comply with all Commission Rules and still must file a construction notification based on the extended construction deadline.

3. Required Notification of Construction (NT) – 15 Days After the Construction or Coverage Deadline

(Note: While §1.946(d) states that the required construction notification must be filed within 15 days of the construction deadline, the ULS filing system allows a grace period up to 15 days after the deadline.) A licensee that has met its construction deadline must notify the Commission by filing FCC Form 601, Main Form and Schedule K (NT), through the ULS no later than 15 days after the expiration of the applicable construction period.

Any late-filed construction notification must include a request for waiver. Once ULS places the license, location or frequency into Termination Pending status, a licensee will be unable to file construction notifications or applications associated with them.

4. ULS Changes the Status to Termination Pending

Once ULS identifies a license or license component for which the licensee has not filed an NT or extension request, ULS places it in the Termination Pending status. If the system has been constructed in a timely manner, that licensee must file a Petition for Reconsideration within 30 days of the weekly "Termination Pending" Public Notice showing that it met the requirements to have the TP status removed.

New FCC Database Icons

As part of this change, icons have been added to the database to assist you in ascertaining the status of your authorization. The status "Termination Pending" is represented with the icon "TP." During a license search on ULS, the TP icon appears next to the Call Sign on the Search Results page for any license that is site-based, which includes virtually all BAS licenses. Again, the TP denotes that this license contains a license or license component(s) in a termination pending status for failure to meet the build-out requirements. TP status, however, applies to the components of site-based licenses. If, for example, one of four frequencies is placed in the Termination Pending status and the remaining frequencies on the license are active, the TP icon appears on the Frequency Page of the License Search next to the frequency in TP status. If all four frequencies are in Termination Pending status, the TP icon appears next to each frequency.

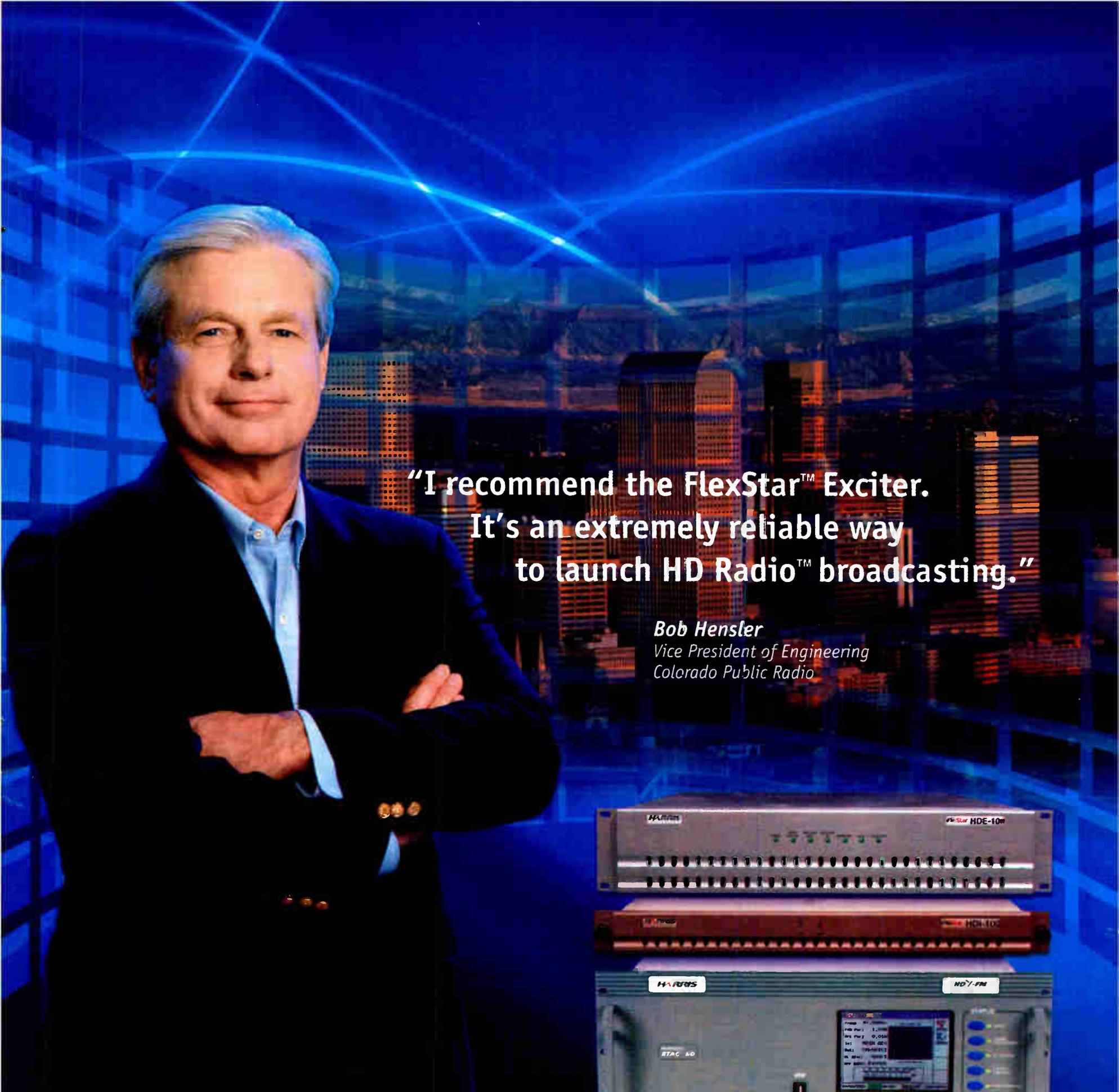
So, if you have received a grant of a WTB authorization and have not filed a construction notification on Schedule K of FCC Form 601, you better check the database to see what the status is of your authorization. This will help you avoid the cost and loss of time involved in re-filing.

Special Search Link

The WTB has provided a specific search link to their database to determine if you have met or exceeded your build-out date. The new build-out deadline search can be accessed at this URL: <http://wireless2.fcc.gov/ULSApp/ULSSearch/searchLicense.jsp>. For further information on construction requirements or how to file a construction notice, visit the WTB website: <http://wireless.fcc.gov/licensing/const-req>

One last thing we have noticed trying to use these search engines is, that in many cases, licensees have forgotten to associate their wireless (BAS) call signs to their FCC Registration Number (FRN). If you have additional questions, visit <http://esupport.fcc.gov> or call the FCC Support Center at (877) 480-3201, TTY (717)338-2824 and select Option 2, Forms or Licensing Assistance.

This month's report courtesy of Wayne Reese, Munn-Reese Broadcast Consultants. www.munn-reese.com



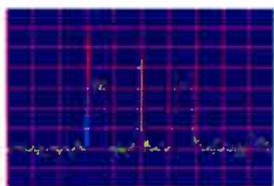
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Gear Guide:

February – Telco, Remote Audio, Codecs, Wireless

Broadcast Electronics

Marti GX-500 – Remote Broadcast Mixer

www.bdcast.com • 217-224-9600

Imagine for a minute, if you will, arriving at a remote broadcast and being able to setup and be on the air in mere minutes. Sound impossible? Well, it is not, because you have the versatile Marti GX-500 at your command. With four mic and two auxiliary inputs, four headphone jacks, a mic/line auxiliary output and complete mixing facilities, the GX-500 makes it easier than ever. It is also capable of two telephone connections – one for the main program and one for communications or a call-in guest.

The GX-500 can be operated using the external AC power supply or the included, long-life (five-to-seven hours) rechargeable batteries. Other features include a peak limiter, a squelch/mute switch, an internal tone generator and an off-air monitor input.

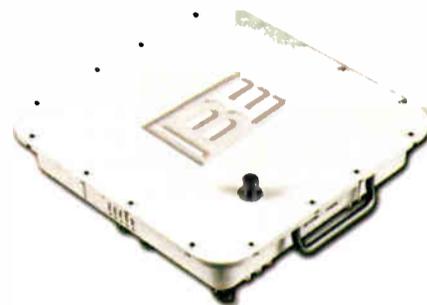


Broadcast Electronics

BP 4500 – Big Pipe Microwave Radio

www.bdcast.com • 217-224-9600

While most commonly used as part of a complete Big Pipe system, the BP 4500 can provide reliable, full-duplex data transmission in a wide variety of applications. The BP 4500 operates in the 5.3 or 5.8 GHz bands for quick implementation. With interfaces such as DS3 and 100BaseT Ethernet, it is fully compatible with broadcast protocols such as Telos' Axia. The BP 4500 boasts throughput up to 45 Mb/s with a transmission range up to 40 miles. 16 QAM modulation allows 12 collocated radios without interference. The BP 4500 mounts directly and easily on a tower or pole for minimal cable loss. Various antennas are available for short hops or longer hauls. Constructed to meet the demands of radio broadcasters with a Mean Time Between Failure of greater than seven years.



Broadcast Tools

tinyTOOLS TT-1 – Phone Hybrid/Coupler

www.broadcasttools.com • 360-854-9559

The tinyTOOLS TT-1 is more than just an ordinary telephone line coupler. The TT-1 is a rack-able compact telephone line powered auto-answer and auto-disconnect hybrid/coupler. The TT-1 utilizes dual-hybrid transformers providing full duplex audio at a plain old coupler price. They provide a rear panel multi-turn hybrid NULL trimmer to allow the user to achieve approximately 20 dB separation figures.

Additional TT-1 features: front panel line seize button, call drop button, auto-answer/monitor-TAP switch, audio mute switch, and off-hook and ring indicators. A rear panel RJ-11 is provide for connection to a POTS line along with a second RJ-11 loop-thru jack that may be configured to disconnect attached devices when the TT-1 goes off-hook. Plug-in euroblock screw terminals along with 3.5 mm stereo jacks are provided for both balanced send and caller audio. The TT-1 may be mounted on a desktop, wall or up to 4 units on a 1-RU rack shelf.



CircuitWerkes

TelTap – Telephone Coupler

www.circuitwerkes.com • 352-335-6555

The TelTap is a versatile and inexpensive telephone coupler. Once connected to a standard RJ-11 plug, the user has a choice of seizing the phone line or just tapping the line. The TelTap can be used to either send or receive audio regardless of which mode is selected. Internal jumpers let you choose how the TelTap operates.

You can set the second phone port to automatically disconnect whenever the TelTap is in the line seize mode. You can also choose to never tap the line, only seize the line. You can also select between balanced audio, unbalanced-stereo or unbalanced mono audio. A ring LED indicates the presence of an incoming call when there is no audible ringer, making the TelTap a good choice for both studio and field work. A mute switch disconnects the audio port when silence is required.



Comrex

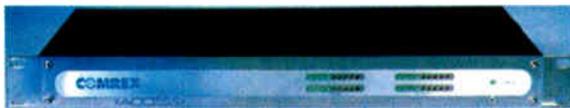
ACCESS – Stereo BRICIP Codec

www.comrex.com • 800-237-1776

The ACCESS Stereo BRIC IP Codec from Comrex is the first wideband audio codec to work reliably over most data networks including the Public Internet and the first codec of its kind to take advantage of revolutionary BRIC technology.

ACCESS is capable of utilizing widely available wired circuits like DSL, broadband Cable, POTS and T1/E1 as well as wireless circuits like Wi-Fi, cellular broadband data services like EVDO and UMTS as well as IP-over-satellite applications.

ACCESS will be available as both Rack Mount and Portable units. Capable of providing ultra-reliable, voice quality connections over IP, ACCESS also offers a high-quality stereo mode which offers optimized performance on unconstrained data circuits. Optional "High-Efficiency AAC" and "AAC Low-Delay" algorithms are available for optimized audio quality when used on managed data networks. POTS Compatibility Mode for use with Comrex Vector, BlueBox and Matrix POTS codecs as well as a Linear PCM Mode are standard features on Access.



Conex

FJ-700 – 4-Channel Remote Mixer

www.conex-electro.com • 360-734-4323

The FJ-700 is perfect for ball games and remote broadcasts. It is a compact, battery operated, 4 channel mixer that easily connects to your hand-held cell phone or to a standard land-line desk telephone. It features 4 standard Mic/line inputs and 4 separate 1/4" headphone jacks. There are separate source selection switches for the "Host" headphone and for the three guest headphones. These switches allow monitoring phone "send" audio as well as "receive" and external audio. Each headphone has its own level control.

Other features include: • Separate line output jack to feed recorders, etc. The output is switch-selectable to be fed from the main mixer output or to the phone receive signal. • Easy-access battery compartment for 3 AA batteries. • Jack for external power. (12.6 VDC) • LED Level meter with low-battery indicator.



Gear Guide:

February – Telco, Remote Audio, Codecs, Wireless

Henry Engineering

MixMinus – Telephone Hybrid

www.henryeng.com • 626-355-3656

Henry Engineering's MixMinus Plus adds a "mix-minus" output to an audio console that lacks this feature. Mix-minus is a special audio mix that is required when a telephone hybrid is used to broadcast telephone calls.

MixMinus Plus works by taking samples of (a) the Program output and (b) the Caller audio. By manipulating the level and phase of these two signals, it subtracts Caller audio from the Program mix, producing an output that contains everything that is mixed to Air, except for Caller audio.

This mix-minus signal is fed to the hybrid's Send input, so the caller hears everything that is on the air.

MixMinus Plus is easy to install and needs no adjustments once set up. It provides about 30 dB of caller-null, and eliminates caller-echo and feedback when phone calls are broadcast.



JK Audio

InnKeeper 2 – Digital Hybrid

www.jkaudio.com • 800-552-8346

JK Audio introduces InnKeeper 2, a two line rack mount digital hybrid. This is not your typical hybrid. The front panel keypad, display, and handset jacks provide easy speed dialing and call setup.

Digital hybrids allow you to send signals into an analog telephone line while maintaining excellent separation between your voice and the caller. The balanced XLR output jacks contain only the caller's voice. With separate balanced inputs and outputs, the two digital hybrids can function independently.

On the other hand, Innkeeper 2 offers a unique feature. Simply press the conference button to join both callers in a full duplex voice conference without fear of echo and feedback. The master input allows you to send one input to both callers.

Need more channels? Innkeeper 4 offers four channels in a 1U rack space.



The InnKeeper 2

Telos

Desktop Director - Call Controller - Axia Element

www.telos-systems.com • 216-241-7225

Telos offers a variety of control surface options featuring Telos' exclusive Status Symbols, allowing easy observation of each caller at a glance.

Desktop Director offers a comprehensive approach, with built-in handset and speakerphone. Desktop units can easily be switched between "Talent" (on-air line control) and "Producer" (screener) modes.

Call Controller economically offers similar functionality in a compact space. It connects to a POTS telephone of your choice, for screener or studio telephone operation, supporting both Talent or Producer modes.

Axia Element accepts a call control module that eliminates the need for a separate connection to a TWO x 12 or 2101 Talkshow System by using an Ethernet connection. The phone fader module allows direct control of a Telos TWO (on, off and dialing) and other hybrids.



Monthly Gear Guide Categories

July - AM-FM Transmitters, Exciters, IBOC
August - Telco, Remote Audio, Codecs, Wireless
September - Audio Processing, Interface Boxes
October - Towers, Antennas, Phasors, RF Products
November - RPU, STL, Remote Control, Satellite
December - Automation, Digital Storage, Workstations

Inovonics

PBX – Phone Line Manager

www.inovon.com • 831-458-0552

Even in today's network-based environment, sometimes all that's available to a remote site is a Telco dial-up line. Various devices at the site may require selective access to this one line, including transmitter remote control, door alarm, wall phone, and perhaps one or more modems to address audio processing, or an RDS encoder.



The Inovonics PBX

The "PBX" from Inovonics gives seven dial-up devices access to a single Telco line, both for outgoing and for incoming calls. One device may be assigned priority-override status; otherwise, first-come-first-served for outgoing calls. When an incoming call is received at the site, the PBX answers, unlocks with a security code, and then rings the targeted equipment.

With eight RJ-11 jacks, the "PBX" is simple to hook-up and use. Dialing strings for incoming calls can be included in automatic dialers in most cases.

Sine Systems

TAS-1 – Time and Temp Delivery System

www.sinesystems.com • 615-228-3500

Sine Systems TAS-1 is a complete time and temperature delivery system that does not require an external host computer.

Advertising or informational messages are recorded in nonvolatile digital storage that requires no battery backup. Outgoing message options include: an opening greeting that can be a single message of up to 30 seconds, two rotating messages of up to 15 seconds each, or three rotating messages of up to 10 seconds each.

An optional closing message can be up to 15 seconds. The time and temperature are delivered in a male voice. The basic TAS-1 system works with up to two telephone lines. The system is expandable with model TAS-1/EX Expansion Unit which adds the capability of up to 6 more lines. A maximum of ten expansion units can be added for a total of 62 lines.



Tieline

Wireless Internet Remote Broadcasting

www.tieline.com • 800-780-4750

Remote wireless broadcasting over the Internet is here. Tieline will demonstrate Wireless Internet Remote Broadcasting at booth #N3215 at NAB 2006 in Las Vegas over a broadband cellular network. Tieline audio codecs are the first to offer broadcast quality stable links from your remote to the studio over your choice of the Internet, GSM Wireless, POTS and ISDN links. With Tieline's codec flexibility you only pay for the network modules you need.

As your needs grow, simply buy the network module you need for less than 1/3 of the price of buying another codec. Plus connect from a single Tieline in your studio to two remote Tielines in the field and run two simultaneous remotes. No need to buy 4 codecs when 3 will do the same job and save up to \$2,000. Visit Tieline Technology on the web at www.tieline.com or 888-211-6989.



Service Guide: Radio Equipment Products and Services



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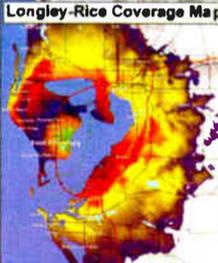
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BE to Host Higher Learning for Consulting Engineers

Broadcast Electronics continues to raise the bar on higher learning with new certified broadcast engineering seminars specifically for consulting engineers.

Industry recognized and BE-accredited Learn and Earn sessions covering key disciplines of HD Radio™ technology will be presented at two locations:

Tuesday, February 28 – San Francisco, CA
Hotel Nikko, 222 Mason Street

Thursday, March 2 – Washington, D.C.
Marriott Washington, 1221 22nd Street, NW

Broadcast Electronics, which has been on the forefront of HD Radio developments such as HD2 Multicasting, will host comprehensive sessions presented by its top engineers Richard Hinkle, Vice President Engineering and Technical Services, and Jerry Westberg, Principal Engineer. John Bisset, BE NE Regional RF Sales Manager, will present field reports and case studies of the latest technological developments. The following topics will be discussed:

HD Radio Technical Review

- Basics of HD Radio technology.
- Combining methods for FM.
- Technology evolution over the past three years.
- Current regulatory issues pending.

HD Radio for AM

- Theory of operation.
- AM antennas and HD Radio.
- Real world implementation issues.

HD Radio for FM

- HD2 Multicasting
- Datacasting
- Case studies

Consulting engineers that participate in BE Learn and Earn seminars receive a certificate of participation and are listed on the BE website as resources for stations and groups seeking engineering services.

The 2006 Learn and Earn seminars are offered at no charge. BE will provide a continental breakfast and buffet luncheon. Although the sessions are free, pre-registration is required. Consulting engineers can send an e-mail to consultants@bdcast.com for details.

Broadcast Electronics

Phone: 217-224-9600
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Prophet Systems and Radio Systems/StudioHub+ Form Strategic Alliance

In a joint press release, Prophet Systems Innovations and Radio Systems Inc. have announced an agreement to provide StudioHub+ connectivity as a factory supplied value-added option for all Prophet Systems installations.

Prophet Systems Innovations provides digital delivery systems through its NexGen and 101 models of PC-based audio storage and playback equipment. StudioHub+ from Radio Systems is an integration and wiring platform that provides easy plug-and-play wiring solutions via CAT-5 pre-made cable assemblies and break-out boxes.

Tim Gieschen, President of Prophet Systems comments, "The ease of installation provided by StudioHub+ is a perfect fit to our Prophet Systems philosophy of total customer support and system reliability. Because StudioHub+ will add to the flexibility and dependability of Prophet, it is a natural for us to bundle it with our factory integrated and site-installed systems."

Daniel Braverman, president of Radio Systems, the developer and manufacturer of StudioHub+, remarks that, "It's very gratifying to us when a company as prestigious as Prophet Systems gets behind the StudioHub+ solution. This is another giant step towards StudioHub+'s acceptance as the broadcast wiring standard."

StudioHub+ wiring for Prophet Systems installations will be offered as a factory shipped pre-wired option, or field installed by Prophet's full-time team of professional field technical reps.

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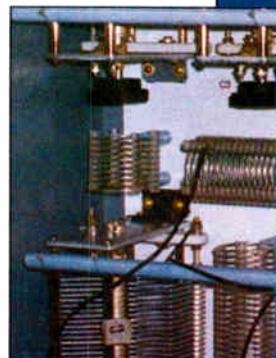
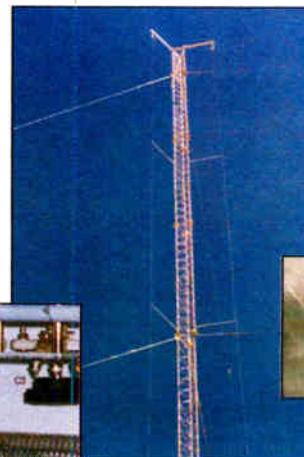
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